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EFFECTS OF 2,4,5-T AND RELATED HERBICIDES ON MAN AND THE ENVIRONMENT

HEARINGS

BEFORE THE

SUBCOMMITTEE ON ENERGY, NATURAL RESOURCES, AND THE ENVIRONMENT

OF THE

COMMITTEE ON COMMERCE UNITED STATES SENATE

NINETY-FIRST CONGRESS

SECOND SESSION

ON

THE EFFECTS OF 2,4,5-T AND RELATED HERBICIDES ON MAN AND THE ENVIRONMENT

JUNE 17 AND 18, 1970

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EFFECTS OF 2,4,5-T AND RELATED HERBICIDES ON MAN AND THE ENVIRONMENT

THURSDAY, JUNE 17, 1970

U.S. SENATE,
COMMITTEE ON COMMERCE,
SUBCOMMITTEE ON ENERGY, NATURAL RESOURCES,
AND THE ENVIRONMENT,
Washington, D.C.

The subcommittee met at 10:07 a.m. in room 1202, New Senate Office Building, Hon. Philip A. Hart (chairman of the subcommittee) presiding.

Present: Senator Hart.

Senator. HART. The committee will be in order.

OPENING STATEMENT BY THE CHAIRMAN

Permit me a brief opening statement.

This week's hearings of the Subcommittee on Energy, Natural Resources and the Environment are essentially a continuation of an earlier examination by the subcommittee into the effects of the herbicide known as 2,4,5-T on man and the environment.

In April, we held 2 days of hearings, at which it was emphasized by several of the witnesses that the potential dangers to man posed by this herbicide and related chemicals are in fact limitless. At the second day of those hearings, the administration announced a suspension of certain uses and a cancellation of certain other uses of 2,4,5-T. This action was in accordance with the view of the administrative agencies concerned that the herbicide in certain formulations and when used for certain purposes constituted an imminent hazard to public health.

It is the purpose of our hearings today and tomorrow to determine whether the administration's action has been commensurate with the hazards involved in the use of this pesticide. The subcommittee also intends to examine certain other related chemicals which have been alleged to pose threats to human health and safety.

The questions raised by our discussions here are bound to be hard ones which almost certainly will admit of no wholly satisfactory answers. Yet, since man's very existence may hang in the balance, it is essential that they be confronted as thoroughly and as carefully as we are capable of proceeding.

One whose thoroughness and care have already contributed significantly to public knowledge in this area is Thomas Whiteside, whose New Yorker article entitled "Defoliation" was in large part responsible for our earlier hearings on 2,4,5-T. Mr. Whiteside

Staff member assigned to this hearing: Leonard Bickwit, Jr.

has updated his earlier writings on this subject in a piece in the current New Yorker which has been released to the newsstands today.

I would like to place a copy of that article [1] in the record of today's hearings and again to express gratitude to Mr. Whiteside and to the New Yorker for their respective contributions.

Senator HART. Let us proceed to our first witness, and I welcome him back—Mr. Harrison Wellford of the Center for Study of Responsive Law.

Mr. Wellford, would you identify your associate?

STATEMENT OF HARRISON WELLFORD, CENTER FOR STUDY OF RESPONSIVE LAW; ACCOMPANIED BY MRS. JOAN KATZ, CENTER FOR STUDY OF RESPONSIVE LAW

Mr. WELLFORD. Thank you. I have with me this morning Mrs. Joan Katz, a practicing lawyer who prepared the petition on 2,4,5-T which we presented to the Secretary of Agriculture in April.

I appreciate very much your invitation to appear at these hearings this morning. I am director of a task force to study pesticide regulation at the Center for Study of Responsive Law of which Ralph Nader is managing trustee.

On April 7, we testified before this committee on the present and potential dangers of widespread use of the herbicide 2,4,5-T in populated areas in the United States. On the same day, representatives from the Department of Agriculture testified that they saw no reason to take any action against 2,4,5-T at that time.

On April 15, the Surgeon General reversed this position and announced to this committee that certain uses of 2,4,5-T were to be suspended immediately and registration for other uses was to be cancelled. Our initial response to this action was one of great relief.

Five months earlier, on October 30, Dr. Lee DuBridge, the science advisor to the President, first brought the potential dangers of 2,4,5-T to the attention of the public, when he announced that the Government would restrict the use of 2,4,5-T in populated areas. This early warning from the White House would have enhanced this administration's credibility on environmental issues if it had been heeded by the Federal Government.

But, unfortunately, USDA, FDA, and the Department of Defense treated it with "benign neglect" and refused to act.

On April 15, with the announcement of suspension and cancellation, it seemed that wiser counsel had prevailed and the Government was finally going to protect the public from unnecessary exposure to a herbicide suspected of having birth defect properties. Upon closer examination, however, it became apparent that the ban contained some of the same elements of administrative chicanery which have led environmentalists—and in effect the Circuit Court of Appeals for the District of Columbia—to brand the DDT ban a sham.

[1] See p. 89.

On April 30, in association with the Children's Foundation, the Friends of the Earth, and the Migrant Research Council, we filed a formal petition with the Secretary of Agriculture requesting that the Department cease further delay and take steps fully and effectively to ban 2,4,5-T and its close chemical relatives, such as Silvex. At the time of our filing the petition, the Department had taken the following steps:

It had suspended use of products containing 2,4,5-T in liquid form for use around the home, on water, and in recreation areas. In fact, it suspended all uses of 2,4,5-T in any form around water or ditch banks. To effect this suspension order, the Department had written to companies manufacturing 2,4,5-T and requested that they recall suspended products.

USDA, however, had not notified retailers directly. The local hardware store officially learns that it is to cease selling liquid 2,4,5-T for home use when it receives a letter from a manufacturer of the product. The Department did not warn the public generally of potential danger from individual consumer use of 2,4,5-T.

In the appendix to this testimony, I have listed results of a survey of hardware and garden stores in the Washington metropolitan area we conducted on June 15. We surveyed 15 stores and discovered that five stores were still selling prohibited products. The products involved were:

Real-Kill Spot Weed Killer, of which I have a sample here; Amchen Weed-on; Greenfield Crab Grass Broadleaf Weed Killer; Ortho Weed-be-gon Spot Weeder, which is this object; and Ortho Brush Killer here.

Therefore, one-third of the stores surveyed have either not received or refused to comply with the recall letter from the manufacurer of 2,4,5-T.

The Department had also initiated cancellation proceedings against 2,4,5-T in dry formulations for use around the home, on water, recreation areas, and similar sites and all use of the chemical on food crops intended for human consumption, including rice. Three companies, Hercules Corp., Dow Chemical Co., and Amchem Corp., have appealed this action and requested the establishment of an advisory committee.

The companies can continue to produce and sell their 2,4,5-T products in interstate commerce pending the outcome of these proceedings. Hercules Corp. has also appealed suspension of liquid 2,4,5-T, but is required to recall its products pending the outcome of the proceedings.

We feel that this action by the Department of Agriculture fails in six ways to protect the public from the dangers posed by 2,4,5-T. The significance of the ban is diminished because:

1. It exempts nonliquid formulations of 2,4,5-T from suspension and recall. Therefore, fertilizer herbicide mixes, containing 2,4,5-T, such as Sears Superfine Weed-Feed, widely used on residential lawns, would be exempt from the immediate suspension;

2. It exempts 2,4,5-T used on food crops from suspension and recall;

3. It fails to even begin cancellation proceedings for other uses of 2,4,5-T, as in brush clearing operations, for example;

4. It permits manufacturers to avoid suspension and recall by relabelling. The product can, therefore, remain on the shelves with nothing to prevent a consumer from persisting in a prohibited use;

5. USDA has failed to warn the public against buying or using herbicides containing 2,4,5-T which may presently be on local hardware shelves or in the home;

6. Most significant of all, the action of the Department exempts from the ban other herbicides made with or derived from 2,4,5-Trichlorophenol, the chemical family of 2,4,5-T.

Silvex, one of the most popular herbicides for home and garden use, is such a product. The highly teratogenic dioxin contaminant is a by-product of a stage in the manufacturing process at which Silvex and 2,4,5-T are identical.

There is no evidence whatsoever that subsequent differences in the process by which Silvex and 2,4,5-T are made either removes or detoxifies this contaminant. Moreover, it should be recalled that even purified 2,4,5-T without dioxin still causes birth defects in test animals. Silvex and 2,4,5-T are chemically so similar that even if Silvex can be produced without dioxin, it would probably still be teratogenic.

The burden of proof lies squarely on the manufacturers of Silvex to establish its safety. If Silvex is not banned, the ban on 2,4,5-T will do little to protect the public from the teratogenic potential of these herbicides and will make the Government's action against 2,4,5-T, like its action on DDT, a sham which misleads the public.

To prevent further delay and to ensure that the ban covers the exemptions listed above, we, therefore, petitioned the Secretary of Agriculture to suspend immediately 2,4,5-T and Silvex in all its esters and formulations for use around the home, recreation areas, lakes, ponds, and on food crops, whether or not they are relabelled.

We also asked the Secretary to make public the names of all suspended products.

In order to make sure that all uses of 2,4,5-T and Silvex are carefully reviewed, we petitioned the Secretary to issue notices of cancellation of the registration of 2,4,5,-T and Silvex in all formulations for all other uses not yet mentioned.

Another purpose of the petition was to announce our desire to participate in all proceedings to be conducted in this matter with the intention through counsel of submitting evidence, requesting and participating in public hearings, cross-examining witnesses, filing briefs, and presenting our argument.

I would like at this point, Mr. Chairman, to request permission to place this petition in the record of the hearing.

Senator HART. It will be received.

(The petition follows:)

BEFORE THE SECRETARY OF AGRICULTURE

HARRISON WELLFORD, MRS. LORRAINE HUBER, MRS. JUDITH EDES, THE CHILDREN'S FOUNDATION, FRIENDS OF THE EARTH, MIGRANT RESEARCH PROJECT, PETITIONERS

PETITION FOR IMMEDIATE SUSPENSION OF REGISTRATION OF ECONOMIC POISONS CONTAINING 2,4,5-T FOR USE AROUND THE HOME, ON LAKES, PONDS, AND DITCH BANKS, AND ON FOOD CROPS; FOR IMMEDIATE RECALL TO THE RETAIL LEVEL OR FOR SEIZURE OF SAID ECONOMIC POISONS; AND FOR CANCELLATION OF REGISTRATION OF SUCH ECONOMIC POISONS

WILLIAM A. DOBROVIR,
JOAN M. KATZ,
Washington, D.C.,
Attorneys for Petitioners.

Of Counsel:
JAMES A. MOORMAN,
Washington, D.C.

Petitioners request the Secretary of Agriculture to exercise his authority under the Federal Insecticide, Fungicide, and Rodenticide Act, 61 Stat. 163, as amended, 7 U.S.C. 135–135k (FIFRA) to take immediate action to ban the use of economic poisons containing 2,4,5-T around the home, in lakes, ponds, and ditch banks, and on food crops. There is no evidence that human beings and animals can safely be exposed to 2,4,5-T.[1] There is considerable evidence that 2,4,5-T is dangerous to human beings and that it presents an immediate hazard to the public. For the reasons set out in detail in this petition and the evidentiary exhibits attached to it:

1. We petition the Secretary of Agriculture, pursuant to FIFRA section 4c, to suspend immediately the registration of 2,4,5-T and of economic poisons containing 2,4,5-T in all formulations for use around the home, in recreation areas, in lakes, ponds, and ditch banks, *and on food crops, whether or not relabelled;* and make public the names of all suspended products.

2. We petition the Secretary of Agriculture, pursuant to FIFRA section 9, to seize, or under pain of seizure require manufacturers immediately to recall, down to the retail level, all products that contain 2,4,5-T *in all formulations,* which are sold or advertised for use around the home, in recreation areas, in lakes, ponds, or ditch banks *and on food crops, whether or not relabelled.*

3. We petition the Secretary of Agriculture, pursuant to FIFRA section 4c, to take all steps necessary to issue notices of cancellation of the registration of 2,4,5-T and of economic poisons containing 2,4,5-T *in all formulations and for all uses.*

4. *We petition the Secretary of Agriculture, pursuant to 5 U.S.C. 552(a), to publish notice of all action taken in this matter in the Federal Register,* as well as issuing individual notices of suspension, cancellation and recall; *and publish producers' and products' names.*

5. We intervene, pursuant to the principles of administrative law established in *Office of Communication of United Church of Christ* v. *F.C.C.* 123 U.S. App. D.C. 328, 359 F. 2d 994 (1966) and in *Scenic Hudson Preservation Conference* v. *F.P.C.*, 354 F. 2d 608 (2d Cir. 1965), in all proceedings to be conducted in this matter, including proceedings in or before any advisory committee appointed pursuant to FIFRA section 4c, with the intention, through counsel, of submitting evidence, requesting and participating in public hearings, cross-examining witnesses, filing briefs and presenting oral argument.

[1] For the purposes of this petition the term "2,3,4-T" also includes other herbicides of the same chemical family, made with or derived from 2,4,5-trichlorophenol. Silvex, a commercially marketed weed-killer, is such a product.

I. PURPOSE OF THIS PETITION

This petition is made necessary by the failure of the Department of Agriculture to take steps fully and effectively to ban 2,4,5-T. Congressional action and promises by federal officials had led the public to expect comprehensive and immediate action. The limited action taken to date fails in five respects to protect the American public from the dangers posed by 2,4,5-T:

1. It exempts non-liquid formulations of 2,4,5-T from suspension and recall;
2. It exempts 2,4,5-T used on food crops from suspension and recall;
3. It permits manufacturers to avoid suspension and recall by rebelling;
4. It fails to begin cancellation proceedings for all uses of 2,4,5-T and
5. It has not been published in the Federal Register and therefore does not automatically bind all who are in the chain of distribution of 2,4,5-T or inform the public, by name, of dangerous substances on the market.

ACTION TO DATE

On October 29, 1969, Dr. Lee A. DuBridge, Science Advisor to the President and Executive Secretary of the President's Environmental Quality Council, announced that "The Department of Agriculture will cancel registrations of 2,4,5-T for use on food crops effective January 1, 1970, unless by that time the Food and Drug Administration has found a basis for establishing a safe legal tolerance in and on foods." Executive Office of the President, Office of Science and Technology, Press Release, October 29, 1969 (Exhibit 1, p. 2).

A petition to establish a specific tolerance for 2,4,5-T on particular foods had been filed with the Food and Drug Administration in December 1967. FDA reported that "Neither the petition as originally submitted or as later supplemented provided data to support affirmative action." FDA Fact Sheet (Exhibit 2, p. 2). The petition was withdrawn on December 29, 1969. *Ibid.* In the absence of "a safe legal tolerance"—which FDA refused to establish—food contaminated with any 2,4,5-T may not lawfully be shipped in interstate commerce. *Ibid.*; Federal Food, Drug and Cosmetic Act, sections 301, 402, 406, 408, 21 U.S.C. 331, 342, 346, 346a.

Despite the refusal of the Food and Drug Administration to set tolerances for 2,4,5-T the Department of Agriculture failed to take the action promised by the President's Science Advisor. Apparently responding to a request by Dow Chemical Company, one of the major manufacturers of 2,4,5-T, the Department delayed any measures against the herbicide pending the completion of further laboratory studies. *See Hearings Before the Subcommittee on Energy, Natural Resources and the Environment of the Senate Committee on Commerce* ["Hearings"]. Satement by Ned D. Bayley,Director of Science and Education, Department of Agriculture (Exhibit 3, p. 3); Thomas Whiteside, Letter to the Editor, *The New Yorker*, March 14, 1970 (Exhibit 4, p. 1). As set forth in Section IV of this petition, those studies only confirmed earlier laboratory findings exposing the dangers of 2,4,5-T.

In light of accumulating scientific evidence against 2,4,5-T, Senator Philip Hart of Michigan, concerned about reports of administrative delays in taking protective measures against 2,4,5-T, called for hearings on 2,4,5-T before the Subcommittee on Energy, Natural Resources, and the Environment of the Senate Committee on Commerce. On the first of the two days of hearings, April 7, 1970, Ned D. Bayley, the Director of Science and Education of the Department of Agriculture, stated that, "We have no reasons to take action [against 2,4,5-T] at this time." *Hearings*, colloquy between Senator Hart and Ned Bayley, Transcript p. 111. But one week later, on the second and last day of the hearings, April 15, 1970, Dr. Jesse L. Steinfeld, the Surgeon General of the United States, read a press release announcing that 2,4,5-T was to be suspended for some uses and cancelled for others:

"Agriculture Secretary Clifford M. Hardin, Interior Secretary Walter J. Hickel, and HEW Secretary Robert H. Finch today announced the immediate suspension by Agriculture of the registrations of liquid formulations of the weed killer, 2,4,5-T for use around the home and for registered uses on lakes, ponds, and ditch banks . . .

"The three Cabinet Officers also announced that the Department of Agriculture intends to cancel registered uses on non-liquid formulations of 2,4,5-T around the home and on all food crops for human consumption . . ." HEW Press Release, April 15, 1970 (Exhibit 5, p. 1).

On Thursday, April 23, the Department of Agriculture issued a press release stating that manufacturers had been notified of the suspension of "liquid formulations [of 2,4,5-T] for use around the home, recreation areas, and similar sites, . . . and all formulations for use in lakes, ponds, or on ditch banks." Department of Agriculture Press Release, April 23, 1970 (Exhibit 6). The order does not apply to the use of non-liquid formulations of 2,4,5-T, around the home and in recreation areas, or the use of any formulations on food crops. The press release failed to mention recall.

In fact, the form letter sent to manufacturers and formulators (Exhibit 7) does provide for recall. But it leaves a loophole for manufacturers to have the product relabeled to delete "claims" for the suspended uses. Moreover, the Department has declared that the suspension and recall notice will not be published in the Federal Register. No notices of cancellation have yet been issued.

Finally, the Department has failed to make public the trade names of herbicides containing 2,4,5-T that it has suspended. It has failed to warn the public against buying or using these products; and a survey conducted the day before the filing of this petition has found that the products were still on the market and being offered for sale.

II. PETITIONERS

Harrison Wellford, of the Center for Study of Responsive Law, of which Ralph Nader is managing trustee, has been directing a study of the administrative performance of the Department of Agriculture in its regulation of food production in the United States. The study has focused, *inter alia*, on regulation of economic poisons under FIFRA. The study uncovered increasing evidence of the dangers of 2,4,5-T. Wellford and James S. Turner of the Center testified at the hearings before the Hart Subcommittee, mentioned in part I. Wellford also lives in suburban Maryland and is the father of a two-year-old daughter. He is concerned about the dangers of use of 2,4,5-T by other householders in the neighborhood.

Mrs. Lorraine Huber is a resident of Bethesda, Maryland. She is a registered nurse. She became concerned with the hazards posed by 2,4,5-T upon reading a scientific article on the herbicide. Her concern was personalized and intensified in the summer and fall of last year, when her three-year-old daughter suffered prolonged physical and mental illness after inhaling a considerable amount of 2,4,5-T spray which had drifted over from a neighbor's yard. A second exposure of the child to 2,4,5-T could be fatal. Mrs. Huber is pregnant with her second child. She petitions for effective action against 2,4,5-T on behalf of her three-year-old child, her unborn child and any future children she may conceive.

Mrs. Judith Edes is a resident of Shepherd Park, an area of single family, detached homes in the District of Columbia. She is an expectant mother. She is concerned that exposure to weed killers containing 2,4,5-T sprayed by her neighbors in their gardens and on their lawns may cause malformations or other abnormalities in her unborn child or future children she intends to have. She fears the possibility of severe harm to her baby after it is born should such spray drift onto her property. Mrs. Edes is a social worker in an adoption agency and has a general and professional interest in the health of all children. She petitions on behalf of herself, her unborn child and any future children she may conceive.

The Children's Foundation is a non-profit charitable corporation dedicated to the health, education and welfare of children. Among its projects are the promotion of the health and education of children in migrant workers' camps. The Foundation is generally concerned about the exposure of all children to 2,4,5-T used as a household weed killer. It is particularly concerned about migrant workers' children, who may be exposed to 2,4,5-T used on farm land.

Friends of the Earth (FOE) is a non-profit membership organization with approximately 3,000 members, incorporated under the laws of the state of New York. Its purposes and the purposes of its members are to promote the preservation, restoration and rational use of the environment. FOE and its members oppose the use of chemical agents like 2,4,5-T that drastically affect living systems, including man, when there is no knowledge of the ultimate effects of such use on all living systems in the chain of life. FOE has published a book, Whiteside, *Defoliation* (Ballantine Books, 1970) intended to educate the public about the dangers of 2,4,5-T.

Migrant Research Project of the Manpower Evaluation and Development Institute, funded by the Office of Economic Opportunity, has as its principal

purpose the promotion of the health, education and welfare of migrants and seasonal farm workers and their families. In connection with this purpose, the Project is concerned about the possible harmful effects on the health of such workers and their families of economic poisons sprayed on food crops. The workers prepare fields for sowing the crops, harvest the crops, and clean the fields after harvest. The Project petitions on its own behalf and on behalf of its approximately 40 sub-grantee agencies in the field.

III. THE SECRETARY'S RESPONSIBILITIES UNDER FIFRA

Registration Requirements.—The Secretary of Agriculture (the Secretary) regulates economic poisons under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). "Economic poisons" are defined in FIFRA, section 2a, 7 U.S.C. 135(a), as including "(1) any substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any . . . weeds, and other forms of plant . . . life, and (2) any substance or mixture of substances intended for use as a plant regulator, defoliant or desiccant." 2,4,5-T is intended for, and is used for, the destruction, regulation and defoliation of plants. It is an economic poison.

Section 4a of FIFRA, 7 U.S.C. 135b(a), requires that: "[E]very economic poison . . . which is shipped or delivered for shipment from any State, Territory or the District of Columbia to any other State, Territory or the District of Columbia, or which is received from any foreign country shall be registered with the Secretary [of Agriculture]." 2,4,5-T is registered with the Secretary of Agriculture.

Immediate Suspension of Registration.—Section 4c of FIFRA imposes on the Secretary the duty to "suspend the registration of an economic poison immediately", "when he finds that such action is necessary to prevent an imminent hazard to the public." 7 U.S.C. 135b(c). *See* also 7 C.F.R. 364.4(c), 34 F.R. 13822 (1969).

Cancellation of Registration.—Section 4c of FIFRA imposes on the Secretary the duty to issue a notice of cancellation of the registration of an economic poison "whenever it does not appear that the article or its labeling or other material required to be submitted complies with the provisions of this Act." 7 U.S.C. 135b(c). A "misbranded" economic poison does not so comply "with the provisions of the Act." Section 2z(2) defines "misbranded" to apply "(2) to any economic poison . . . if the labeling does not contain directions for use which are necessary and if complied with adequate for the protection of the public; (d) if the label does not contain a warning or caution statement which . . . if complied with [is] adequate to prevent injury to living man . . . (g) if in the case of an herbicide when used as directed or in accordance with commonly recognized practice it shall be injurious to living man . . . or to the person applying such economic poison; . . ."

7 U.S.C. 135(z)(2)(c), (d), (g). *See* also 7 C.F.R. sections 362.6, 362.9, 362.10(k), 362.105(h), 362.106(f)(4)(v), 362.108(c)(6), 362.121(g). An economic poison is "misbranded" when *no* directions for use are "adequate for the protection of the public", which *no* warning is adequate "to prevent injury to living man" or when as commonly used it is "injurious to living man . . . or to the person applying" it.

Seizure and Recall.—The Secretary of Agriculture also has a duty to seize misbranded or unregistered economic poisons.

"Any economic poison . . . that is being transported from one State, Territory or District to another, or, having been transported, remains unsold or in original unbroken packages, or that is sold or offered for sale in the District of Columbia or any Territory, or that is imported from a foreign country, shall be liable to be proceeded against in any district court of the United States in the district where it is bound and seized for confiscation by a process of libel for condemnation . . . (a) if it is . . . misbranded; (b) if it is not registered . . ."

FIFRA section 9a, 7 U.S.C. 135g(a)(1)(a), (b). An economic poison so misbranded as to constitute an "imminent hazard" is subject to seizure. The Secretary may order manufacturers to recall such products immediately, as an alternative to seizure.

Burden of Proof.—Congress has placed the burden of proving an economic poison safe and lawful upon the registrant—the manufacturer. H.R. Rep. No. 1125 on H.R. 9739, 88th Cong. 2d sess., 64 U.S.C. Cong. & Admin. News, 2166–67 (1964); H.R. Rep No 91–637, on the Deficiencies in Administration of Federal Insecticide, Fungicide, and Rodenticide Act, 91st Cong 1st sess. (1969), pp. 51–52. If a registrant cannot affirmatively prove the safety of his product, the Secretary must take immediate steps to stop its sale and distribution.

IV. THE HEALTH HAZARD POSED BY 2,4,5-T

2,4,5-T and its uses

2,4,5-T (trichlorophenoxyacetic acid) and the other trichlorophenols are herbicides widely used in residential areas to rid lawns of dandelions, chickweed, ivy, crab grass and other common weeds. It is similarly used on a number of food crops and for brush and weed control in the maintenance of rights-of-way, waterways, and industrial areas. In 1964, approximately 11 million pounds of 2,4,5-T were used in the United States on non-crop lands, and one million pounds on crop lands. Use of herbicides in general has been increasing in the United States at a compounded growth rate of 10 per cent a year. *Hearings*, Testimony of Dr. Arthur H. Westing, Chairman of the Biology Department at Windham College, Putney, Vermont (Exhibit 8, p. 4). A survey of 10 Washington, D.C. area stores—eight hardware stores, one grocery market, and one gardening shop—found that eight of the stores investigated were selling household lawn and garden weed killers containing 2,4,5–T. *Hearings*, Testimony of Harrison Wellford of the Center for Study of Responsive Law, Washington, D.C. (Exhibit 9, p. 10).

The easy availability of 2,4,5–T and its widespread domestic use indicate the extent of the danger involved in leaving this herbicide on the market when it has not been proven safe and as evidence mounts o fits dangers to human health.

THE DANGERS OF 2,4,5-T

2,4,5-T as a Teratogen.—A study commissioned by the National Cancer Institute, an agency of the Department of Health, Education, and Welfare, and conducted by Bionetics Research Laboratory of Bethesda, Maryland, concluded that 2,4,5-T is clearly teratogenic (i.e., causes birth defects) in certain test animals. Department of Health, Education, and Welfare, Report of the Secretary's Commission on Pesticides, and Their Relationship to Environmental Health, December 5, 1969 ["Mrak Report"] (Exhibit 10, pp. 10–11). Litters of pregnant mice and rats given 2,4,5-T experienced excessive rates of fetal mortality and various abnormalities, most frequently cleft palate and cystic kidney.[2] Mrak Report (Exhibit 10, p. 11). More recent tests on rats, mice and hamsters, conducted by Dow Chemical Company, by the National Institute of Environmental Health Sciences, and by the Food and Drug Administration "clearly confirm (the) teratogenicity (of relatively pure 2,4,5-T)" and the need for "(immediate restriction) to prevent risk of human exposure." *Hearings*, statement of Dr. Samuel S. Epstein, Co-Chairman of the Advisory Panel on Teratogenicity of Pesticides of the Mrak Commission (Exhibit 12, pp. 11–12 and 17). The latest Food and Drug Administration studies, demonstrating the teratogenic effect of 2,4,5-T on chick embryos, reinforce these conclusions. *Hearings*, statement of Dr. Jacqueline Verrett (Exhibit 13, pp. 8–10).

The appearance of gross malformations in human babies following intensive spraying of 2,4,5-T in Vietnam furnishes direct, although not systematically developed, evidence of the teratogenicity of 2,4,5-T in humans. *See* Robert E. Cook, William Haseltine, and Arthur W. Galston, "What Have We Done to Vietnam?" reprinted in 116 Cong. Rec. S1988, 91st Cong. 2d sess. (February 19, 1970, daily edition) (Exhibit 14, pp. 1–2); Frank Mankiewicz and Tom Braden, "Spray Earth Policy", *New York Post*, November 4, 1969, quoted in "'Leaf Abscission'?", *Thời-Báo-Gà* (November 1969) (Exhibit 15, pp. 6–7); Ralph Blumenthal, "U.S. Shows Signs of Concern Over Effect in Vietnam of a 9-Year Defoliation Program, *The New York Times*, March 15, 1970 (Exhibit 16, pp. 2–5). The reports of birth defects have not been officially released;[3] hence, it has not been possible

[2] The tests on rats and mice are particularly significant in light of evidence that these animals may be less susceptible to the teratogenic effects of chemicals than are human beings. Such was certainly the case with thalidomide. *See* Thomas Whiteside, "Defoliation", *The New Yorker*, February 7, 1970, p. 32 (Exhibit 11, 11). Unlike the obvious deformities produced by thalidomide, however, the defects discovered in the Bionetics tests are fairly common and less noticeable—facts which may explain in part the previous failure to perceive the dangers posed by 2,4,5-T.

[3] Blumenthal states that "Vietnamese newspapers have been suspended for publishing articles about birth defects allegedly attributed to the defoliants, and the Public Health Ministry declines to provide any statistics on normal and abnormal births." (Exhibit 16, p. 2).

to conduct any scientific investigation to verify these facts. But their potential significance as evidence of human susceptibility to the teratogenic effects of 2,4,5-T cannot be disregarded. *See Cook*, Haseltine, and Galston (Exhibit 14, pp. 1-2).

Other Toxic Effects of 2,4,5-T. There is considerable evidence that 2,4,5-T has serious toxic effects on man, animals and plants besides its effect as a teratogen.

1. In the mid-1960's, the Dow Chemical Company was obliged to shut down part of a 2,4,5-T plant in Midland, Michigan for some time, after about 60 workers had contracted chloracne from contact with dioxin, a substance produced in the manufacture of 2,4,5-T. The disease, which has afflicted workers in 2,4,5-T plants in the United States, the Netherlands, Germany and Japan, causes extensive skin eruptions, liver damage, disorders of the central nervous system, chronic fatigue, lassitude and depression; the symptoms often persist for years.[4] Whiteside, *Letter to the Editor*, (Exhibit 4, p. 3). *Hearings*, statement by Dr. Jacqueline Verrett (Exhibit 13, p. 45).

2. At a hearing on herbicides conducted by Congressman Richard McCarthy in Globe, Arizona, Professor Arthur Galston discussed a scientific report which related the experience of two girls, aged four and six years old, who had played for several hours in a yard sprayed a short while before with 2,4,5-T herbicide. The girls suffered general reddening of the skin and swelling of the oral and vaginal mucous membranes, the limbs and the eyelids. Kidney damage developed on the third day after exposure and persisted for approximately two weeks. *See Hearings*, testimony of Harrison Wellford (Exhibit 9, p. 18); Bulletin, March-April 1968, HEW National Clearinghouse for Poison Control Centers (Exhibit 17, p. 1).

3. The child of one of these petitioners suffered diarrhea, vomiting, swelling of the lymph glands and prolonged mental distress, as a result of exposure to a herbicide spray containing 2,4,5-T, which drifted over from a neighbor's lawn. *Hearings*, testimony of Harrison Wellford (Exhibit 9, pp. 18-19). *See* affidavit of Lorraine Huber (Exhibit 18).

4. A study in Cambodia documented damage to man and other animals from the spraying of "agent orange", a herbicide containing 2,4,5-T and the closely related 2,4-D. Diarrhea and vomiting were common, especially among infants. Large, adult livestock such as cattle, water buffalo and sheep fell ill for several days after the spraying, but recovered. Smaller animals such as baby pigs, chickens and ducks were more seriously affected and some died. Many birds became partially paralyzed, while domestic mammals suffered digestive disorders. Damage to rubber trees, food crops and other vegetation was extensive. Dr. Arthur H. Westing, et al., *Report on Herbicide Damage by the United States in South-Eastern Cambodia*, December 31, 1969 (Exhibit 19, pp. 8-9).

5. In South Vietnam, the use of sprays containing 2,4,5-T has been held responsible for severe and irreversible damage to mangrove associations. Statement of Dr. Arthur W. Galston Before the Subcommittee on National Security Policy and Scientific Developments of the House Committee on Foreign Affairs, December 1969 (Exhibit 20, pp. 3-4). Nausea, dizziness and respiratory ailments—resulting in death in three cases—have also been attributed by Vietnamese citizens to 2,4,5-T spraying incidents. A doctor practicing in Vietnam for 21 years has observed a clear correlation between spraying and increased respiratory complaints. Blumenthal article (Exhibit 16, p. 4).

6. In acquatic habitats trout and other fish have died and crabs, shrimps and mollusks have been harmed after ingesting low concentrations of 2,4,5-T. *Hearings*, testimony of Dr. Westing (Exhibit 8, p. 17).

7. The Mrak Report suggests the possibility of 2,4,5-T-connected respiratory problems in humans (Exhibit 10, p. 6) and the potential for 2,4,5-T damage to birds and plants (*Id.*, p. 7). Congressman McCarthy has stated that the occurrence of disease in humans and livestock in Globe, Arizona may be attributable to 2,4,5-T. *Hearings*, testimony of Congressman McCarthy (Exhibit 21, p. 5). *See* letter to Ralph Nader from The National Health Federation, January 26, 1970 (Exhibit 22); "Defoliants, Deformities: What Risk?" *Medical World News*, February 27, 1970 (Exhibit 23, p. 3).

[4] Whiteside reports that workers at a 2,4,5-T plant in New Jersey became ill with chloracne in the mid-1960's, and six years later some of them still suffered from the effects of the disease. Whiteside, Letter to the Editor (Exhibit 4a, p. 3).

In summary, the evidence at hand appears to represent only the tip of the iceberg of the hazards of 2,4,5-T.[5]

FACTORS INCREASING THE DANGERS OF 2,4,5-T

Drift.—The Mrak Commission has reported that, depending upon meteorological conditions, pesticides applied by airplane and by commercial spraying or fogging equipment have drifted as far as 100 miles (Exhibit 10, p. 2). In one example cited by the Commission, a dust storm originating in southern Texas carried pesticides, including 2,4,5-T, all the way to Cincinnati, Ohio (*Id.*, p. 1). But normal weather conditions and common household spraying or dusting techniques also carry a significant threat of drift:

"The report of the Subcommittee on Weeds of the National Research Council stated in 1968 that spray with 'droplets of 10 microns in diameter can drift up to one mile when released at a height of ten feet with a 3 mile per hour wind.' . . . The Department of Agriculture, in its caution suggested for use on weed-killers containing 2,4,5-T and 2,4-D warns that 'this dust may drift for miles even on quiet days.' (Federal Register, May 21, 1969)."

"It is a conservative estimate that even on a relatively calm day children playing within 100 yards of an area where a yard is being sprayed or dusted with 2,4,5-T are probably going to be exposed to the chemical. . . . In heavily populated residential areas, one simply cannot defoliate his backyard of chickweed and dandelions without running the risk of contaminating his neighbors or their children." *Hearings*, testimony of Harrison Wellford (Exhibit 9, p. 13).

Persistence.—The hazards of 2,4,5-T persist after application because a long period of time may elapse before 2,4,5-T breaks down chemically and loses it potential for harm. In wet and warm conditions, 2,4,5-T generally takes six to eight weeks to break down and in dry and cool conditions it may take well over a year. *Hearings*, testimony of Dr. Westing (Exhibit 8, pp. 9-10). The Mark Commission cites three studies reporting that total degradation of 2,4,5-T required 103, 205, and 270 days, respectively (Exhibit 10, pp. 203-204).

No safe method of use.—The dangers of 2,4,5-T are increased by improper application. Even the United States Forest Service, a part of the Department of Agriculture, has been negligent in carrying out 2,4,5-T spraying programs. The Forest Service has contaminated bodies of water and private property by spraying methods that violated the Department's own restrictions. *Hearings*, testimony of Congressman McCarthy (Exhibit 13, p. 3).

If professionals are negligent, it is likely that non-professionals will also be negligent. The Mark Report observes:

"Homeowners are seldom acquainted with the scientific rationale of safe application and frequently fail to read and understand the instructions contained in the label. Thus, problems of over-use and misapplication have reached the point where contamination by household pesticides may constitute a significant proportion of the total population exposure." (Exhibit 3, pp. 3-4).

A survey in Charleston, South Carolina found:

"Both white and nonwhite families commonly ignored safety precautions in the use of household chemicals. Locked storage was not employed by 88 per cent of all families; 66 per cent stored the pesticides within easy reach of small children; 54 per cent stored the chemicals near food or medicine; andl 66 per cent never wore protective gloves during use or washed their hands after the application." Mark Report (*Id.*, p. 6).

So it is likely that no labeling will provide sufficient protection against improper and potentially dangerous use of 2,4,5-T. *Hearings*, testimony of Harrison Wellford (Exhibit 9, pp. 14-15).

Impurities.—Commercially available 2,4,5-T contains a number of impurities, one of which is 2,3,7,8-tetrachlorodibenzo-p-dioxin. Dioxin is one of the most potent teratogens and toxic substances ever discovered. Amounts as little as 2.5

[5] Scientific opinion against many or all uses of 2,4,5-T as well as other public and private expressions of concern over the use of 2,4,5-T are accumulating. Exhibit 24 includes a few such statements not specifically referred to in this petition. More evidence would be available if doctors and scientists had been alerted to the hazards of 2,4,5-T at an earlier date, and if pesticide control centers compiled information identifying specific pesticides with particular accidents reported. Unfortunately, statistics on pesticide accidents, and on birth defects in general, are totally inadequate. *Hearings*, testimony of Harrison Wellford (Exhibit 9, pp. 17 and 6-7, respectively).

parts per trillion have caused birth defects in chicks (Exhibit 23) while 9 parts per trillion were fatal to 98% of hamster fetuses. (Exhibit 13).

Compounding the hazards of dioxin is the fact that it, even more than 2,4,5-T, may be persistent in the environment. There is no "data on the stability of dioxin in soil, water, crops, milk and human or animal tissue." (Exhibit 12). However, the facts that dioxin is heat stable up to 800°C, has a DDT-like solubility in fats and has a cumulative toxicity in experimental animals, suggests that it may be quite persistent and may accumulate in the food chain, with extreme hazards to man. (Exhibit 12).

V. WHY THE RELIEF PETITIONED FOR IS IMPERATIVE

Immediate suspension for use on food crops

The Food and Drug Administration has ruled that a food contaminated with *any* detectable 2,4,5-T is "illegal and subject to seizure if found in the channels of interstate commerce." (Exhibit 2, p. 2). But the FDA cannot sample all food in interstate commerce. The use of 2,4,5-T on food crops must necessarily leave some residues in food marketed and eaten by human beings. The only way of ensuring against such residues is to ban the use of 2,4,5-T on the crops themselves

Apples, blueberries and sugarcane were among the crops included in Dow Chemical Company's petition to FDA to establish tolerances for 2,4,5-T. These and other crops on hich 2,4,5-T is sprayed are harvested by migrant workers. Migrant families, including children and women in the early months of pregnancy, all work in the fields together. They are employed in spraying pesticides and herbicides, in harvesting the treated crops and in cleaning the fields after harvest. Given the slow breakdown of 2,4,5-T during their entire working season. Immediate suspension of use on food crops is imperative to protect their health.

Nonliquid formulations

Without explanation—and without any factual basis for differentiation—the Department has exempted non-liquid formulations of 2,4,5-T for home and recreation area use from the suspension and recall order. The dangers from 2,4,5-T exist whatever its form. 2,4,5-T in dust form is easily carried for long distances by the wind. Unlike liquids, it does not soak into the ground but, in the absence of rain, remains on the ground and on plants for long periods. Suspension and recall should apply to *all* formulations of 2,4,5-T.

No relabelling

The Department has ordered recall of the suspended products; but it has left a hoophole for relabelling (Exhibit 7). That loophole should be plugged; *no* product available for home or recreational area use, use on waters or use on food crops should be allowed to be sold. As this petition shows, label directions are simply inadequate to protect users and the public.

Recall is the common remedy employed to prevent substances that are found to be hazardous to human health from causing disease or injury. Recall requires the manufacturer to issue an immediate recall of the product in the distribution pipeline, down to the retail level. This remedy has been used many times by the Food and Drug Administration. It is the only effective way of making sure that no more of the dangerous substance is sold. The sanction of libel and seizure and consequent unfavorable publicity is the unpleasant alternative. Manufacturers generally cooperate with alacrity with a recall order; although now and then an exemplary seizure is required to speed cooperation.

Proceedings for cancellation for all uses

According to Dr. Steinfeld's announcement (Exhibit 5), the Department proposes to begin proceedings to cancel the registration of 2,4,5-T in non-liquid formulations for home use and for use on food crops. We have petitioned for immediate suspension of 2,4,5-T for use on food crops. But we also petition for issuance of notices of cancellation of 2,4,5-T for all uses in all formulations.

The accumulating evidence of the dangers of 2,4,5-T casts serious doubt about whether it can be used safely in any circumstances. In any event, the burden of proving safety must be placed on the registrants. 2,4,5-T may be safe for certain uses if applied with proper precautions in areas where there is no chance of human contact. But the registrants should bring in evidence so proving. The only way to effect this is by issuing a blanket notice of cancellation; in advisory committee proceedings and hearings registrants can argue for and produce evidence supporting the safety of certain uses. And these petitioners should have the opportunity to participate in those proceedings.

Publication in the Federal Register

The Department has sent notices, by letter, to manufacturers and formulators of 2,4,5-T, notifying them of the partial suspension of registration. That notice is inadequate because no publication in the Federal Register is contemplated.

The Administrative Procedure Act provides that "substantive rules of general applicability adopted as authorized by law" shall be published in the Federal Register. 5 U.S.C. 552(a). Suspension of registration of an economic poison used as widely as is 2,4,5-T is such a rule. It affects major corporations that manufacture the substance, more than 100 "formulators"—i.e., producers of mixed herbicides containing 2,4,5-T—thousands of wholesalers and jobbers of mixed thousands of retailers and millions of consumers. It affects sales of products of tens of millions of dollars. It is, therefore, a substantive rule of general applicability within the meaning of the Administrative Procedure Act.

Since actual notice of suspension has been given only to manufacturers and formulators, only they are bound by the notice. 5 U.S.C. 552(a)(1). The thousands of wholesalers and jobbers and the tens of thousands of retailers are unaffected by the notice until they receive a recall notice from their suppliers. They may therefore, in violation of FIFRA section 3a, unknowingly continue to sell 2,4,5-T to an unsuspecting public, perpetuating the dangers that the suspension has recognized.

The only appropriate remedy for this impossible situation is immediate publication of the notice in the Federal Register—so that *all* sellers of 2,4,5-T will be bound and will be subject to the penalties of law if they sell another container of an herbicide containing 2,4,5-T.

Publicly naming dangerous products

Full publication in the Federal Register will also alert the public to the dangers of 2,4,5-T found by the Department. Inexplicably, the press release (Exhibit 6) fails to mention recall. There has been no notification to the public to avoid purchasing specific, named products. Nowhere are these products publicly named; names of products were omitted from the form of letter furnished to petitioners (Exhibit 7). When health is at stake the public interest in being fully informed must overide solicitousness for the public relations image of chemical manufacturers. It is imperative that the Department immediately make public, and warn the public against all products containing 2,4,5-T.

Conclusion

The Department of Agriculture's action to date is insufficient to remove the health hazard of 2,4,5-T. The potential teratogenicity and toxicity of 2,4,5-T for humans has been amply documented by scientific studies and clinical reports. Further use of 2,4,5-T around the home, in or near water or on food crops directly contravenes the high standards of safety which the Secretary of Agriculture is bound to enforce.

Biologists Arthur W. Galston, Robert E. Cook and William Haseltine have stated that 2,4,5-T "may represent the ecological equivalent of thalidomide." (Exhibit 14, p. 2). Professor John T. Edsall of Harvard University has observed that "the use of these compounds [including 2,4,5-T] is much more seriously questionable than the use of cyclamates. If one applies the same criteria, one would consider the risks quite unacceptable." *See Hearings*, testimony of Harrison Wellford (Exhibit 9, p. 1).

Where the danger of human contamination by 2,4,5-T is most critical—in its use around the home, on bodies of water and on food—immediate and publicized removal of 2,4,5-T from the channels of commerce is necessary.

Respectfully submitted.

EXHIBITS

1. Announcement by Dr. Lee A. DuBridge from the Executive Office of the President, Office of Science and Technology, October 29, 1969.
2. FDA Fact Sheet, announcing refusal to authorize residues of 2,4,5-T on foods.
3. Statement by Ned D. Bayley, Director of Science and Education, Department of Agriculture, Before the Subcommittee on Energy, Natural Resources, and Environment of the Senate Commerce Committee, April 7, 1970.
4. Thomas Whiteside, Letter to the Editor, *The New Yorker*, March 14, 1970.
5. Department of Health, Education, and Welfare Press Release, April 15, 1970.
6. Department of Agriculture Press Release, April 23, 1970.

7. Department of Agriculture Notice to Manufacturers, Formulators, Distributors and Registrants of Economic Poisons (PR Notice 70–11).
8. Testimony of Dr. Arthur H. Westing, Chairman, Biology Department of Windham College, Putney, Vermont, Before the Subcommittee on Energy, Natural Resources, and Environment of the Senate Commerce Committee, April 7, 1970.
9. Testimony of Harrison Wellford of the Center for Study of Responsive Law, Before the Subcommittee on Energy, Natural Resources, and Environment of the Senate Commerce Committee, April 7, 1970.
10. Excerpts from the Department of Health, Education, and Welfare Report of the Secretary's Commission on Pesticides and Their Relationship to Environmental Health, December 5, 1969 (the "Mrak Report").
11. Thomas Whiteside, "Defoliation", *The New Yorker*, February 7, 1970.
12. Statement of Dr. Samuel S. Epstein, Children's Cancer Research Foundation, Inc., and Harvard Medical School, Before the Subcommittee on Energy, Natural Resources, and Environment of the Senate Commerce Committee, April 15, 1970.
13. Statement by Dr. Jacqueline Verrett, Division of Toxicology, Food and Drug Administration, U.S. Department of Health, Education, and Welfare, Before the Subcommittee on Energy, Natural Resources and Environment of the Senate Commerce Committee, April 15, 1970.
14. "What Have We Done to Vietnam?" by Robert E. Cook, William Haseltine, and Arthur Galston, reprinted in 116 Cong. Rec. S1983, 91st Cong. 2d sess. (February 19, 1970, daily edition).
15. "'Leaf Abscission'?" *Thời-Báo Gà*, November 1969.
16. Ralph Blumenthal, "U.S. Shows Signs of Concern Over Effect in Vietnam of 9-Year Defoliation Program", *The New York Times*, March 15, 1970.
17. Bulletin, March-April, 1968, HEW National Clearinghouse for Poison Control Centers.
18. Affidavit of Mrs. Lorraine Huber.
19. Westing, Pfeiffer, Lavorel, and Matarasso, *Report on Herbicidal Damage by the United States in South-Eastern Cambodia*, December 31, 1969.
20. Statement of Dr. Arthur W. Galston Before the Subcommittee on National Security Policy and Scientific Developments of the House Committee on Foreign Affairs, December, 1969, reprinted in Thomas Whiteside, *Defoliation*, pp. 107–116, 1970.
21. Testimony of Congressman Richard D. McCarthy Before the Subcommittee on Energy, Natural Resources and the Environment of the Senate Commerce Committee, April 7, 1970.
22. Letter to Ralph Nader from the National Health Federation, January 26, 1970.
23. "Defoliants, Deformities: What Risk?" *Medical World News*, February 27, 1970.
24. Supplementary compilation of Scientific, Eye-Witness and Other Statements of Concern Over the Use of 2,4,5-T.

Mr. WELLFORD. The Secretary of Agriculture has authority under the Federal Insecticide, Fungicide, and Rodenticide Act to take all the steps specified in this petition.

Now, let me expand on the reasons why cancellation of registration rather than immediate suspension for most uses of 2,4,5-T erodes the significance of the ban. I do not need to remind this committee that there is considerable evidence that 2,4,5-T may be dangerous to human beings. The Surgeon General has branded it an imminent and immediate hazard to the public. There is no evidence that human beings and animals can safely be exposed to 2,4,5-T.

To move against some uses of 2,4,5-T with only a notice of cancellation, to take no action against certain other uses, and to take no action against Silvex, seems a very inadequate response to the situation. Indeed, the manufacturers of 2,4,5-T have reacted to the ban almost complacently. Mr. Horace D. Doan, president of Dow Chemical Co., estimates that the ban as presently conceived will affect only 10 percent of Dow's 2,4,5-T sales.

As far as protection of the public is concerned, there is a critical difference between suspension and cancellation of a product's registration. Suspension removes the product from the marketplace, if not immediately, at least within a couple of months in most cases. Cancellation allows the accused product to be sold as before while administrative and legal proceedings take place. Cancellation in effect is often no ban at all.

The DDT case demonstrates this point. The Pesticide Regulation Division cancelled the registration of DDT last November. The DDT manufacturers then had 30 days to appeal and request appointment of an advisory committee of scientists.

After the appeal was made, there has been to date a 6-month delay in naming the advisory committee of scientists. Here is the loophole in the act, and the Department apparently is taking full advantage of it.

While there is a 30-day deadline for the companies to request the formation of a committee and a 60-day deadline for the committee to report once it has convened, there is no deadline compelling the Government to name the committee members within a specified time. The members have still not been named as of yesterday.

Senator HART. This is how many weeks after the cancellation?

Mr. WELLFORD. It is about 6 months, Senator.

The DDT ban proceedings have not yet gone past this stage, but in any case, its journey has just begun. Once the advisory committee has reported within its allotted 60 days, USDA has 90 days within which to issue an order. After the order is made, the companies have 60 days in which to file an objection and to request a public hearing. Here, this stately procession of deadlines, pauses, and another hiatus occurs. There is no deadline within which USDA must call the public hearing. Again, a delay of several months could occur.

It is also not clear who has standing to appear at this public hearing. After the hearing is held, USDA has 90 days in which to issue a final order.

At this point, administrative due process has consumed 310 days —by the way, it actually could be longer than that because there are various points where you can get extensions of deadlines—of deadlines and an indeterminate additional period of discretionary delays permitted the Government under a loophole in the law. All of this time, of course, the product accused of causing the harm continues to be marketed in "business as usual" fashion.

This elaborate process may be only a skirmish, however, along the way to the ultimate outcome. Having failed in two hearings and three agency decisions to win its case, the companies may simply shift the fight to another arena. They can challenge USDA's final ruling in the courts where the wheels of due process, of course, also grind wondrous slow.

Of course, I am not suggesting that 2,4,5-T or other pesticides are undeserving of their day in court; what I am saying is that when a company can take advantage of a system of due process which allows perhaps years of delays, products as potentially dangerous as 2,4,5-T and Silvex should at least be held in "preventive detention."

Here, where the potential social threat of a detainee can be tested in a laboratory, this procedure actually makes sense. Suspension as opposed to cancellation is a form of "preventive detention." It allows

for an expedited hearing and prevents the public from continuing as unknowing guinea pigs while proceedings take place.

Senator HART. I am sure in your judgment, the record is clear that there is greater danger to society by permitting the suspect pesticide to remain at large pending adjudication than to permit the alleged criminal to be at large pending determination of whether he is guilty or innocent?

Mr. WELLFORD. Absolutely. The decision in the case of a pesticide is much less capricious.

The Department's failure to suspend or even cancel the registration of Silvex indicates that it intends to take only minimal steps to protect the public from teratogenic herbicides. Both 2,4,5-T and Silvex are prepared from 2,4,5-trichlorophenol which has been made through the synthesis of 1,2,4,5-tetrachlorobenzene with sodium hydroxide. It is in the synthesis of this precursor of 2,4,5-T and Silvex, 2,4,5-trichlorophenol, that the potently teratogenic dioxin arises as a byproduct.

It was the synthesis of 2,4,5-trichlorophenol that workers in chemical plants developed chloracne, the painful skin disease for which there is no known cure, and the prolonged mental distress.

The dioxin contaminant, therefore, is present in Silvex at one stage in its development. There is no evidence to indicate that the difference in the processes by which 2,4,5-T and Silvex are made which occur after this stage remove or reduce the amount of dioxin in the final product. There is no evidence, therefore, which would support a claim that Silvex is substantially safer than 2,4,5-T for home and garden use.

I might add in our survey of the 15 stores this week Silvex was far more prominent on the shelves than 2 months ago when we first began examining herbicide products. It seems that the companies realize that Silvex sales are likely to increase now that some action has been taken against the 2,4,5-T.

The chief difference between Silvex and 2,4,5-T is that Silvex has not been as thoroughly tested in the laboratory. Tests by the FDA have shown that Silvex causes birth defects in chicks, but tests on mammals are incomplete. Nevertheless, the similarity in the chemical synthesis of 2,4,5-T and Silvex clearly place a difficult burden on the chemical companies to demonstrate that the latter is safe.

In the meantime, USDA should suspend the registration of Silvex for home use. In a memorandum dated September 18, 1969, the Pesticide Regulation Division's former director, Dr. Harry Hays, stated that, ". . . when a reasonable doubt exists as to the safety or efficacy of a product, action should be taken to cancel the registration or to require changes in the labeling."

The memorandum goes on to state that when a "registered product is determined to be hazardous when used as directed or in accordance with commonly recognized practices," action should be taken to "suspend registration immediately and request a recall of all stocks." If a product has not been found to be "hazardous," but a "reasonable doubt" exists as to its safety, PRD officials are instructed to request the registrant to recall or relabel existing stocks and issue a notice of cancellation. There is far more than "reasonable doubt" as to the safety of Silvex, yet not one of the actions specified above has been taken.

I would like to have entered into the record at this point a memorandum prepared by Dr. Albert J. Fritsch, an organic chemist which expands on the analysis of the similarity of the chemical process of Silvex and 2,4,5-T.

Senator HART. It will be received.

(The memorandum follows:)

SOME CHEMICAL DATA CONCERNING THE SYNTHESIS AND REACTIONS OF CHLORINATED PHENOL AND PHENOXY PESTICIDES

(By Albert J. Fritsch, Ph. D.)

The general synthesis of 2,4,5-trichlorophenoxyacetic acid (2,4,5-T) was described by J. E. Johnson of Dow Chemical Company [1] at a previous hearing of this Committee:

1,2,4,5-tetrachlorobenzene is hydrolyzed in a solution of methanol and sodium hydroxide in water to form sodium 2,4,5-trichlorophenate. This is in

FIGURE 1

Major Synthetic Route to 2,4,5-trichlorophenoxyacetic acid (2,4,5-T) and the related compound Silvex.

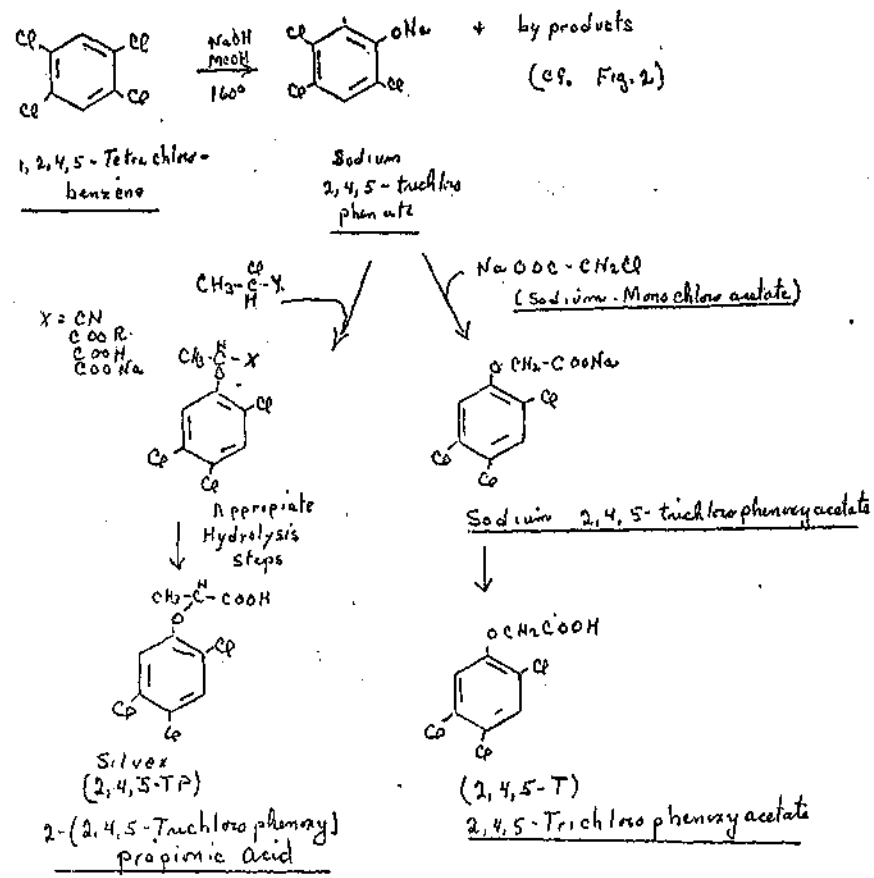
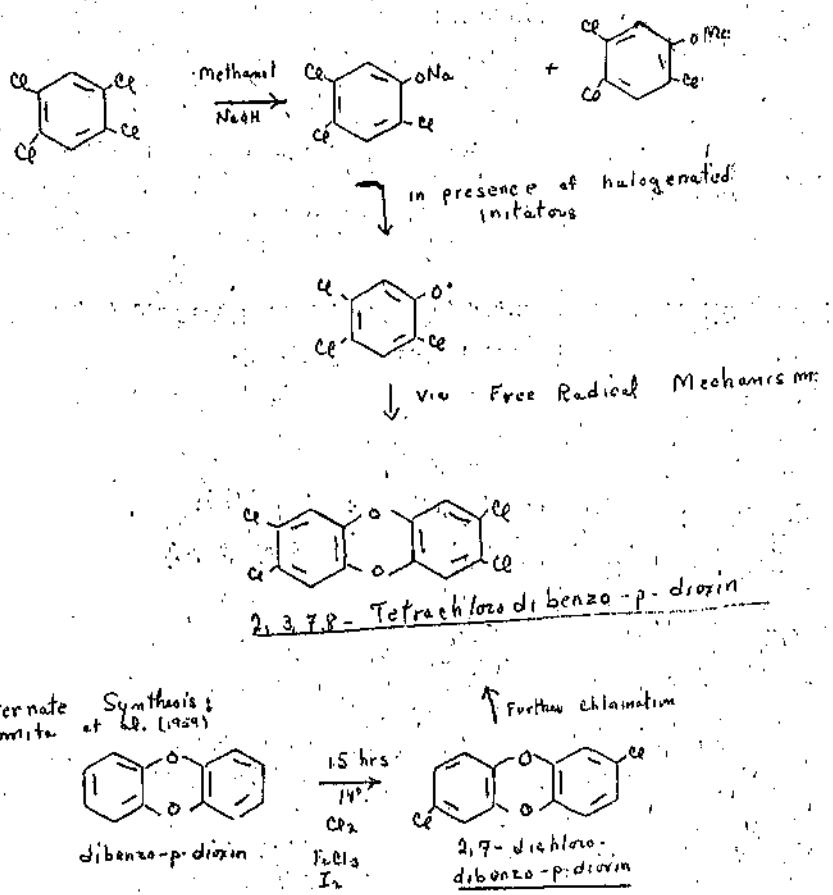


FIGURE 2

Byproducts in the synthesis of 2,4,5-trichlorophenol



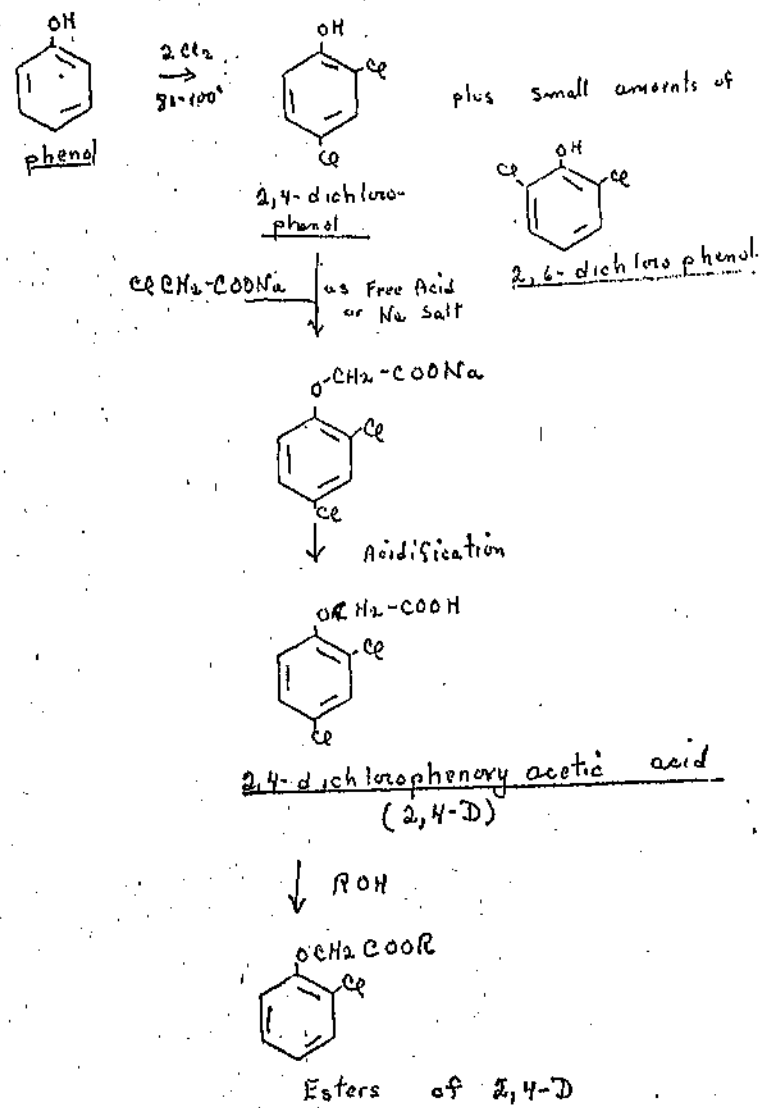
turn reacted with sodium monochloroacetate to form sodium 2,4,5-trichlorophenoxyacetate. The solution is acidified to precipitate and recover the 2,4,5-trichlorophenoxyacetic acid.

There is no reason to believe that a related important herbicide silvex (2-(2,4,5-trichlorophenoxy)propionic acid) is not made using the same precusors since the method shown on Figure 1 is the most commercially feasible sequence.[9] Thus the toxic byproduct which is formed in the 2,4,5-trichlorophenol synthesis would still be present in the silvex synthesis in some degree dependent upon the various possible final procedures used. However, it is possible to purify the 2,4,5-trichlorophenol to remove this highly toxic impurity, 2,3,7,8-tetrachlorodibenzo-p-dioxin (Figure 2).[2-6]

The 2,4-dichlorophenol used in the synthesis of 2,4-dichlorophenoxyacetic acid (2,4-D) is commonly prepared by the direct chlorination of phenol.[3] (Fig. 3) This dichlorination reaction most likely does not allow toxic dioxins to form as by products but the 2,4-dichlorophenol can be made to undergo transformation to the analogous 2,7-dichlorodibenzo-p-dioxin (Figure 4).[4] The precursor 2,4 dichlorophenol is also found to be the intermediate breakdown product of the soil degradation of 2,4-D.[7,8,9,10,11]

FIGURE 3

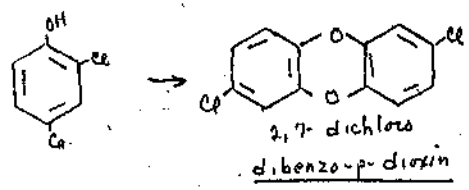
Major Synthetic Route to 2,4-dichlorophenoxyacetic acid (2,4-D)



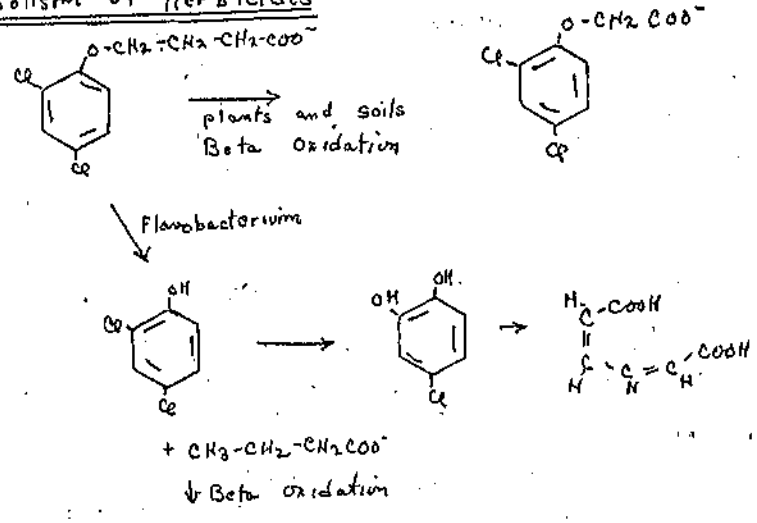
A third important and very toxic pesticide, pentachlorophenol (PCP) is known to undergo reactions leading to the formation of the 1, 2, 3, 4, 5, 6, 7, 8, 9-octachlorodibenzo-p-dioxin. The toxicity and harmful effects of this compound has not been fully evaluated but are perhaps less than the tetrachloro or the hexachloro analogs (cf. Figure 5).[12-14]

FIGURE 4

Reactivity of 2,4-dichlorophenol



Metabolism of Herbicides



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Supplemental:
"Degradation of Herbicides" ed. by P. C. Kearney and D. D. Kaufman, Marcel Dekker, Inc., N.Y. (1969) p. 350.

Mr. WELLFORD. There is another compelling reason why the Government should take action to suspend Silvex and the cancelled and exempted uses of 2,4,5-T. It is time to dispel the secrecy which has shrouded these herbicides. In the hearing of this committee on April 7, we discussed the mysterious attempts to suppress the Bionetics report which revealed the birth defect properties of these herbicides.

I would remind the committee that as early as the fall of 1966, the Bionetics Laboratory, in a contract report to the National Cancer Institute, disclosed test results which showed that 2,4,5-T caused birth defects in mice. These results were concealed from other teratologists and the rest of the scientific community for 3 years.

In this time, no action was taken by the Government to minimize human exposure. Only in August of last year did Dr. Samuel Epstein succeed in prying the report loose for use by the Panel on Teratogenicity of the Mrak Commission. Unfortunately, the treatment of the Bionetics reports was not an isolated case.

As a general rule, data on the toxicology, efficacy, chemical identity and epidemiology of these chemicals has never been collected, disseminated or stored in ways which allow for rapid and easy access by interested scientists or the general public. It is imperative that data on these herbicides and on all pesticides which relate to the safety of the public and environmental quality be a matter of open record.

Few people realize the extent to which analysis of these chemicals has become a closed system for insiders only. Biological testing of these chemicals to anticipate the consequences of human exposure is neither impartial nor necessarily competent. This testing is performed through confidential contracts between the manufacturers and commercial testing laboratories. The possibilities, indeed the incentives, for abuse are obvious.

As one PRD staffer recently told us, "The manufacturer runs the tests he wants to run, selects the test results which are most favorable to him and sends them to us. Rarely, if ever, will PRD ask him to submit additional data." Under the present system, a pesticide company has a clear incentive to avoid a laboratory which is embarrassingly thorough in its tests.

This initial testing is not open to independent scrutiny. Furthermore no independent tests are performed by USDA when the pesticide is presented for registration. Registration is, in effect, a paper procedure which largely accepts at face value data submitted by the manufacturer as to the safety and effectiveness of a product.

There is no access to the registration procedure for independent scientist who might want to comment before a new chemical agent is released in the environment. There is, for example, no publication of a new registration prior to its effective data.

Similarly, even well into cancellation proceedings, review of potential hazards of a pesticide remains a closed shop for Government and industry insiders.

The advisory committee, for which we are still awaiting appointment in the case of DDT, is appointed by USDA in collaboration with the NAS meeting in secret. USDA and company representatives may consult with the committee, but the public may not. All formal and informal discussions between the agencies, industry, and the committee of experts remain secret.

Presumably, if proceedings reach the stage of a public hearing, independent scientists and representatives of environmental and consumer groups may be able to appear, but even this is not clear.

The question of who has standing to be heard is ambiguous and remains to be tested.

In the course of our study of pesticide regulation, we requested and were denied any access to registration on other files in the Pesticides Regulation Division. We have filed suit under the Freedom of Information Act to gain access to this information.

In the meantime, there is no way for an individual citizen, an interested scientist, or even a member of the U.S. Senate to review safety data submitted by a manufacturer either before or after a pesticide enters the market.

I request permission to enter into the record our complaint under the Freedom of Information Act which was filed in U.S. District Court for the District of Columbia.

Senator HART. It will be received.

(The complaint follows:)

IN THE UNITED STATES DISTRICT COURT FOR THE DISTRICT OF COLUMBIA

Civil Action No. 740-70

HARRISON WELLFORD, JOE TOM EASLEY, BERNARD NEVAS, PLAINTIFFS

v.

CLIFFORD HARDIN, SECRETARY OF AGRICULTURE; GEORGE W. IRVING, JR., ADMINISTRATOR, AGRICULTURAL RESEARCH SERVICE; F. R. MANGHAM, DEPUTY ADMINISTRATOR, AGRICULTURAL RESEARCH SERVICE; H. W. HAYS, DIRECTOR, PESTICIDE REGULATION DIVISION; PESTICIDE REGULATION DIVISION, AGRICULTURAL RESEARCH SERVICE; DEPARTMENT OF AGRICULTURE, DEFENDANTS

COMPLAINT FOR INJUNCTION AGAINST UNLAWFUL WITHHOLDING OF RECORDS AND FOR ORDER FOR PRODUCTION OF RECORDS

1. This is an action under the Freedom of Information Act, 5 U.S.C. 552, to enjoin defendants from withholding certain specified records maintained by defendants, and to order them immediately to produce, and permit plaintiffs to inspect and copy, these records.

2. This action arises under Section (a)(3) of the Freedom of Information Act, 81 Stat. 54, 5 U.S.C. 552(1967). This court has jurisdiction pursuant to the provisions of 5 U.S.C. 552(a)(3).

3. The agency records sought to be produced in this action are located within the District of Columbia.

4. Plaintiffs are "persons" within the meaning of 5 U.S.C. 552.

5. The defendants Department of Agriculture ("Department") and Pesticide Regulation Division ("P.R.D.") of the Agricultural Research Service ("A.R.S.") are agencies within the definition of 5 U.S.C. 552. The defendant Clifford Hardin is Secretary of Agriculture and head of the Department; defendant Hays is Director of the P.R.D.; defendant Mangham is Deputy Administrator for Administration of A.R.S.

6. In the summer of 1969, plaintiff Wellford undertook the supervision of two law students, plaintiffs Joe Tom Easley and Bernard Nevas, in a study of the P.R.D.

7. On June 30, 1969, plaintiff Easley, acting on behalf of all three plaintiffs, submitted to defendants Hays and Mangham a written request (Exhibit 1) to inspect and/or copy fourteen specifically identified groups of records of the P.R.S. The records involved related to various facets of the agency's pesticide regulation program. At the same time, Easley made an oral request of Hays for examination of the registration file for a pesticide known as Shell Vapona "No-Pest Strip."

8. Defendants refused to grant immediate access to any of the records requested, and Hays suggested that Easley and Nevas enter into a series of briefings with P.R.D. staff members, giving as a reason that the request for documents would thereby be made more specific.

9. A briefing session was held on July 1, 1969, but on July 2, 1969, Hays informed Easley and Nevas that no further sessions would be held, and that none of the records requested would be made available. At Hays' request, Easley put his request for the Shell Vapona "No-Pest Strip" file in writing (Exhibit 2).

10. On July 7, 1969, Hays denied Easley's request for the Shell Vapona "No-Pest Strip" file (Exhibit 3).

11. On July 23, 1969, defendant Mangham wrote Easley, granting the request for certain items (Nos. 8, 10 and 13), referring plaintiffs elsewhere for one item (No. 9) and denying the rest (Nos. 1–7, 11, 12 and 14). (Exhibit 4).

12. On August 15, 1969, plaintiff Wellford, on behalf of all three plaintiffs, appealed in writing to defendant Irving.

13. On November 17, 1969, R. J. Anderson, Acting Administrator of the A.R.S., replied to Welford's appeal, upholding defendant Mangham's denial of access to documents and the reasons given therefor. (Exhibit 5)

14. Wellford responded to Anderson on January 12, 1970, taking issue with Anderson's reasons for denial and, specificaly, identifying the records sought with still greater specificity, further pointing out that defendants had refused to allow plaintiffs access even to defendants' indices, and further limiting the request to documents no more than five years old. (Exhibit 6)

15. On February 20, 1970, Irving responded further, granting plaintiffs access to one of three indices defendants maintain, but otherwise affirming the prior denials. (Exhibit 7)

16. Plaintiff's request and appeals complied with defendants' applicable regulations. Plaintiffs have exhausted their administrative remedies.

17. Plaintiffs' study of the P.R.D. has been severely impeded by defendants' refusal to make the requested records available.

18. Defendants are required by 5 U.S.C. 552(a)(3) to make the records requested promptly available to plaintiffs; defendants have failed and refused to do so and, unless ordered to do so by this Court, will continue to deny plaintiffs access to the records requested, in violation of 5 U.S.C. 552(a)(3) to plaintiffs' great injury.

19. The records that plaintiffs have requested and to which access has been denied in violation of the Freedom of Information Act are:

(*a*) Defendants' master record card file, indicating the status of complaints or other action involving manufacturers, filed by name of manufacturer;

(*b*) Defendants' summary file of monthly reports of all seizure and citation actions with the month, filed chronologically;

(*c*) Defendants' "Registration Jackets" containing material submitted by a manufacturer when he seeks registration of an economic poison, application forms and P.R.D. staff notations (except the product formula, in a small brown envelope marked "Confidential"); e.g., Registration File No. 201–136, the registration file of Shell Chemical Co.'s Vapona No-Pest Strip;

(*d*) Defendants' "Enforcement File Folders", containing field inspectors' reports of economic poison sample collections, laboratory reports of tests of samples, recommendations for action and correspondence with the manufacturer regarding the sample; filed by number;

(*e*) Defendants' "Company Correspondence Folder", containing correspondence with each manufacturer of an economic poison filed by manufacturer;

(*f*) To the extent that they do not appear in the files described in paragraphs (a) through (e), the records maintained by defendants with respect to:

(1) the pesticide accident reporting mechanism (e.g., who reported each accident, how P.R.D. evaluated the information, action taken, if any, efforts of P.R.D. to coordinate with other governmental and private organizations to facilitate accident reporting);

(2) seizures made under the Federal Insecticides, Fungicides and Rodenticides Act (FIFRA);

(3) violations recommended for prosecution under FIFRA;

(4) procedure for and records respecting citation for violations of FIFRA including supporting files, letters of citation, responses by manufacturers and P.R.D. follow-up;

(5) the recall process, including procedures for recall and files in cases of recall, manufacturer action, P.R.D. supervision, quantity and location of the product recalled, memoranda respecting the effectiveness or completeness of recall action;

(6) intra- or inter-departmental committees or study groups which may have made recommendations concerning pesticide regulation;

(7) the Interdepartmental Committee on Pesticides and its working group, minutes of meetings and recommendations made at meetings.

20. Section 552(a)(3) of Title 5, U.S.C. provides that actions brought thereunder shall take precedence on the docket and shall be expedited in every way.

Wherefore, plaintiffs pray that this Court:

1. Issue a preliminary and permanent injunction to the defendants, their agents and subordinates, enjoining them from further withholding the agency records demanded;
2. Order the immediate production of the records for inspection and copying;
3. Order defendants to reimburse plaintiffs for the reasonable expenses incurred in bringing this proceeding;
4. Provide for expedition of proceedings on this complaint; and
5. Grant such other and further relief as may be appropriate.

EXHIBIT 1

HARVARD LAW SCHOOL STUDENT TASK FORCE

Agricultural Research Service, Pesticides Regulation Division

Items desired, copies of or access to:

1. Files and data on the *pesticide sampling program:* where samples were taken, who collected each sample, what pesticides from each manufacturer were sampled. Also, what tests were run on each sample, who performed the test, and what action if any was taken on the test report.
2. Files and data on the *pesticide registration program:* copies of all proposed labeling and directions for use. Where such files contain proprietary information (specific formulas), provision should be made for either—

(*a*) access to the entire file with the understanding that no proprietary information will be copied or divulged, *or*

(*b*) access to the requested file after such proprietary information has been removed. The mere presence of an item of proprietary information in a particular file does not exempt that entire file from public disclosure.

3. Files and data on the *pesticide accident reporting mechanism:* who reported each accident, how PRD evaluated the information, what action if any was taken on the basis of such information. Also, what efforts PRD has made to coordinate with other governmental and private organizations in order to facilitate accident reporting.
4. Files and data on seizures made under FIFRA, including multiple seizures.
5. Files and data on violations recommended for prosecution under FIFRA.
6. Files and data on the process of citation for violation of FIFRA: files supporting citations, the letters of citation themselves, all responses by each manufacturer to such citations, follow-up action by PRD.
7. Files and data on the *recall process:* general procedure for recall and the file in each case where recall was employed. Each recall file should include all actions by the manufacturer, all supervision by PRD, quantity and location of the product recalled, and memoranda which indicate the effectiveness or completeness of the recall action.
8. Access to the binder or file containing the *basic instructions* on pesticide regulation, specifically the "PR Division Memorandum" numbered series and any other memoranda on poicy or administration which have been circulated to the entire Division or its sub-divisions.
9. Files and data on the *Pesticides Documentation Bulletin Survey* now being conducted by the Statistical Reporting Service, Special Surveys Branch, including tabulation of responses to those surveys completed, and access to all complete raw survey forms.

10. Files and data on USDA responses to the recommendations of the General Accounting Oce reports of September 10, 1968 and February 20, 1968; USDA responses to the National Research Council report of May, 1969.
11. Files and data on any intra- or inter-departmental committees or study groups which may have made recommendations concerning pesticide regulation.
12. Files and data on the *Interdepartmental Committee on Pesticides* and its working group, together with minutes of all meetings and all recommendations made at such meetings.

A description of the *filing system* in use and a list of files.

14. Please give us a list of specific reports which cannot be made available under the Freedom of Information Act.

NB: Where it is impractical to provide a xerox copy of data or files, the Task Force asks simply for access to original files.

EXHIBIT 2

JULY 2, 1969.

(Copy of letter hand-delivered to Dr. Hays on 7–2–69)

Dr. H. W. HAYES,
Director, Pesticide Regulation Division, Agricultural Research Service, Department of Agriculture, Washington, D.C.

DEAR DR. HAYES: As required day before yesterday. I would like to examine file folders containing all registration materials regarding product No. 201–136, the Shell Vapona No-pestrip, excluding only the product formula as proprietary information.

Sincerely,

JOE TOM EASLEY,
1730, 18th St., N.W.,
Washington, D.C. 20009.

EXHIBIT 3

U.S. DEPARTMENT OF AGRICULTURE,
AGRICULTURAL RESEARCH SERVICE
PESTICIDE REGULATION DIVISION,
Washington, D.C., July 7, 1969.

MR. JOE TOM EASLEY,
Washington, D.C.

DEAR MR. EASLEY: This is in reply to your letter of July 2, 1969, requesting permission to examine file folders containing all registration material regarding product number 201–136, the Shell Vapona "No-Pest Strip," excluding only the product formula as proprietary information.

Regulations in the U.S. Department of Agriculture, 7 CFR 1.4(a)(1) and in the Agricultural Research Service, 7 CFR 370.13 exempt for disclosure such things as trade secrets, interagency memoranda in letters, investigatory files compiled for law enforcement purposes, scientific and technical data on products submitted by manufactures, data on research studies including both laboratory and field tests, and product formulation.

On the basis of the above information, it will not be possible for us to honor your request.

Sincerely yours,

HARRY W. HAYS, Ph.D., *Director.*

EXHIBIT 4

U.S. DEPARTMENT OF AGRICULTURE,
AGRICULTURAL RESEARCH SERVICE,
Washington, D.C., July 23, 1969.

MR. TOM JOE EASLEY,
Washington, D.C.

DEAR MR. EASLEY: This has reference to the list of requests for material to review, numbering 14 separate items, presented to the Agricultural Research Serv-

ice when you and Mr. Nevans reported to the office of Mr. Nathaniel E. Kossack, Inspector General, on July 2, 1969.

Also on that day, in a meeting with you and Mr. Nevans and Dr. Hays, Director, Pesticides Regulations Division, we reviewed your request and found that many items were broad in scope, with general coverage to the extent that we could not definitely determine what was desired. We proposed that you meet with Dr. Hays and his two Assistants, Mr. Miller and Mr. Alford, and identify areas that would be desirable for review in line with your objectives. It was felt that this approach would more adequately provide information that would be useful to you.

We have been attempting to obtain clarification on many of your requests but due to their broad coverage specific responses have not been possible. We have, as you recall, specifically covered your request for review of File No. 201–86, the Shell Vapona "No-Pest Strip." Also, specific written response has been made to your request for unlimited freedom in interviewing any employee in the Pesticides Regulations Division, without any type clearance.

I understand that you would like to have immediate written response to your total initial requests presented on July 2. Our response refers to the items by number in sequence of the request.

Items 1 through 7. These items all contain information that is restricted and are not available for public review. Certain of these files do contain information that is not proprietary and would be available for review if separated from the basic file. However, our staff and work schedule is such that this cannot be done on a cash basis. Therefore, it is necessary that the entire file be restricted.

Item 8. Generally the files included in this area are available for your review.

Item 9. The Economic Research Service and the National Agricultural Library each have bulletins containing this type information. We suggest you contact these agencies for information desired.

Item 10. USDA responses to the recommendations of the General Accounting Office Reports of February 20 and September 10, 1968, are available for your review. USDA has not to date made a response to the National Research Council on the May 1969 report.

Items 11 and 12. This information is restricted and cannot be made available for your review.

Item 13. A description of this system will be provided.

Item 14. You request a list of specific reports that cannot be made available under the Freedom of Information Act. We believe the restricted subjects are adequately covered under Title 7, Chapter III, Subpart B, of the Combined Federal Regulations. Therefore, we have not attempted to prepare such list.

The Agricultural Research Service wishes to cooperate with you and Mr. Nevans in providing information that can be useful in completing the objectives of your project. At the same time we know you recognize that certain records cannot be disclosed without impairing the rights of privacy or important operations of the Government. These must be protected from disclosure.

We are continuing a careful review of your total request and if we are able to make additional information available to you we will do so promptly when it is cleared.

Dr. Hayes and I will be available to discuss with you any phases of your request and our response, if desired.

Sincerely,

F. R. MANGHAM,
Deputy Administrator.

EXHIBIT 5

U.S. DEPARTMENT OF AGRICULTURE,
AGRICULTURAL RESEARCH SERVICE,
Washington, D.C., November 17, 1969.

MR. HARRISON WELLFORD,
Coordinator, Student Study Group on USDA, Center for Study of Responsive Law, Washington, D.C.

DEAR MR. WELLFORD: This has reference to your letter dated August 15, 1969, appealing the decision dated July 23, 1969, by Deputy Administrator F. R. Mangham, which denied your request for access to certain files and documents located in the Pesticides Regulation Division of this Service. Your appeal is made under provisions provided for by 7 CFR 370.15.

The undated request for 14 separate items presented to the Agricultural Research Service when Mr. Easley and Mr. Nevas reported to the Office of the Inspector General on July 2, 1969, and which was the subject of Mr. Mangham's letter of July 23, 1969, has been reviewed. Also, your letter of appeal dated August 15, 1969, has been carefully considered. The appeal relates to the following items from your original request:

"1. Files and data on the *pesticide sampling program:* where samples were taken, who collected each sample, what pesticides from each manufacturer were sampled. Also, what tests were run on each sample, who performed the test, and what action if any was taken on the test report.

"2. Files and data on the *pesticide registration program:* copies of all proposed labeling and directions for use. Where such files contain proprietary information (specific formulas), provision should be made for either—

(*a*) access to the entire file with the understanding that no proprietary information will be copied or divulged, *or*

(*b*) access to the requested file after such proprietary information has been removed. The mere presence of an item of proprietary information in a particular file does not exempt that entire file from public disclosure.

"3. Files and data on the *pesticide accident reporting mechanism:* who reported each accident, how PRD evaluated the information, what action if any was taken on the basis of such information. Also, what efforts PRD has made to coordinate with other governmental and private organizations in order to facilitate accident reporting.

"4. Files and data on seizures made under FIFRA, including multiple seizures.

"5. Files and data on violations recommended for prosecution under FIFRA.

"6. Files and data on the process of citation for violations of FIFRA: files supporting citations, the letters of citation themselves, all responses by each manufacturer to such citations, follow-up action by PRD.

"7. Files and data on the *recall process:* general procedures for recall and the file in each case where recall was employed. Each recall file should include all actions by the manufacturer, all supervision by PRD, quantity and location of the product recalled, and memoranda which indicate the effectiveness or completeness of the recall action.

"11. Files and data our any intra- or inter-departmental committees or study groups which may have made recommendations concerning pesticide regulation.

"12. Files and data on the *Interdepartmental Committee on Pesticides* and its working group, together with minutes of all meetings and all recommendations made at such meetings.

"14. Please give us a list of specific reports which cannot be made available under the Freedom of Information Act."

As you know, requests for information must contain a reasonably specific description of the particular record sought as provided by 5 U.S.C. 552(a). "The burden of identification is with the member of the public who requests a record." Attorney General's Memorandum on the Public Information Section of the Administrative Procedure Act, p. 24. In a number of discussions that ARS staff members had with Messrs. Easley and Nevas, and on one occasion when you were present, repeated efforts were made to have your request contain a more specific description of what you desired to review rather than a broad and indefinite type of request. ARS was not successful in getting your staff to modify or to be specific in their request. It is also noted that the requests are not limited to information applicable to any particular period of time. Even if there were no proprietary information in these files, the effort that would be required on the part of the Pesticides Regulation Division to assemble and provide this type of information would be extremely burdensome and would materially interfere with the performance of other agency functions. This would require us to take personnel off programs which are vital to the public interest and where there is already a sizeable backlog of work due to the limited number of personnel.

Specifically responding to your appeal, items of request Nos. 1, 2, 3, 4, 5, 6, 7, 11, and 12 are denied on the basis that the requests do not contain a reasonably specific description of the particular record sought as provided by 5 U.S.C. 552(a). Also, the items of request as identified below are denied for the additional reasons stated:

(1) Item No. 1, relating to the pesticide sampling program, is denied on the basis of 7 CFR 370.13(e) (4) and (g) of 5 U.S.C. 552(b) (5) and (7).

(2) Item No. 2, relating to the pesticide registration program, is denied on the basis of 7 CFR 370.13(c)(1), (d)(1) through (3), and (e)(4), and 5 U.S.C. 552(b)(3) and (4).

(3) Item No. 4, relating to seizures made under FIFRA, is denied on the basis of 7 CFR 370.13(e)(4) and (g) and 5 U.S.C. 522(b)(5) and (7).

(4) Item No. 5, relating to violations recommended for prosecution under FIFRA, is denied on the basis of 7 CFR 370.13(e)(4) and (g) and 5 U.S.C. 552(b)(5) and (7).

(5) Item No. 6, relating to the process of citations for violations of FIFRA, is denied on the basis of 7 CFR 370.13(e)(4) and (g) and 5 U.S.C. 552(b)(5) and (7).

(6) Item No. 7, relating to the recall process, except the recall procedure previously given to Mr. Easley, is denied on the basis of 7 CFR 370.13(d)(4), (e)(3) and (4), and (g), and 5 U.S.C. 552(b)(4), (5), and (7).

(7) Items 11 and 12, relating to intra- or inter-departmental committees or study groups, are denied on the basis of 7 CFR 370.13(d)(2) and (4), (e)(3) and (4), and 5 U.S.C. 522(b)(4) and (5).

Items of request Nos. 1, 4, 5, 6, and 7 call for information relating to investigatory files compiled for law enforcement purposes. Items Nos. 1, 4, 5, 6, 7, 11, and 12 call for material containing reports of internal deliberations and plans. Item No. 2 calls for files which contain formula information which is prohibited from disclosure by the basic ACT, FIFRA. Items Nos. 2, 7, 11, and 12 call for files containing information given to the Department in confidence.

Pesticide samples are collected by field inspectors and normally sent to the Pesticides Regulation Division laboratories for analyzing or testing. A file is made up for each sample. This file includes information and documents relative to the interstate shipment of the product, a complete copy of the product's labeling, the analytical and testing data relative to the product, and the evaluations and opinions of the staff concerning the product.

Certain of the information contained in these files would not be exempt from mandatory public disclosure. Such information would include information relative to the name of the sample, the location at which it was obtained, the date on which obtained, and the name of the inspector collecting the sample. However, information of this nature is not readily available. It could be obtained only by going through each file and extracting the particular information which is desired. Last year more than 7,000 samples were collected. This means more than 7,000 files would have to be reviewed in order to obtain the information. We do not have the manpower to do this.

Other information in the files is, and should be, exempt from disclosure. Such information would include the analytical and testing data and the internal memorandums of the staff relative to the sample. If such information were available to the public, it could be used by one manufacturer against a competitor to such an extent that our regulatory efforts would be greatly nullified. In addition, if the "working papers" in our files are made available to all members of the regulated industry, we could not effectively operate as an enforcement agency. These files are used in connection with the recall process, seizures, citations for violations, and recommendations for prosecution under the Act.

With respect to the files and data in the pesticide registration program, it is also true that certain information would not be exempt from disclosure. As in the case of files on the sampling program, however, such information is not readily available and it would be necessary to review more than 45,000 files to obtain this information.

Concerning item of request No. 3, again it must be pointed out, as previously discussed with Messrs. Easley and Nevas, if the reuest will be clarified and made specific, ARS will be pleased to give it further consideration and try to provide information that will be meaningful in the objectives of your project. It must be noted that the staff time required by the Pesticides Regulation Division to sort out files and accumulate information for the use of your staff must be at the convenience of the Division and ARS has no alternative but to make a charge to recover the full cost to the Federal Government for such service.

Item of request No. 14 is so broad and general that our staff is unable to make a reasonable conclusion as to what is wanted. Messrs. Easley and Nevas were specifically informed that it had not been found necessary to maintain a documented list of specific reports which were not to be made available under the Freedom of Information Act. The reports in ARS files that would appear in

such listing are adequately covered by existing regulations under appropriate headings in the category of exempt records as described under Title VII, Chapter 3, Subpart B, Section 370.13 of the Code of Federal Regulations. To date, ARS has not found a need for a list of this type in carrying out the responsibilities of the Pesticides Regulation Division, and, therefore, does not propose to prepare such a list.

We trust that we have adequately clarified the ARS position in connection with your request that is now before this Agency for consideration.

Sincerely,

R. J. ANDERSON, *Acting Administrator.*

EXHIBIT 6

JANUARY 12, 1970.

MR. R. J. ANDERSON,
Acting Administrator, Agricultural Research Service, U.S. Department of Agriculture, Washington, D.C.

DEAR MR. ANDERSON: Your letter of November 17, 1969, denies our appeal from your denial of access to documents of the Pesticide Regulation Division on two purported grounds. One ground is that the records are covered by one or another of the exemptions to disclosure under the Freedom of Information Act in 5 U.S.C. 552(b). With respect to this ground it seems that there is no recourse but to leave it to the decision of the courts.

A second ground, however, is that the records requested were not sufficiently identified. In support of this claim, your letter states: "In a number of discussions that ARS staff members had with Messrs. Easley and Nevas, and on one occasion when you were present, repeated efforts were made to have your request contain a more specific description of what you desired to review rather than a broad and indefinite type of request. ARS was not successful in getting your staff to modify or to be specific in their request."

This charge is disingenuous in the extreme. Let us review the facts. As you know, in our efforts to gather the information we needed on pesticide regulation, we learned that your office maintains three master index files:

(1) master record card file, indicating the status of complaints or other action involving manufacturers, filed by name of manufacturer; 2) a master registration card file, which is filed by registration number and is cross-referenced to the pesticide and the manufacturer by name; and 3) a summary file of monthly reports of all seizure and citation actions taken with the month, filed chronologically.

Despite repeated requests, we were denied access to these files. Had we had such access we could have specified our requests for files by name, data and number, which is apparently the only data which will satisfy your demand for specificity. We once again herewith request access to these files. The "Catch 22" logic which characterizes your charges of lack of specificity in our requests is extraordinary: you deny us information on the grounds that it lacks specifying data which is available in index files also denied to us.

In any case, the information furnished by us in our original request was more than sufficiently specific for your personnel, familiar as they are with the records, to determine exactly what to furnish us. But to leave no doubt as to the specificity of our request, I will add the following:

Your files are arranged as follows:

(*a*) "Registration Jackets" which contain all the material submitted by a manufacturer when he seeks registration of a chemical product: application forms together with all PRD notations from the various pesticide evaluation staffs; it also contains the product formula (which we do not desire to see) in a small brown envelope marked "Confidential," slipped in the jacket. These jackets are filed by manufacturer number and then by product number within the manufacturer number. Once we have had access to the master index files described above, we will be happy to furnish you with a list, by number of files we desire to examine; we have already requested, and have been denied access to File No. 201–130, the registration file of Shell Chemical Co.'s Vapona No-pest Strip.

(*b*) "Enforcement File Folders" which contain the sample collections report of the field inspector who collected the sample, together with all laboratory reports on the tests run on the sample, all recommendations for actions and all

correspondence with the manufacturer regarding the sample. These are filed by number. Once we have had access to the Master index files described above, we will be happy to furnish you with a list of the files we wish to examine.

(c) "Company Correspondence Folder" which contains all the correspondence from each manufacturer, filed by manufacturer. They are filed in the same file cabinets with the registration jackets, in front of the set of registration jackets for all of the manufacturer's products. Again, after access to the Master Index, we will specify exactly which files we wish to examine.

Your letter further states:

"It is also noted that the requests are not limited to information applicable to any particular period of time. Even if there were no Proprietary information in these files, the effort that would be required on the part of the Pesticides Regulation Division to assemble and provide this type of information would be extremely burdensome and would materially interfere with the performance of other agency functions. This would require us to take personnel off programs which are vital to the public interest and where there is already a sizeable backlog of work due to the limited number of personnel."

In response to this we are willing on our part to limit our request to files no older than five years.

Very truly yours,

HARRISON WELLFORD.

EXHIBIT 7

U.S. DEPARTMENT OF AGRICULTURE,
AGRICULTURAL RESEARCH SERVICE,
Washington, D.C., February 20, 1970.

MR. HARRISON WELLFORD,
Coordinator, Student Study Group on USDA, Center for Study of Responsive Law, Washington, D.C.

DEAR MR. WELLFORD: This is in reply to your letter of January 12, 1970, relating to Dr. Anderson's letter of November 17, 1969, denying your appeal for certain information under the Freedom of Information Act, 5 U.S.C. 552. Dr. Anderson's letter of November 17, 1969, denied your appeal for lack of specificity and on the additional grounds that the files requested would contain information exempt from mandatory disclosure under the Act.

I appreciate your attempt to be more specific. With respect to your request number (2) for access to "a master registration card file," this is apparently a reference to registration report (PR Form 9-184 and 9-184-1). I have determined that you may have access to these reports. Please contact Dr. Harry W. Hays, Director, Pesticides Regulation Division, to make necessary arrangements.

Your request number (1) for access to "a master record card file, indicating the status of complaints or other action involving manufacturers, filed by name of manufacturer" and request number (3) for access to "a summary file of monthly reports of all seizure and citation actions taken with the month, filed chronologically," call for internal communications and investigatory files compiled for law enforcement purposes. Such information is exempt from mandatory disclosure under 5 U.S.C. 552(b)(5) and (7). I have considered whether this information should nevertheless be made available to you and have determined under 7 CFR 1.4(a)(3) that disclosure of this information would adversely affect the national interest and constitute an unwarranted invasion of privacy. Your requests numbered (1) and (3) are therefore denied.

We realize that granting requests (1) and (3) might assist you in identifying the particular underlying files in which you are interested. However, to grant those requests would require us to release a complete list of citations and other preliminary law enforcement steps we have taken in recent years, as well as the opinion of our staff as to whether violations had occurred warranting such steps in each instance. We do not believe it is appropriate for an investigative agency to release to the general public this type of information. In our view to release publicly charges of law violations that are the result of *ex parte* investigation, where there may be no evidence of wilfulness, and where the suspect has not been given an opportunity to offer an explanation or correction, may prove not only unfair but also counterproductive in terms of law enforcement. Statistical and other reports of our law enforcement activities, which unlike the materials you seek do not name particular suspects, are of course available to the public. If you desire to see such reports, please contact Dr. Harry W. Hays.

Your request for registration jackets, enforcement, file folders, and company correspondence folders for the last five years is also denied: The material in these files is generally exempt from mandatory disclosure under the various provisions of Section 552(b). Disclosure of certain materials in the files, for example, is prohibited by the FIFRA and therefore exempt under Section 552(b)(3) of the Freedom of Information Act. Also in the files is information furnished the agency in confidence which is exempt under Section 552(b)(4), internal communications of the agency which are exempt under Section 552(b)(5), and materials which are a part of an investigatory file compiled for law enforcement purposes and therefore exempt under Section 552(b)(7). As to all of these documents, compulsory disclosure is not required under the Freedom of Information Act. I have also considered the question whether these materials, though exempt, should nevertheless be made available to you. My conclusion is that they should not, because disclosure would "adversely affect the national interest and constitute an unwarranted invasion of privacy." 7 C.F.R. 1.4(a)(3).

It may be true that the jackets and folders requested contain certain items of information which we would be willing to release. However, the task of segregating this information from these jackets and folders is an almost impossible one. A review of each paper in tens of thousands of folders and jackets would be required, followed by excerpting as necessary. The manpower of this agency does not even begin to approach that which would be involved.

For these reasons, I am unable to act more favorably on your requests.

Sincerely,

GEORGE W. IRVING, JR., *Administrator.*

Mr. WELLFORD. Mr. Chairman, I have discussed this morning the following points with regard to Federal action on 2,4,5-T and related herbicides:

The ineffectiveness of action taken by USDA up to this point;

The fact that the burden of proof in establishing safety should be placed on the manufacturers of suspected herbicides;

The delays in the administrative procedures of cancellation; and

The secrecy and lack of public participation which infects all phases of Federal regulation of pesticides.

In conclusion, I would like to add that the herbicide 2,4-D, which I did not discuss for lack of time and because it did not figure in our petition to the Secretary of Agriculture on 2,4,5-T, is just as deserving of cancellation and probably suspension as Silvex. The Bionetics report labelled 2,4-D is probably teratogenic and deserving of further study. Further tests in the FDA revealed that 2,4-D did cause birth defects in chicks.

In testimony before this subcommittee on April 15, Dr. M. Jackueline Verrett reported that:

> The herbicide 2,4-D as a commercially available sample, and a purified sample . . . have been tested. Terata and chick edema syndrome have been observed with all of these materials at levels of 10 p.p.m. and above. Lower levels are under investigation . . . .

Although experiments on chicks are not as meaningful for man as experiments on mammals, they do show that 2,4-D and other chlorophenoxy herbicides cause birth defects in a wide variety of species.

Dr. Samuel Epstein expanded on this in his report to this committee in April that experiments done by the Pesticide Chemistry and Toxicology Division of the FDA showed that 2,4-D also caused birth defects in golden hamsters. A dosage of 100 mg/kg caused birth defects in 22 percent of the fetuses.

After analyzing the hazards of herbicides, the Mrak Commission on Pesticides concluded that:

> The use of currently registered pesticides to which humans are exposed and which are found to be teratogenic by suitable test procedures in one or more mammalian species should be immediately restricted to prevent risk of human exposure. Such pesticides in current use include . . . the butyl, isopropyl, and isoctyl esters of 2,4-D. . . ."

As the committee knows, there has been no implementation of the Mrak report recommendation to date.

Thank you, Mr. Chairman.

Senator HART. Mr. Wellford, you mentioned the memorandum from Dr. Hays—Dr. Harry Hays. Do you agree that the criteria that it sets down for suspension and cancellation are sound?

Mr. WELLFORD. As far as Silvex is concerned, I think yes. When the public health is at stake, reasonable doubt is sufficient grounds for restriction of a pesticide. But I think that one of the gaps in the memorandum is that it apparently applies only to hazards to human beings and not to the environment. I think that is one point that should be clarified and expanded.

Senator HART. Well, it is my feeling—and I should, I suppose, make it tentative—my impression that the reasonable doubt test should apply to suspension, not just legal cancellation.

Mr. WELLFORD. Absolutely. I think this is one point that just needs to be restated here. That is that Silvex and 2,4-D at the time of our previous hearings certainly had enough suspicious evidence about them to warrant at the very least cancellation and I think suspension under this reasonable doubt test. But at this point, the Department has refused to act.

Senator HART. What is your opinion as to the consideration of the utility of the pesticide in determining cancellation or suspension? We are talking now on the assumption that potential public health hazard has been identified in the product. And to what extent should the Department consider putting into the statute the evaluation of the economic benefit, other benefits?

Mr. WELLFORD. I think there are several stages that one has to go through in deciding to restrict a pesticide. And one stage is clearly to estimate its economic utility. The first step, it seems to me, is to ask how much remains to be known about the potential risk from a pesticide. If the potential risk is very great—Dr. Arthur Galston of Yale described 2,4,5-T as potentially the ecological equivalent of thalidomide—in cases of these herbicides, I think there is so much we dont's know and the potential risk is so great that the economic considerations really have to be downgraded in importance.

But I think a second question clearly is how vital is the use for which the pesticide is being sold. It is clear that in a yellow fever epidemic, DDT ought to be used. It is not clear that it ought to be used in other areas where it can do great damage to wildlife and their is no compelling public health need.

A third point is the fact that most pesticides do have economically feasible alternatives. And the alternatives are frequently more costly, but they can be experimented with and frequently will eliminate the economic hardship of a specific restriction of a pesticide.

There is another point, I think, a more general point, which your question brings to mind. And that is that estimates of effectiveness of pesticides just like estimates of safety are extremely imprecise. The whole field of cost benefits analysis of pesticides is at a very primitive stage. Effectiveness for the most part now means effectiveness in killing a particular thing, whether it is a weed or a specific insect.

But effects, for example, on the long-term quality of the soil, or on the predators of the target insect which may ultimately actually reduce the yield of a specific crop—these more subtle and long-term effects, are not as carefully investigated. And I think that one area that needs great expansion in research is to make more precise our calculations in a broad sense of the cost and benefits in pesticides.

Senator HART. That is a very comprehensive answer and of value. It is your feeling that the Department of Agriculture has not applied in its decisions on pesticides the appropriate criteria, I guess is the way to put it, or adequate criteria. The Congress should respond by doing what? Of all the many things we do not know much about, if anything, is the business of herbicides and pesticides, chemistry. What do you suggest?

Mr. WELLFORD. Well, I do not suggest that we send all the members of this committee to school in organic chemistry, but I do think that there is a very valuable and appropriate role for you to play.

In the first place, these hearings obviously serve as a valuable educational service to the Nation and to the scientific community specifically.

But secondly, there are a large number of procedural steps—and Senators are experts on procedure—that can be taken which will make the whole process of pesticide regulation more responsible. One step is to assure that impartial and competent biological testing of pesticides be introduced before the public is exposed to them.

And Dr. Samuel Epstein has a proposal which I think has a lot of merit. He suggests that an advisory committee of disinterested scientists be established to receive from chemical companies requests that safety data on proposed pesticides be determined. And this advisory committee would take the request from the chemical company and then, as I understand it, take bids from commercial testing laboratories.

The laboratories, by the way, would have already been checked in advance for competence and reliability. And then the advisory committee would assign the safety effectiveness laboratory work to the testing laboratory that had the lowest bid.

Now, there are a lot of advantages to this plan. It breaks the intimate relationship between the testing laboratory and the chemical company. As I mentioned in the testimony, you have built-in conflicts of interest here in the testing system. The testing laboratory that is too vigorous and comes up with too many unpleasant facts about a pesticide is likely to be avoided the next time around by the company.

The company does not have to be Machiavellian to act this way. If its competitors are doing it, he probably feels he has to follow suit.

Now, we would place an intermediary between the companies and the testing laboratories. And I think it would go a long way to making this biological testing more significant and probably more competent.

Another point which I want to stress very strongly is I think that really we have gotten to the point now where it is pointless to have secrecy still shroud all the formal and informal discussions between the companies, the Pesticide Regulation Division and the various expert committees, laboratories and so forth, who are doing research on pesticides. It seems to me that when safety is at issue, safety for human beings, and for the environment, all these procedures should be a matter of open record.

And this is a procedural step again, but I think it is entirely within the competence of the Senate to take it. There are many other steps.

I think accident reporting is still in a rather pathetic state. There are many reforms there that could be introduced. There are certain biases in the Federal Insecticide Act which might be reduced.

For example, if I am a manufacturer of 2,4,5-T and I want to violate the ban and ship my prohibited products in interstate commerce, the most I am going to be penalized on the first offense is $1,000 fine without any jail term. It would just be considered a misdemeanor. On the other hand, if somebody revealed trade secrets of the same manufacturer, he would be subject to 3 years in jail and a $10,000 fine.

Now, that is quite a discrepancy.

Senator HART. That is in the same act?

Mr. WELLFORD. That is in the act, right.

Senator HART. I would say that is in the realm, first of all, of Congress.

Mr. WELLFORD. There is a larger point. Again, I seem to like to go to generalities here. But I think Congress should, the Senate should, consider at some point the anomaly of continuing to have an agency like the Pesticide Regulation Division within a department whose main purpose is to increase the production of American agriculture. The Pesticide Regulation Division must do business with the Forest Service, the Pest Control Division and the conservation agencies, which are themselves large-scale users of pesticides.

There is an ethos in the Department quite naturally which stresses efficacy over safety. And I think some of the pressures on the regulation of pesticides, some of the negative pressures, might be reduced if this agency was not in that Department.

Senator HART. I did not anticipate as full a response. And each point you make, to me, seems to make sense. It behooves us to pursue each of those suggestions and see if their adoption would not lessen the hazards.

You comment in your testimony on the Department's failure to warn the public against buying a product that is suspended or warning against using a suspended product. How effective is relabelling in terms of caution and alert going out to the public?

What else would you expect the Department to do?

Mr. WELLFORD. The relabelling really goes to the heart of the basic problem of pesticide regulation. You, I remember, followed closely the controversy over automobile safety a few years ago.

Within the world of agricultural chemical procedures, the nut behind the wheel has sort of been replaced by the nut behind the spray can. And there is a feeling that most dangers of pesticides can be eliminated by simply using the label to guide the user to safe uses only.

The problem with that, as the Mrak Commission points out, very few people actually read the label. And in the case of a potentially dangerous herbicide like 2,4,5-T, for example, I really do not think we can rely on the individual consumer to avoid dangerous uses.

There may be other cases where the danger from the toxicity is much less where this might be possible, but labelling is a very small step to take and often inadequate and misleading.

Senator HART. You described and introduced for the record the petition filed or that Mrs. Katz has filed. Assume the petition is granted and every prayer in it. In view of what you have said, do we still not run the risk of a hazardous product appearing on the market and being purchased by one who knowingly misuses it? They canceled 2,4,5-T for use on pastures. Could the farmer continue to buy it and continue to use it on food crops—a use for which it would then be suspended—without violating the law?

Mrs. KATZ. Well, at the moment, there is no effective sanction against a consumer who either knowingly or unknowingly uses the product which has been suspended or canceled. And I think this is another area where Congress can take some meaningful steps and give us some real reform. I think two kinds of steps could be taken in this regard.

I think both private court actions could be authorized so that a neighbor who receives, say, drifted spray from 2,4,5-T spraying could sue his neighbor. And if the act is willful, he could get punitive damages. I think that could be accomplished.

And I also think there should be criminal liability for a consumer, especially if he knowingly uses a product which has been banned. There should be criminal liability to punish him for this. And I would recommend, not only a fine, but perhaps a jail term, however small, depending on the magnitude of the offense committed so he feels he is, in fact, a criminal and not merely someone who did a slightly erroneous thing.

I think fines tend to be absorbed and forgotten rather readily.

Senator HART. I am not good at remembering bill numbers. I do have a bill pending that would substantially achieve the results you indicate you think wise.

Mrs. KATZ. I am glad.

Senator HART. Mr. Bickwit.

Mr. BICKWIT. Under current law cannot someone who has a suspended product sprayed on his land sue to enjoin the nuisance thereby created?

Mrs. KATZ. I presume that is correct if there is real damage which he can convince the court is sufficiently serious. And in some cases, we do not really know the precise effect. It is hard to prove damage.

We have had such a case in Silver Spring, and the doctor refused to say definitely that the little girl who was allegedly injured by the spray was in fact injured by the spray. He said it could have been a virus, it could have been this, that, and the other thing.

Doctors are fraid to go out on the limb. And it is on their testimony that a verdict in such a case would hinge. So there is that problem now.

Mr. BICKWIT. So your suggestion of punitive damages would not be tied to any demonstration of damage actually proved by the plaintiff.

Mrs. KATZ. That is right.

Mr. BICKWIT. Mr. Wellford, you suggest that the administrative procedures under the Federal Insecticide, Fungicide, and Rodenticide Act have too much built-in delay. Have you given any thought as to how one could strengthen them?

Mr. WELLFORD. I have given a lot of thought to that. It is a question of where to start.

In the first place, I think that the secret advisory committee stage of cancellation procedures should probably be eliminated. At least the secrecy should be eliminated.

Also, I think this is something we have not really mentioned in the direct testimony, but I think is absolutely vital. Every pesticide which has been initially registered comes up for renewal every fifth year. At this point, reregistration is just a pro forma activity.

It seems to me that it would be a great service to responsible use of pesticides and to anticipation of human health hazards if a notice of reregistration was put in the Federal Register and comments solicited from interested scientists all over the country. Then, you would really have a chance to have the use of the pesticide over the first five years reviewed and discussed and perhaps unpleasant consequences avoided.

At this point, this is what I would have done. I think it would be a very valuable change.

Joan, did you have something?

Mrs. KATZ. If I could, I would like to amplify on that a little bit. I think the whole procedure should be essentially reversed. I do not think we should be waiting until somebody discovers there is something wrong with a pesticide to initiate the kind of thorough investigation that we have been talking about. I think before any pesticide is registered, there should be a notice published in the Federal Register and comments from scientists and other interested persons, farmers or whoever they may be should be able to be received for the Department's consideration.

If at this point there is any real doubt raised about the safety of the proposed pesticide in any of its uses, perhaps the hearing procedure should be initiated right then rather than waiting until after the pesticide is in use and opinions have been formed and the whole thing is much harder to stop.

I would also suggest something along the line of eliminating the advisory committee. I think in courts, very often a master is used to find facts in difficult cases. I think you might use a similar setup here. You might have a hearing if that would be requested by the manufacturer. And the first stage in that hearing might be a master—in other words, something like an advisory committee, two or three scientists who would find the scientific facts concerning this product—and there would be no decision at that point, however, as in the advisory committee setup as it now exists.

That would go right into the hearing, the next stage. And there would be a decision reached within the hearing within a very short time. And from there, this could be reviewed by the Secretary and ultimately additional review. I think all the time limits could be moved up from where they are now. I do not think you need the 60- and 90-day periods.

Mr. BICKWIT. Thank you. That is helpful.

Senator HART. Your testimony has been, not only interesting, but very helpful. And I thank you.

Mr. WELLFORD. Thank you.

Mrs. KATZ. Thank you.

Senator HART. I am compelled to recess for 15 minutes in order to get to the Judiciary Committee and hopefully get out.

(Recess.)

Senator HART. The committee will come to order.

We welcome back, I suspect you feel, two long-suffering friends of ours from the Department of Agriculture, Dr. Ned Bayley, the director of science and education, and Dr. Byerly. We welcome you both.

Dr. Bayley, you have a prepared statement?

STATEMENT OF DR. NED D. BAYLEY, DIRECTOR OF SCIENCE AND EDUCATION, U.S. DEPARTMENT OF AGRICULTURE; ACCOMPANIED BY DR. T. C. BYERLY, ASSISTANT DIRECTOR, SCIENCE AND EDUCATION, U.S. DEPARTMENT OF AGRICULTURE

Dr. BAYLEY. Yes sir; I do have a prepared statement.

Mr. Chairman, I am pleased to have this opportunity to appear before you to report actions and information on the herbicide 2,4,5-T, other phenoxy pesticides, and the dioxins. As you mentioned, Dr. T. C. Byerly, assistant director, science and education, is with me.

I will direct my remarks chiefly in this formal statement to the period subsequent to April 8, 1970, when we appeared before the committee.

On April 15, 1970, the Secretary of Agriculture, the Secretary of Health, Education and Welfare, and the Secretary of the Interior jointly announced the suspension of registration of liquid formulations of 2,4,5-T for use around the home and all formulations for use in aquatic areas.

They also announced the cancellation of registration of all nonliquid formulations of 2,4,5-T for use around the home and on food crops grown for direct human consumption.

Action to restrict registered uses of 2,4,5-T was agreed upon following review, evaluation, and recommendation that action be taken by the representatives of the three Departments designated to represent them under the Interagency Agreement for the Protection of the Public Health and the Quality of the Environment in Relation to Pesticides.

New information was reported to those representatives on April 13, 1970, by scientists of the National Institute of Environmental Health Sciences (NIEHS). This information showed that the purest available 2,4,5-T, when injected subcutaneously into preg-

nant mice at the very high dosage level of 100 mg/kg body weight n a solvent, dimethyl sulfoxide, on the sixth to 15th day of pregnancy, resulted in a significant and substantial increase in developmental defects in their unborn young. These and other results of this study were reported to this committee by the Surgeon General, Dr. Jesse Steinfeld, on April 15, 1970.

The decision by the Secretary of Agriculture to suspend certain registered uses of 2,4,5-T was pursuant to the finding by the Secretary of the Department of Health, Education, and Welfare that continuation of such uses might constitute an imminent hazard to the health of pregnant women. The actions to cancel other registrations were based on the determination that the continued use of canceled products might constitute a hazard, but not an imminent hazard.

The notice of suspension, issued on April 20, 1970, required immediate cessation of interstate movement of the suspended products. The registrants were also requested to stop the sale of the suspended products to the public and to recall the products on dealers premises.

The Department is informed that 106 registrants have requested their dealers to stop sale of the suspended products. The only other registrant was noncooperative. We are initiating action to effect seizure of its products. We obtained a warrant and examined the registrant's records to determine product location.

Recall may be accomplished by approved relabelling for registered use by return of the product to the registrant or by disposal in accord with Federal, State and local requirements or by any other appropriate means such as storage in a safe place which removes the product from the channels of trade.

Our Pesticides Regulation Division inspectors are instructed to report on the progress of each recall action. Reports of noncompliance provide the basis for initiation of action to seize the product.

Several of the formulators have informed the Department that recall of the several million retail packages of the suspended products present on the premises of thousands of dealers entailed problems of repackaging, transportation, disposal and costs extremely burdensome to them.

Hercules Chemical Co. has appealed the suspension and cancellations of their registered 2,4,5-T products, and Amchem and the Dow Chemical Co. have appealed the cancellation of their canceled products. Advisory committees will be provided to consider these appeals as provided in the FIFRA.

Suspended products may not be moved in interstate commerce during the period of the appeal. Canceled products may.

A Registration Review Panel has been established under the provisions of the Interdepartmental Agreement to consider all problems relevant to registration of 2,4,5-T. Such problems include, for example, poison ivy control around the home for which purpose 2,4,5-T is highly effective, efforts of registered uses of 2,4,5-T directly on wildlife and their habitats and the problem of quality control of 2,4,5-T formulations with respect to contaminant dioxins.

On February 6, 1970, the Department announced that it would examine samples of 2,4,5-T and 17 other phenoxy pesticide compounds to determine whether or not they contained dioxins.

The 18 phenol based pesticides which were included in a February 6, 1970, announcement consists of 14 herbicides, two fungicides, one nematocide (nemacide), one insecticide (Ronnel), and two acaricides.

The table accompanying our testimony which I would like to have inserted in the record describes these in accordance with the types of chemical compounds that they are.

You notice that under dichloro compounds, there are eight which are herbicides, one is a fungicide, one is a nematocide. In the trichloro compounds, there are four which are herbicides, one is an insecticide, two are acaricides.

And then we have the pentachloro compounds which are used in both herbicides and fungicides.

Senator HART. The table will be printed.

(The table follows:)

COMPOUNDS

	Dichloro	Trichloro	Pentachloro
Herbicides	2,4-D 2,4-DB 2,4-DP sesone falone dicamba TOK (Nitrofen) zytron	2,4,5-T silvex tricamba erbon	PCP
Fungicides	chloroneb		Do.
Nematocides*	nemacide		
Insecticides		Ronnel	
Acaricides		Animert Tetradifon	

*Also used as an insecticide.

Dr. BAYLEY. 2,4-D is our most widely used herbicide. About 79 million pounds were produced in 1968, more than 20 percent of the total herbicide production of about 375 million pounds produced that year. 2,4-D herbicides are widely used for weed control in cereal grain crops and to a lesser extent in hay and pasture crops.

2,4,5-T formulations have been used on about 8 million acres of land annually. About 4.5 million acres are non-agricultural land and about 3.5 million acres are agricultural.

Other phenoxy herbicides indicated in this table are used on smaller acreages.

Pentachlorphenols are used principally as wood preservatives. About 27 million pounds were used for this purpose in 1968. Pentachlorphenols are also used as an herbicide in limited amounts.

Ronnel which is one of the trichloro compounds is a systemic insecticide used to control cattle grubs. It is also used for external application to control face flies and also aids in the control of lice and horn flies.

At this point, Mr. Chairman, I think it might be worthwhile if Dr. Byerly would explain the chemical significance of these three different kinds of compounds in this table from the standpoint of the presence of the dioxins in them.

Senator HART. Dr. Byerly.

Dr. BYERLY. Thank you, Mr. Chairman.

The dichloro compounds as listed are those that are made by the reaction of dichlorophenol, a 2 chlorine compound with chloroacetic acid. This is a reaction that takes place in the cold. It is one that is unlikely to result in the production of dioxins.

The trichloro compounds are made from tetrachlorobenzene as you heard this morning. And during that process, trichlorophenol is made. During this process, there is reaction with sodium hydroxide and heat. It is possible that dioxins will be formed.

Therefore, in quality control in good manufacturing practice, there has to be control of the mother substance and the final product to remove or eliminate dioxins to the extent possible. In good manufacturing process, this will bring them down to less than a half ppm of the tetra compound.

In the production of pentachlorophenols, these are more chlorine atoms and a high temperature process is required. This may result in the presence of one of the dioxins, the octa, the eight chlorine compound, which is far less toxic than the tetra compound.

I believe, sir, unless there are questions, this concludes my remarks.

Dr. BAYLEY. The Department has initiated a research and evaluation program which includes chemistry and plant physiology of the phenoxy pesticides and chemically related compounds. Priority is established for studies of dioxins because of their high toxicity and teratogenicity.

Our objectives include:

1. Determination of those compounds which may contain contaminant dioxins.
2. The kinds and amounts of such contaminant dioxins.
3. The source and formation of dioxin contaminants in fats and oils.
4. Determination of presence or absence of 2,4,5-T or dioxin residues in meat from meat animals administered 2,4,5-T formulations.

The Department has provided and equipped an isolation laboratory at Beltsville, Md., for research and chemical assay of dioxins. This laboratory is now fully equipped with Electron Capture Gas Chromatography. Mass spectrometry will be used to verify results obtained with these highly sensitive methods.

The laboratory is staffed with chemists and their technical assistants fully competent in the methodology. As you remember the last time we reported, we were having to train these people. They are also fully prepared to handle the highly toxic dioxins with minimal hazard to their own health. They have undergone physical examination to establish their current health status. The Department will continue to exercise due regard for the protection of their health.

Certain 2,4-D compounds were implicated as possible teratogens by the Bionetics Study. These Bionetics data relevant to 2,4-D are published in tables 1, 2 and 3 of chapter 8, "Teratogencity of Pesticides," of the Report of the Secretary's Commission on Pesticides and Their Relationship to Environmental Health which we all know is the Mrak Commission Report. They show that:

Of the 2,4-D compounds tested in the Bionetics Study, the isooctyl, isopropyl and butyl esters gave significantly increased proportion

(significance level of 0.05, 0.01 an 0.01 respectively) of abnormal fetuses per litter in tests, including 15, 20 and 20 litters respectively.

Other Bionetics tests with these compounds involving 19 litters with the isooctyl ester, 12 litters with the isopropyl ester, and 16 litters with the butyl ester, respectively showed no significant increase of anomalies.

Tests including 18 litters (methyl ester), 14 litters (ethyl ester) and 59 litters (2,4-D acid) showed no significant increase in proportion of abnormal fetuses per litter (significance level 0.05).

The report states: "Due to the teratogenic activity of certain of its esters, 2,4-D should be studied further." Comment on recommendation 5 of the report includes only isooctyl, isopropyl and butyl esters of 2,4-D among the list of compounds requiring priority for evaluatory research and review of registered uses and other relevant data.

USDA is undertaking research with 2,4-dichlorophenol and the corresponding dichloro-dioxins. The Northern Utilization Research Laboratory at Peoria, Ill., will use ^{14}C labeled 2,4-dichlorophenol to follow this material through the soybean oil refining process. You remember that last time, we alluded to the fact that there are other products and pesticides involved in some of these products.

We have also initiated research with the ^{14}C labeled tetrachlorodibenzo-p-dioxin. Specifically, we have plant uptake studies underway with both dioxins and the 2,4-dichlorophenol.

2,4-dichlorophenol is the precursor used in the manufacture of 2,4-D by its reaction with chloroacetic acid.

We have been verbally informed by the Dow Chemical Co. that they have extensive tests underway with rats to determine whether or not 2,4-D is teratogenic. They also plan to have similar tests conducted with mice.

The Department is conducting research in cooperation with the Department of Health, Education, and Welfare and industry scientists on the chemistry and physiology of the dioxins.

Research studies and assay methods alike depend upon reliability as well as sensitivity of assay methods. Pure reference materials of each of the chlorodibenzo-para-dioxins are necessary. They are being developed by scientists in the Department of Health, Education, and Welfare and the Dow Chemical Co. laboratories.

Small amounts of each of the chlorodibenzo-para-dioxins have been prepared. There is excellent cooperation among the scientists in USDA, HEW, and industry laboratories in development of methods and verification of results.

There are 67 possible compounds and isomers of the dibenzo-para-dioxin family which we ordinarily call dioxins. Information to date indicates that the degree of their toxicity may depend on the number of chlorine atoms attached to the benzo rings and, perhaps, to the positions of the chlorine atoms of the isomers. The tetrachloro compounds known alphabetically as TCDD are apparently much more toxic than compounds with more chlorine atoms.

Some of the important research questions concerning dioxins are:

1. Can dioxins be formed in soils or plants from chlorinated phenols?
2. Can dioxins be destroyed by soil microorganisms or plant or animal enzymes?

3. Does dioxin accumulate in animal tissues?

4. Can dioxins be formed from chlorophenols or destroyed during vegetable oil refining or fat processing?

Research is being started this week at Kerrville, Tex., to obtain residue data on the occurrence of 2,4,5-T, 2-4-D, Silvex, and MCPA in animals. The first work will be done on 2,4-D. It will be fed to cattle and sheep for 28 days at several rates and then different numbers of animals will be sacrificed at different intervals and analysis made for residues in five tissues—namely, blood, liver, kidney, muscle, and fat.

For example, one of the intervals for sacrificing animals would be 24 hours after last feeding. Another interval would be 7 days after last feeding. In a similar manner 2,4,5-T will be fed to sheep, and subsequently, studies would be run on Silvex and MCPA.

The Department has some preliminary results from its research with TCDD.

Solutions of this compound which is tetrachlorodibenzo-para-dioxin in methyl alcohol were exposed to ultraviolet light from a sunlamp of wavelengths present in sunlight (maximum output at 310 nanometers).

Other solutions of TCDD in methyl alcohol were sealed into glass tubes and exposed to direct sunlight.

About half of this particular dioxin was decomposed by energy from the sunlamp in 5 hours and practically all of it in 48 hours. So, too, was the TCDD decomposed in the samples exposed to direct sunlight. These results indicate that TCDD is very much more rapidly decomposed by sunlight than, for example, DDT.

On the other hand, TCDD applied to dry soil surface showed no decomposition after 96 hours of sunlamp irradiation.

Experiments on mobility of TCDD in soils showed that it did not move in soils. It is unlikely to leach into ground water, but could be carried into water supplies on sediment eroded from treated areas.

Identification of decomposition products from photolysis of TCDD remains to be done. In dilute solutions, it is probable that chlorine atoms are replaced successively by H or OH. Such products would be much less toxic than TCDD.

This statement summarizes the actions taken since our previous appearance. We have found no information thus far which would cause us to change the actions announced on April 15, 1970.

With your permission, Mr. Chairman, I would like to add some remarks regarding my personal experience with the administration of FIFRA during the past two years.

Senator HART. You are welcome.

Dr. BAYLEY. First of all, I would say that we have been developing amendments to FIFRA which indicate that we do not believe the law as presently written is adequate to carry out our responsibility to protect the public. In the development of these amendments—they are presently under review among the various Federal agencies—several of us have come to the conclusion that mere amendment may not be enough and that we may need to rewrite FIFRA and come up with a new law.

One of the amendments which is under consideration and which I personally think is necessary has to do with preliminary suspension so that the products can be suspended from the trade while administrative action is proceeding.

Senator HART. Doctor, would you restate that? I was distracted.

Dr. BAYLEY. One amendment which I personally think should be seriously considered is the one involving preliminary suspension so that products can be suspended from the trade while administrative procedures are being carried out.

I believe that this will provide an additional option that we need in order to exercise our responsibilities in protecting the public and at the same time avoid the complete disruption of the use of some of these products until the final information is in.

I believe that we are always going to be confronted from time to time with some preliminary data which requires preliminary but not final action until the data is complete. We need the authority to be able to carry this out.

Senator HART. If I can interrupt you without turning off your track on these others——

Dr. BAYLEY. Yes. I have the others listed.

Senator HART. Do I understand that the existing extension would not permit you to suspend while these administrative procedures are carried out? Because your data at this point will not have established that it is an imminent hazard, is that the point?

Dr. BAYLEY. That is the point. And it would not have established this sufficiently to take the final action involved in its suspension.

Senator HART. Does the statute itself require a finding of imminent hazard in so many words?

Dr. BAYLEY. As a basis of suspension, I understand this is correct.

Senator HART. And Congress apparently recognized there was a difference between hazard and imminent hazard.

Dr. BAYLEY. Yes.

Senator HART. I will bet we did not define either of them, did we?

Dr. BAYLEY. No; you did not.

Senator HART. So it is your fault.

I realize that much of this is in a sense unfair to you.

Dr. BAYLEY. Well, let me make clear the basis on which I would like to present this information. I am indicating the problems as we see them in administering this law, recognizing that the law itself provides for a wide range of interpretation.

Senator HART. Yes, but on the point I was pursuing, the law admits of no confusion or differing interpretations. It says to suspend, you have to have imminent hazard.

Dr. BAYLEY. That is my understanding, yes, sir.

Senator HART. All right.

Dr. BAYLEY. Now, the second area that goes beyond registration is one that has been referred to several times. We have heard some comments this morning about the ineffectiveness of changing the label. I would go a little further than that and raise some questions about the effectiveness of restricting the law to labelling.

We presently have a contract in progress looking into the effectiveness of labels and how they can be made effective. We do not

have the full results of that contract, and we will not for some time. But our review of the literature regarding labels in general suggests that this is not an effective way to protect the housewife, who does not read labels very closely.

We believe that one of the amendments that should be considered is the authority for restricted use of certain pesticides. The general pattern would be to classify the pesticides according to their hazards. Those which are considered more hazardous should be registered only if they are applied by license applicators who must meet certain standards of training and responsibility and who would be responsible for misuse.

Now, we recognize that this type of action involves relationships with State Governments, and that similar to some other licensing arrangements, we may want to carry this out so that the applicators are licensed by the States in accordance with a uniform standard set by the Federal Government.

This procedure has complications regarding State Governments, but we believe some type of restricted use is essential if we are going to protect the public and at the same time be able to provide the pesticides for essential uses.

In regard to enforcement. we believe that the recall procedure should be supplemented with "stop sale" authority at the retail level. This is one of the amendments that should be given very strong consideration. It would make the retail outlets responsible for stopping sale when it is necessary to take this type of action. We think this would close a very wide loophole in the effectiveness of our endeavor.

Again, we would have to give serious consideration to the cooperation and the relationships with local police and authorities if such an amendment were developed.

In addition, we strongly support consideration of amendments requiring quality control in manufacturing and formulating plants including the right for Federal inspectors to enter the premises and take samples to check on the conduct of the quality-control program.

With these additional legal tools, and there may be others—these are the main ones that we have been considering until now—there is also a pesticide program which we are presently initiating that I think will go a long ways, particularly in regard to agricultural uses, to solve the ecological problems that face us. We call this program, "Pesticide Use Management."

In the last few months I have been discussing with the State Departments of Agriculture, the Cooperative Extension Services and our own Federal personnel the development of a program which would base the use of pesticides in agriculture strictly on need and avoid some of the traditional preventive treatments which have been used in the past.

Let me illustrate for you the effectiveness of one of these programs which was carrier out on a pilot basis in Arizona. In Graham County, Ariz., there are approximately 12,500 acres of cotton. The growers in 1968, when treating this cotton on what we call a calendar basis—that is, spraying it every so often—spent $198,000 for pesticides in order to control the pests in their cotton.

In 1969, with the assistance of the Arizona Cooperative Extension Service, the farmers organized their own business unit and employed field checkers. The field checkers went into all the fields during the summer and determined the level of insect infestation. The fields were not treated unless the level of infestation indicated treatment was necessary.

In 1969, these cotton growers controlled the pests on their 12,500 acres, not at a cost of $198.000, but at a cost of $36,000, including the employment of checkers.

Now, this is dramatic, and I am willing to agree it is an unusual situation because of the contiguous nature of the fields of the cotton in this particular valley. But I think it is sufficiently factual and sufficiently capable of being repeated to justify exploring on a nationwide basis the possibility of treatment on need rather than on calendar basis and not just for cotton, but for all our crops.

We are bringing our three agencies that are active in agriculture together to see if we can launch such a program. We have set up a steering committee to study how we could organize such a national effort and bring this about.

One of the very enlightening results of the Arizona trial is the fact that the bee producers, who are responsible for the pollination of a good many of our fruits and vegetables and other crops, tell me that with such a program, they can survive as an industry whereas before, pesticides were driving them out of business.

Now, do not misunderstand me, I quoted you financial figures. I have quoted you how this would help the bee people. But even of more importance to me is the fact that we can obtain the essential uses of our pesticides in an effective manner with less amounts of pesticides used and solve many of our ecological and human health problems as we do so. We do not need to amend FIFRA for this. This is one we intend to move out on right away.

In addition to that, there was mention this morning of the need for opening up the opportunities for diverse groups to participate in some of the policymaking and some of the decisionmaking processes regarding pesticides. I agree with this point of view wholeheartedly. I believe that the past structure has tended to exclude those public interest groups who were not as effectively organized as some others for making presentations to members of the executive branch such as our own Department.

We need to explore means of providing participation for these groups. At the same time, of course, we do not want to completely tangle up the machinery of decisionmaking.

These are generally principles for changing the law and programs that I have presented to you here this morning, but I believe in them very sincerely. We are working on them. We will be more than glad to work with Congress in any way to carry these out.

Senator HART. The points you indicate are being considered for recommendation for amendment to FIFRA. Given your explanation of them and the background of our hearings, they all seem to make good sense. We live in the hope that that which makes good sense eventually comes about. It was not just on the campuses that there are voices doubting that assumption.

But for whom are you speaking in terms of how much muscle are we going to get up here to help us?

Dr. BAYLEY. I can speak for the Department of Agriculture in this case.

Senator HART. Good.

You ought to send a memo to the Department of HEW, attention Food and Drug, because you know most of the problem we have been listening to in terms of licensing or registering these pesticides. And as you say, the criticism is directed by the public interest groups as they feel themselves shut out by a high degree of secrecy, with less respect for trade secrets, less concern if you violate the use, the business of the applicant sort of controlling the tests of his own products. This series of criticisms aimed at FIFRA in the administration of pesticides equally are applicable to the whole business of marketing of drugs.

And at least some of these suggestions you make for amendment of FIFRA would seem desirable also as a matter of licensing pharmaceuticals for human application. But that is another department.

Before asking Mr. Bickwit to go through some questions that have been prepared, would you be comfortable in reacting to something that my last comment reminded me of?

Earlier today, Mr. Wellford repeated a point that earlier there was sort of a schizophrenic assignment that was given. You do represent Agriculture in its broadest sense. And certain floors of the Department are zeroed in on the promotion of means and methods to increase agricultural output. One of the means is the development and licensing and marketing of pesticides.

And on some other floor, another department is responsible to insure that those pesticides not get out unless hazards are not present.

FIFRA comes up here for amendment. It does not come to us; it comes to the Committee on Agriculture. You do not have to be a Ph. D. in political science to know the problem I am talking about.

Now, what do you say to the separation of licensing decisions from the agency which at least in the public's concept and probably in the statutory recitals is intended primarily to promote rather than regulate?

Dr. BAYLEY. I think that it would be perfectly in line with the discussion I just presented to state that my personal position is that a public administrator, works for all the people and not for any particular segment just because of his assignment within the executive branch. This is what I am trying to accomplish.

Senator HART. And your suggested amendments reflect the concern that is very much in the public's interest.

I hesitate to push you on this point, you having just told us what you are trying to develop.

Dr. BAYLEY. I am essentially telling you——

Senator HART. But you do know every prosecutor seeks to serve the public and every judge seeks to serve the public and every policeman seeks to serve the public, but we all agree that they should not be in the same department, do we not?

Dr. BAYLEY. Everyone agrees to this for different reasons.

Senator HART. As far as the public, they cannot be trusted to be policeman, prosecutor and judge. And there is something of this probability in these agencies and these committee organizations and Congressmen.

Dr. BAYLEY. I recognize this is a subject of wide debate at the present time.

Senator HART. I wish it was the subject of wider debate. I do not think it is the subject of enough debate.

Dr. BAYLEY. Perhaps I hear it more often than others. The concept of the fox and the chicken coop is the vernacular expression of this. I do not consider that this type of bias is inherent in regard to the agency with which the responsibility is placed.

I have said this before publicly that the problems we have had in pesticides have been a failure of the bureaucracy, and are not necessarily due to an inherent agency bias. I think you will agree this is portrayed in the position that I am taking here.

Senator HART. It is.

I will leave it by simply saying that there are certain inherent conflicts that we do not permit to exist even though we believe that those staffing the bureaus are dedicated and objective. And as I said, we have long since recognized the imprudence of putting in the one shop the activities I enumerated—the policeman and the prosecutor and judge. And I think we have to examine our functions all through Government to see if in the passage of time we have not come to accept almost equally basic inherent conflict. If there are, then, we should correct them.

Dr. BAYLEY. There is one thing that I would want to add to this discussion. In areas such as pesticides, which require a highly technical base for decision-making, there needs to be a strong tie to the research base from which some of this information can flow. We want to be careful that we do not isolate the availability of that expertise nor the support of developing that expertise if we go the route that you are talking about of separating the policing action from it.

I think this would be wrong and in whatever organization might be developed different from the present one, I think this is a very important principle to consider. Otherwise, we will lose the needed competence.

Senator HART. Mr. Bickwit?

Mr. BICKWIT. Before we get into these questions, I would like to clear the record on one point. In your statement you mention that the three Secretaries referred to announced cancellation of registration of all nonliquid formulation of 2,4,5-T for use around the home and on food crops. As I understood the Surgeon General on April 15th, the cancellation applied to liquid formulations of 2,4,5-T for use on food crops as well as nonliquid formulations. Is my understanding correct?

Dr. BYERLY. Your understanding is correct.

Mr. BICKWIT. You say that the Department of Agriculture has been informed that 106 of 107 of the registrants of 2,4,5-T have requested their dealers to stop sales of the suspended products. Mr.

Wellford's evidence this morning suggests, however, that either you have been misinformed or the dealers are not heeding the manufacturers' requests.

Moreover, a member of our staff visited 10 garden stores in Baltimore yesterday and found the suspended product on sale in seven of them. In each case, the proprietor was asked whether it was all right to use the product around the home. These were some of the responses:

1. "It is okay to use it around the home and domestic ponds."
2. "You can use this around the home and around swimming pools."
3. "It is not very strong stuff. You can use it around ponds or around the house, although I would advise you not to drink it."

Under the law as I understand it, you do have the authority to go beyond requesting registrants to stop sales. And actually, you have the authority to go out and seize products yourself, That is correct, is it not?

Dr. BYERLY. The statement that you have made, sir, is subject to due process. We have to go to Justice and ask the courts for a warrant. And we cited the one instance in which this has been done in this case.

We do not have direct authority for seizure. We have to obtain that authority from the court through due process.

Mr. BICKWIT. Does this situation suggest you ought to do that?

Dr. BYERLY. Sir, I am only expressing here a personal opinion. I firmly hold it, however, that the police power basically belongs locally and in the States. Dr. Bayley in his statement with respect to the FIFRA pointed out that we needed further strenghening of our relationship with the States with respect to local enforcement.

From the standpoint of our own agency, we have 33 inspectors for the whole United States. Obviously, this would be physically impossible for them to visit all of them. Nor do I think we should request 300 or 3,000 or some other number that would make it possible to do this.

I do not think that this function of visiting dealers, visiting retail outlets, is primarily one that the Federal Government should exercise. I think that we require as Dr. Bayley has pointed out a change in FIFRA, a change in our relationship with the States that would make it possible to do this.

Mr. BICKWIT. I agree with that entirely. This, then, points to the ineffectiveness of the recall procedures.

Do you feel if the States do not act in this case, you ought to act now to the extent that you can, given your resources?

Dr. BAYLEY. Yes. When these things are brought to our attention, we have an obligation to act, of course.

Mr. BICKWIT. And your 33 members are planning to act to the extent of their resources?

Dr. BAYLEY. Yes.

Senator HART. Doctor, let me interrupt here. You say that under existing law, you could ask Justice to go to a Federal District Court and get—what would it be—a seizure order?

Dr. BYERLY. We have to get a warrant to go in and determine where the material is, the place of the location, and get due process, yes, sir.

Senator HART. Now, in one of the amendments that Dr. Bayley described, the Department was in all likelihood going to recommend you would be given a stop sale at the retail level.

Dr. BYERLY. That would be the authority at the retail level, yes, sir.

Senator HART. Has it been thought out far enough to explain how this will differ from the existing authority?

Dr. BAYLEY. Not entirely. We do not have the full details on that at this point. As Dr. Byerly mentioned, however, one of the considerations would be to bring local police authorities in to assist so we would not have a completely burdensome police force in order to accomplish the job.

Senator HART. That really was why I was moved to ask the question. If you have this philosophy that the Federal Government may decide that certain uses are dangerous and must not be engaged in, but having done that, it is primarily up to the States and localities to enforce that decision, you have got to change that attitude a little if this stop sale is going to be very useful.

Dr. BAYLEY. More than that. This also shifts the responsibility to that retail person where he has no responsibility at the present time. One of the critical parts of this is that actions against those people at that level will have a deterrent effect on the rest of them.

Mr. BICKWIT. Do you now feel that you are obligated to go into the home to seize suspended products there? Does your obligation extend to that?

Dr. BYERLY. I have checked with our people in PRD, and they tell me that their experience with recall has been on the whole quite satisfactory. There are some numbers here with respect to actions. They have had a substantial number of them. They have had voluntary recall. They do follow through over time.

Now, how much time is enough, I do not know, to check out what is returning and what disposition is being made. They feel that the industry cooperation have been very good, indeed. And in the instant case, the fact that 106 of 107 have given this degree of cooperation is certainly a first step indicating cooperation with the Department people.

Mr. BICKWIT. Yes. But Mr. Wellford's evidence and the evidence of our staff does not indicate that kind of cooperation.

Dr. BAYLEY. That is not his question, Dr. Byerly. He asked if we felt we needed to go into the home in recall actions. I do not think we have ever carried out such an action. I would have to consider this very seriously before I would comment on it. I am not prepared at this time. That is a type of invasion of privacy that is very sensitive.

Mr. BICKWIT. While you are deciding whether or not you ought to go into homes, do you intend to issue guidelines, as I believe you said that you would, for this disposal of suspended 2,4,5-T in the homes?

Dr. BAYLEY. That is correct. And if I may broaden your question to all pesticides, one thing I did not mention is the problem of disposal when recall actions or other actions are necessary to get pesticides out of the hands of people who might be injured. There are enough of these actions presently in motion to have literally

raised a quandary around the country regarding disposal. I would be the first to admit that we do not have any easy answers for this problem.

There have been some recommendations made to me by staff as to what we might issue publicly, and I have personally turned them down because they do not answer the question properly.

We are, therefore, holding a national conference on the 30th of July in which we are having people come in from various segments of interest, including conservationists, to discuss this problem, to look at the solutions that some people are trying out in the States, and to see if we can develop some guidelines to solve this question of disposal, not only of those which we are trying to remove from the market, but also routine disposal of containers.

This is one action we are taking in order to get at this problem. We admit it is a problem.

Mr. BICKWIT. You say that you suspended certain uses of 2,4,5-T because an imminent hazard exists, and you canceled rather than suspended use on food crops because, although a hazard existed in that case, it was not an imminent hazard. That statement brings to mind several questions.

First of all, do you believe you are required to suspend use of an economic poison whenever the use in question creates an imminent hazard? We know you cannot suspend unless an imminent hazard exists, but when an imminent hazard is present, are you required to suspend?

Dr. BAYLEY. I do not see the difference. If there is one, do you want to tell me?

Mr. BICKWIT. An imminent hazard we know is necessary for suspension. What I am asking is whether it is also sufficient?

Senator HART. Have you got that straight?

Dr. BAYLEY. I am not sure I understand the legal difference.

Senator HART. Let me see if I can state it. We are agreed that an imminent hazard is required before you may suspend. If an imminent hazard is present, must you suspend?

Dr. BAYLEY. I have to admit I would be more comfortable if I had a lawyer sitting with me to answer that question because there may be a legal distinction that I am not aware of.

Senator HART. The only thing the question raises is whether you are required by the law in the event an imminent hazard is disclosed to suspend or whether you merely may suspend if there is an imminent hazard disclosed.

Dr. BAYLEY. I am not clear on that point. I will be honest with you. I am not clear on that point.

Mr. BICKWIT. Another question your statement brings to mind is exactly what the difference is between an imminent hazard and just a plain hazard. We adverted to the fact that Congress did not define the difference. Can you articulate the difference as you see it and as you apply it in your practice in suspension and cancellation?

Dr. BYERLY. May I try and answer to that as nearly as I may paraphrase the one in the dictionary that I use? It seems that imminent means something threatening to happen immediately.

Now, we have, of course, given the top priority, the high priority, in addition to the something threatening to happen immediately to any hazard to human health.

Dr. BAYLEY. That is my understanding of it also.

Mr. BICKWIT. Then, in the case of food products, if there is a hazard, it is not an imminent one? Certainly one of the hazards we are concerned about is that of birth deformities that may be occurring right now. How would you respond to that?

(The following information was subsequently received for the record:)

DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D.C., July 1, 1970.

Senator PHILIP A. HART,
Chairman, Subcommittee on Energy, Natural Resources, and the Environment, Senate Commerce Committee, U. S. Senate, Washington, D.C.

DEAR SENATOR HART: In the transcript of testimony presented to you I indicated I was not clear about a question you asked. Your question related to the requirement of FIFRA to suspend if any imminent hazard were found.

Our Office of General Counsel advises me that the law is permissive and not mandatory on this point. It states, "The Secretary may, when he finds that such action is necessary to prevent an imminent hazard to the public, by order, suspend the registration of an economic poison immediately."

I recommend that this clarification be added to the record.

Respectfully submitted,

NED D. BAYLEY,
Director, Science and Education.

Dr. BYERLY. Well, let us look at this. At April 15 or May 1, if, for example, rice is planted in the spring and harvested in the fall—is something that might occur on the rice that will be eaten 6 months hence imminent; is it threatening to happen immediately now?

Senator HART. I am glad Mr. Bickwit is conducting the questioning.

Mr. BICKWIT. Six months is not imminent in your view. Is that what you are suggesting?

Dr. BYERLY. No, sir; that is not what I am saying.

Mr. BICKWIT. How about 5? Where would you draw the line?

Dr. BYERLY. Well, I guess I will not go beyond the word "now." Imminent hazard means threatening to happen immediately.

Mr. BICKWIT. In the case of food crops, will it always be the case that they will be eaten 6 months after spraying with 2,4,5-T?

Dr. BYERLY. Not always, though, as I recall, the risk of food crops for which there are registered uses, I think that taking into account the time of the issuance of cancellation order and the specific list of food crops, as far as I recall them, that is the case.

Mr. BICKWIT. Does is follow that if the evidence were absolutely clear that whenever we applied 2,4,5-T to food crops and those food crops were eaten, we stood a 75 percent chance of a birth defect or, say, a 99 percent chance of a birth defect, that the use on food crops would not constitute an imminent hazard to health and you would not be authorized to take action?

Dr. BAYLEY. I think we are getting back to where we concluded the hearings last time. We are speculating without data. I find it very difficult to develop a precise percentage standard without

having some concrete data in front of me in order to make a judgment.

Dr. BYERLY. May I give you a tangential answer and point again to a comment that Dr. Bayley made with respect to our need for authority to make a temporary cessation of movement while we determine whether or not an imminent hazard would result? And it seems to me the case that you provided would be such a case.

Mr. BICKWIT. You would have authority to act?

Dr. BYERLY. We do not now have authority in my opinion—not clear authority—to act in such a case. Obviously, there would come a time if we were sure of the hazard when such authority could be exercised. And we would do well to warn, if we could warn, of impending action.

Dr. BAYLEY. I think what we are doing is pointing up the difficulty in making this kind of a decision.

Mr. BICKWIT. I think it certainly does point out the difficulty. If imminent hazard is to be defined in terms of months, or less than months, and if due process may take as much as 2 or 3 years, then clearly, if imminent hazard is so defined, you do not have adequate authority now to protect the public health.

Dr. BYERLY. We believe we need additional authority. We said that earlier.

Mr. BICKWIT. The Hays memo which Mr. Wellford referred to prescribes cancellation in the case of a reasonable doubt as to safety. Do you believe there is no reasonable doubt in the use of 2,4,5-T on pasture lands?

Dr. BAYLEY. The word "reasonable" here, of course, is subject to interpretation. And our interpretation is that there is not sufficient evidence to have reasonable doubt in regard to range and pastureland; that is right.

Mr. BICKWIT. Is there not a reasonable doubt about the degradability of dioxin? Can you say that it has been proved beyond a reasonable doubt that dioxin is degradable?

Dr. BYERLY. Dr. Bayley reviewed the state of our knowledge in the formal statement. You will recall that our knowledge at the present time stated that photolysis occurred rather quickly in solution exposed to sunlight. One may rationalize, but one does not know, that the leaf surface allows photolysis to take place. In the soil surface apparently dioxin is so bound that destruction does not take place. Neither does it move. And, therefore, bound to the surface, the hazard is not immediate. This is as far as our knowledge goes. And we are seeking, as you well know, to obtain knowledge as quickly and as thoroughly as we can in this very difficult area.

Mr. BICKWIT. I am not sure I heard you correctly so let me summarize what I think you said.

In solution, when subjected to a sunlamp, dioxin will degrade rather quickly, but when bound to soil, when put on soil, even under a sunlamp it will not degrade rapidly.

Dr. BYERLY. That is our information currently; yes, sir.

Mr. BICKWIT. And as to grass, when you put it on grass, we have no determination as yet?

Dr. BYERLY. We have no direct determination; no, sir.

Mr. BICKWIT. In that case, can we say it has been proved beyond a reasonable doubt that dioxin will degrade when put on grass? That is a rhetorical question of course.

Dr. BAYLEY. I think we have to put this in context of the history of the use of the materials. We should recognize the wide number of materials in which dioxins may be present at relatively low levels. Certainly, there has been sufficient public exposure if dioxins were accumulating over a long period of years for something to have happened.

It is also indicative that when there have been problems with dioxins, we have been able to pinpoint them immediately and correct them and eliminate those problems even in regard to the chloracne aspects of them. I think we have to weight this evidence along with all the rest that we have.

Mr. BICKWIT. I agree with you.

Dr. BAYLEY. I think there is no basis for action at this point.

Mr. BICKWIT. But as you say we have to weight the evidence that you describe. What I am asking is whether you believe that that evidence is sufficient to sustain the burden of proof—which Dr. Hays has stated is a burden of proof beyond a reasonable doubt—that dioxin is not a hazard.

Dr. BAYLEY. Are you using Dr. Hays' words? I do not have that memorandum in front of me.

Mr. BICKWIT. He refers to five groups of actions. Group two is the group under which cancellation would be classified. And he writes:

> The cancellation should take place when a reasonable doubt exists as to the safety or effectiveness of a registered product when it is used as directed or in accordance with commonly recognized practices.

Dr. BAYLEY. Yes. That is different than the way you stated it just a few minutes ago.

Mr. BICKWIT. It is? I read "a reasonable doubt exists as to safety" as meaning when grouped with the assumption that the burden of proof is on the manufacturer, which you have stated is the case, that the manufacturer must prove beyond a reasonable doubt that there is safety. He must eliminate that doubt. If he does not eliminate it, we have a reasonable doubt, and cancellation should ensue.

Dr. BAYLEY. We have to come back to the statement that we have not found a basis for reasonable doubt that the product as it is now registered and used is unsafe.

Mr. BICKWIT. Which leads you to the conclusion that you have not found a basis for reasonable doubt that dioxin on pastureland is not degradable?

Dr. BYERLY. Well, that conclusion is not one to which I would be led because in the process of determining whether or not dioxins exist and in what level they exist. You recall that on the 7th of April, whichever it was, when we were here, we entered into the record first confirmd examination of current levels of dioxins in 2,4,5-T which were on the whole quite low. Those are a matter of record. So we have to take into account first what are the facts. And we must, I believe, determine the facts with respect to whether or not and to what extent dioxin is present.

Mr. BICKWIT. I do not know if it is productive to go into it any further, but I would like to say that if you had no reasonable doubt as to dioxin's degradability, why are you running these tests?

Dr. BYERLY. I would not go beyond the facts. What we reported is that in 96 hours on the soil surface, we found no evidence as to the degradability in sunlight.

Mr. BICKWIT. And you have no evidence as to the degradability of dioxin on grass?

Dr. BYERLY. That is correct.

Mr. BICKWIT. And you have no evidence as to the degradability of dioxin in cows, in cow tissue and in human tissue if humans should ingest products which are the produce of those cows?

Dr. BAYLEY. I would hesitate to say that we have to have reasonable doubt about a product before we make a scientific inquiry in regard to the phenomenon involved. I would hesitate to say that.

Mr. BICKWIT. I withdraw that. But I will not withdraw my conclusion that you have not proved to me beyond a reasonable doubt that there is no hazard.

Dr. BAYLEY. That is a judgment.

Mr. BICKWIT. Applying this same form of approach to 2,4-D, did not the Bionetics Report say that 2,4-D was potentially dangerous? And is there any difference between the terms potentially dangerous and reasonable doubt as to safety?

Dr. BYERLY. The formal record contains, I believe, a direct quote from the report which referred to three esters of 2,4-D and also referred to 49 test litters subjected to 2,4-D, per se, in which no increase of abnormal fetuses per litter occurred.

Mr. BICKWIT. Are these three used in products currently on the market?

Dr. BYERLY. Oh, yes.

Dr. BAYLEY. The Department of Health, Education, and Welfare would be testifying further in regard to 2,4-D tomorrow.

Mr. BICKWIT. That is true, but you do make the decision as to whether or not a product ought to be canceled. I know you seek advice from the Department of HEW. You are required to. But as of now, you have made the decision not to cancel 2,4-D. Therefore, I would like to cite certain evidence which, again, in my mind creates a reasonable doubt as to the safety of 2,4-D, perhaps only as to safety of the 2,4-D esters which you mentioned, but you have admitted that these esters are presently in marketed products.

I am told that Dr. Clara Williams at FDA is running an experiment on a strain of hamsters and has produced teratogenic effects. In the Whiteside article, it was stated that the incidence of birth defects was higher than in the case of comparable doses of 2,4,5-T. The Bionetics data showed a high incidence of abnormalities in the offspring of mice. Finally, Dr. Verrett's studies showed comparable abnormalities in chicks, comparable to those found in 2,4,5-T.

In light of this evidence and in light of the possibility that there may be dioxin in 2,4-D it would appear to me that the requisite reasonable doubt exists.

Dr. BYERLY. Well, sir, I hope and I trust that you will ask these questions when the HEW witness is before you tomorrow. And, in the meantime, it is obvious, sir, that we have not the basis for reasonable doubt sufficient to warrant in our opinion the cancellation of registered uses of 2,4-D.

Mr. BICKWIT. Which means that you have not found a reasonable doubt as to the safety of 2,4-D in current uses.

Dr. BYERLY. Yes.

Mr. BICKWIT. Does the evidence I cited create any doubt whatsoever in your mind?

Dr. BYERLY. Sir, I have reviewed the evidence most carefully. The Department has not found sufficient basis for establishment of a reasonable doubt warranting the cancellation of 2,4-D. And I concur in that position.

Mr. BICKWIT. Our first witness this morning, Mr. Wellford, suggested that action to limit the use of 2,4,5-T would be incomplete without similar action on Silvex, which is closely related to 2,4,5-T. Mr. Wellford's reasoning was that both pesticides have 2,4,5-trichlorophenol as an intermediate product and that dioxins are formed in producing this intermediate.

I am informed that Dr. Verrett's work at FDA has shown Silvex to be highly teratogenic to chicks. How would you answer Mr. Wellford's argument?

Dr. BYERLY. Again, referring to HEW the question, the preliminary information that we have which is limited, I believe, to a single complete assay with some confirmation of that assay and verbal reports of other examinations on 2,4,5-T, that current manufacture is assumed to contain less than 1 ppm of tetrachlorodibenzo-para-dioxin.

I have tried to be careful in my answer because the evidence upon which it is based is very small.

I am sorry, this is Silvex to which I refer. I said 2,4,5-T. I am sorry, I meant Silvex.

Mr. BICKWIT. But though the evidence is small, you regard it as proof beyond a reasonable doubt?

Dr. BYERLY. Beyond a reasonable doubt that what, sir?

Mr. BICKWIT. As to the safety of Silvex.

Dr. BYERLY. I have said there is sufficient evidence in my opinion at present available to establish a reasonable doubt of the safety of the registered uses of Silvex.

Mr. BICKWIT. I notice that Silvex is one of the 18 pesticides that you listed to be checked for dioxin content.

Dr. BYERLY. It is, indeed. It is one of the trigroup in which in my opinion most probably tetradioxin will be present. And, therefore, we are seeking to determine whether or not in fact it is present.

Mr. BICKWIT. And when do you expect the results of the tests on this and the other 17 products?

Dr. BYERLY. I very much hope that within 3 months, we will have completed at least the first go-around on all of the 18.

Mr. BICKWIT. Why 3 months?

Dr. BYERLY. Why?

Mr. BICKWIT. I ask this question from ignorance.

Dr. BYERLY. I understand.

It is simply a matter of the care and sophistication of the method, the time required to get the job done. We have built, Dr. Bayley has pointed out, an isolation laboratory—I say built, I change that to equipped an isolation laboratory. We have the scientists. We are, in fact, ready to proceed. The time, therefore, would be the time required to do the analyses and verify them.

Mr. BICKWIT. Thank you very much.

Senator HART. Gentlemen, thank you. It has been an interesting and informative morning. Congratulations again for the effort that you, I am sure, put into developing and then persuading departmental acceptance of the suggested amendments. I hope improvement in that basic law soon will be written.

Dr. BAYLEY. Thank you, Mr. Chairman.

Senator HART. We adjourn, to resume tomorrow at 11 a.m. in the morning in the hearing room of the Committee on Commerce 5110.

(Whereupon, at 12 40 p.m., the hearing recessed to reconvene at 11 a.m. on Thursday, June 18, 1970.)

EFFECTS OF 2,4,5-T AND RELATED HERBICIDES ON MAN AND THE ENVIRONMENT

THURSDAY, JUNE 18, 1970

U.S. SENATE,
COMMITTEE ON COMMERCE,
SUBCOMMITTEE ON ENERGY, NATURAL RESOURCES,
AND THE ENVIRONMENT,
Washington, D.C.

The subcommittee met, pursuant to adjournment, at 11:35 a.m. in room 5110, New Senate Office Building, Hon. Philip A. Hart (chairman of the subcommittee) presiding.

Present: Senator Hart.

Senator HART. The committee will be in order.

Let me attempt to apologize to the witnesses who have been inconvenienced by this 35 minute delay. A meeting was called yesterday of the Democratic caucus for 10 a.m. and I felt compelled to participate. I wish we could manage things a little more responsibly around here, as busy as Congress is running everybody else's business.

The first witness today is the distinguished science advisor to the President, Dr. DuBridge.

STATEMENT OF DR. LEE A. DuBRIDGE, SCIENCE ADVISOR TO THE PRESIDENT AND DIRECTOR, OFFICE OF SCIENCE AND TECHNOLOGY; ACCOMPANIED BY DR. EDWARD J. BURGER, JR., TECHNICAL ASSISTANT

Dr. DUBRIDGE. Mr. Chairman, I have asked my associate, Dr. Burger, of my office, to accompany me. He is an M.D. who has been following the matters related to health and the other effects of pesticides.

Mr. Chairman, I have testified before this committee on April 15 on the 2,4,5-T subject, and I am not sure there is very much to add to what I said at that time, but there are a few points I would like to review and emphasize.

I reviewed then something about the history and development and value of the use of this herbicide and I used that review as a text from which to draw what I considered to be some important generalizations about pesticides, and these are some of the matters I would like to repeat.

Let me begin by pointing out that 2,4,5-T is a pesticidal chemical which has been introduced intentionally into man's surroundings because of the benefits presumed to follow. Its purpose was to serve as an adjunct to other means of weed and brush control in land and

waterway and agricultural management. Over a period of 20 years it has proved its utility so that we are now in a position of relative dependence on this material.

However, especially in recent months, we have begun to question in greater and greater depth the possible human health effects of pesticides like 2,4,5-T and this has required a greater sophistication in research and testing than was previously thought adequate.

The example, of course, was the Bionetics study for the National Cancer Institute. Previous research on 2,4,5-T had concentrated on the acute toxicity of that compound and had shown this to be of a low level.

The Bionetics study represented a departure in that it investigated the potential of the herbicide to provoke tumors, birth defects and genetic alteration in appropriately exposed experimental animals. 2,4,5-T emerged from this study as a possible teratogenic agent.

As I have said, this study was a departure in several ways. Whereas nearly all of the background toxicology on pesticides had been performed as part of the development process by the developing company or industry, this study was launched and paid for by the Government.

I hinted that this might represent a precedent. If our society demands a very high level of sophistication in this type of research, industry may not be able to afford the increased cost of development and further development of valuable new products may be discouraged or prevented. Hence I suggested that new ways of distributing the costs of this work may have to be found. Expenditures of public funds and Government participation in this research may be desirable.

I emphasized that at any point in time, we find it difficult to get complete information about the true hazards of any pesticide or any other chemical substance. That is, research in this area (as in any other) has no finite end points. It may take long experiments with all kinds of levels and all kinds of circumstances to make any such assertion and one can never be sure what new research results will turn out.

As one performs more research to investigate various hypotheses, one inevitably raises additional questions—as well as answers. It follows from this that any regulatory system for pesticides must be able to accommodate new and unexpected information.

I pointed out that our present arrangement for regulation is not sufficiently flexible to reflect new information as it emanates from research. Again, these points were clearly illustrated by the case of 2,4,5-T.

What I said in April was that there does not exist a mechanism whereby the Government may exercise prudent and unequivocally effective restraint temporarily on the receipt of new, unexpected information and possibly preliminary results and while awaiting more definitive conclusions.

In many ways the Federal Government did act with dispatch in the case of 2,4,5-T. After the October 29 announcement about restrictions imposed on 2,4,5-T additional research studies were begun in a number of agencies. These studies were initiated both by the Government and by industry. The aim in every case was to confirm

or extend the unexpected results obtained from the Bionetics-National Cancer Institute studies.

One of the new issues examined in the new set of investigations was the importance of impurities present in many samples of 2,4,5-T. It had been discovered that over a period of years commercial 2,4,5-T contained varying amounts of a highly toxic impurity which was a member of a family of polychlorinated dioxins. It was of obvious importance to ascertain the relative contributions of the 2,4,5-T and the dioxin impurity as potential teratogenic agents. The dioxin was known to be very toxic. Hence this question became part of the experimental aim.

Fortunately, teratogenesis is a relatively acute affair and experiments necessary to investigate this phenomenon are short-term experiments. Answers were expected in a fairly short period of time.

Some of these confirmatory experiments were undertaken by one of the National Institutes of Health—the National Institute of Environmental Health Sciences. The results of these experiments were reported to you as fresh out of the laboratory at the time of the last hearings.

In brief, you may recall, these results implicated both 2,4,5-T and 2,3,7,8-tetrachlorodibenzo-p-dioxin as potentially teratogenic in nature. In rats, over the same dose range, only the dioxin appeared to produce birth defects.

It was principally on the basis of these results that Secretary Hardin, Secretary Finch and Secretary Hickel jointly announced the series of restrictions on the use of 2,4,5-T. These were related to you by the Surgeon General, Dr. Steinfeld.

In brief, the philosophy behind these restrictions was hoped-for protection of women of childbearing age. Thus the Department of Agriculture suspended the registration of liquid formulations of the weedkiller for uses around the home and of all formulations for use on lakes, ponds and ditch banks.

In addition, registrations were cancelled for uses of nonliquid formulations around the home and of all formulations for use on food crops intended for public consumption.

Of the total amounts of 2,4,5-T used in this country for all purposes it was estimated that these restrictions applied to about 20 percent—the 20 percent of the cases where human exposure was possible.

I firmly believe that the issues raised by the case history which I outlined in April continue to be prominent. In a way, I suppose, we can thank the existence of the questioning about 2,4,5-T for bringing to our attention matters such as the ones I have described.

This study has served as a most useful vehicle and we may learn some lessons for future studies. However, as I warned, any attempt to answer the research questions raised will inevitably raise some additional questions.

I suggested that in some ways we were fairly lucky in our investigations of 2,4,5-T. The issues have appeared fairly straightforward and it was possible to start confirmatory experiments fairly quickly and to get confirmatory results quickly.

Yet, while this appears to have been a modest success story, some may rightly ask: Shouldn't the kinds of experiments which were

mobilized on the spur of the moment for 2,4,5-T have been accomplished on a more systematic basis and without the spirit of a crisis necessary to urge them on?

Further, one might ask whether or not it might be desirable to support a fairly sophisticated level of investigation for a large number of pesticidal chemicals—not just 2,4,5-T.

Now, I and others have outlined the research work on 2,4,5-T and I have termed it relatively sophisticated. Yet I will have to admit that there has been almost no work done to elucidate the metabolic handling of this herbicide in the animal organism. There is little known in biochemical terms of the mechanism of its actions and there is essentially no knowledge of any possible interactions between this chemical and other materials.

In similar fashion we are poorly informed about the characteristics of the dose-response relationship for very low dose levels. This, of course, is the situation which we face in real life in the case of a variety of environmental agents—including pesticide residues. Here the problem is a statistical one. In order to derive meaningful answers with any useful level of confidence very large colonies of experimental animals must be tested, often over a long period of time.

I suggest these comments to illustrate that there are various levels of sophistication in research.

In the realm of pesticides the level of our research activities may not have kept up with the state of that art nor with a corresponding level of questioning to which policy makers and the public are now seeking answers.

The very excellent report on research needs compiled by an advisory task force to the National Institute of Environmental Health Sciences outlined these research areas very well and very explicitly. This report, I am informed, is just now being published.

All of this—more sophisticated research, more expensive research, research sponsored by the Government—will cost money. Again, I repeat, if a really serious thrust is taken in this direction we may be obligated to find new institutional avenues for accommodating this research since, as a part of the cost of development, the bill to industry may be higher than we might desire.

All of this discussion brings me once again to a point which I made in my previous testimony and which I feel is worth emphasizing. While we as a society have recently begun to ask more penetrating questions about the possible adverse health effects of environmental agents it is not clear that we know how penetrating this questioning should be or must be.

What I said before was that we had set our sights higher. What I should add is that we are not sure how high they should be set. For example, up to the present time we have been willing to live with a system under which the amount of toxicological research performed on a pesticide was to some extent related to the probability of human exposure. With a low or seemingly negligible probability of exposure, relatively little understanding was sought and little research was undertaken. In fact, one could argue that since the appearance of residues of 2,4,5-T have been rare events—it is very rare to find measurable residues of 2,4,5-T on food—therefore one

did not have to know too much about the toxicology of the herbicide. Now we are more particular.

I feel that we should be more explicit about assumptions such as these. If they are valid they will stand on their own merit. If they are not valid we should change them. I am happy to say that my office is examining questions such as these at the present time.

Thank you, Senator Hart.

Senator HART. Thank you.

You suggest the possibility that the Government may have to assume a greater role in any testing area but specifically in the matter of pesticides.

Dr. DUBRIDGE. Yes.

Senator HART. You indicate that otherwise the bill to industry might be higher than we might desire, which I suppose is another way of saying an industry could not afford it. How should we read that?

Dr. DUBRIDGE. What I meant to say is if industry is required to carry on years of very expensive research before any new product can be manufactured, obviously industry will no longer be interested in manufacturing new products because they could not recover the loss. Thus the community, the society would be robbed of many future very valuable chemicals which society might find extremely important for health and other reasons. To impose the burden on a particular company that before it can market a product it must undertake millions and millions of dollars more worth of research than it has in the past would simply stop the development of new products. Therefore it seems to me only fair, since we want to protect society as a whole but also to encourage benefits to society, that society as a whole ought to participate in the cost of determining what the damages may be as well as what the benefits may be.

Senator HART. That then would be your basic answer to the suggestion or argument that research is just another element of the cost of production.

Dr. DUBRIDGE. Yes.

Senator HART. That the user of the product should bear that cost along with other costs.

Dr. DUBRIDGE. Yes. Exactly. I am not saying that the manufacturer should not also bear substantial costs. He should make sure that the product that he is proposing to market is not dangerously poisonous, does not have obvious adverse human health effects. Industry should be required to undertake a reasonable set of experiments, and they always do, to assure that this product has a relatively good safety factor. But it may take years to find out low level and easily hidden dangers which sometimes may become obvious only when mass use is undertaken. To help avoid these dangers I think some Federal participation in the research program would be desirable.

Senator HART. Do you know whether the administration intends to embark on broad new research programs in this area?

Dr. DUBRIDGE. There are several agencies which are developing plans, pursuing research in this area, and I believe an advisory committee of the Department of HEW headed by Dr. Emil Mrak

is making some proposals to HEW about substantially extending its research and testing activities in this field of pesticides, and about developing extensive facilities, large animal colonies and large-scale testing equipment and personnel, to carry out extended tests in this field.

These are recommendations that are being formulated and are being proposed to HEW. I do not know what the status of them is at the moment.

Senator HART. It is likely you would not have the figure with you, but let me ask the question. Perhaps it could be provided for the record and I have no idea what it will show. But would it be possible to identify those activities which are not undertaken by the Department of Defense that are comparable to the line item research and development that is done by the Department of Defense? The total figure for research by the Department of Defense is in the range of $7 billion a year. How much are we spending in other research?

Dr. DUBRIDGE. The total Federal budget for research and development in this current year is close to $17 billion.

Senator HART. Including the DOD?

Dr. DUBRIDGE. Including the DOD. If you take out somewhat over $7 billion of DOD funds, it is $9 billion to $10 billion in all other branches of the Government.

Senator HART. We will let others judge whether the allocation of the resources is or is not prudent. I think it is good to have it in the record.

Yesterday we received testimony from the Department of Agriculture. When we think about changes in the system of pesticide research and control we have to think about changes in the basic law of pesticide regulations. Included in the testimony yesterday from the Department of Agriculture were a number of suggestions and changes that they recommend be made in the basic act. Are you familiar with those suggestions?

Dr. DUBRIDGE. Dr. Burger told me about them this morning and I have a copy of them here, and we have discussed them. These are in line with some of the suggestions we have had with Agriculture and other agencies; namely, that there is not sufficient flexibility in the present statute to take a suitable action in all cases where new information becomes available.

Sometimes new information like the Bionetics study is very suggestive but cannot be said to be finally conclusive because of the small number of animals and small number of circumstances involved and the separation of an impurity may not be taken care of.

It will frequently happen that you will get preliminary suggestive results not sufficient to abolish the use of a chemical but sufficient to take some prudent action until more final results have been obtained.

I think the Agriculture suggestions do move in this direction to give, for example, what they call preliminary suspension authority. So if a danger sign is raised you take prudent temporary action and continue further research. If the further research confirms that safety is there after all you can remove the suspension. If further research proves the danger, then permanent suspension can be achieved.

Senator HART. I did not quarrel yesterday with the Department of Agriculture's interpretation of the basic act. Overnight I have tried, as we always do, to justify what we did, namely, those of us who wrote the law. I am not convinced that that statute prohibits the Department of Agriculture, when, as you say, the signal goes up from suspending the marketing of the product—I am not sure that Congress should be held to have said that we excluded the possibility of a temporary suspension.

Just as I was not yesterday, I am not sure you are not equipped, and did not plan to debate what limits there are under the existing law.

Dr. DUBRIDGE. No, I am not an expert on the question of interpretation of the law, but it has simply been taken for granted, maybe not properly and maybe under an interpretation that should be further developed, but it has been taken for granted that preliminary or temporary suspension was not provided for, explicitly at least, in the statute.

If the law were interpreted to allow this, it would be fine.

Senator HART. I cannot imagine there would be any different criteria for a temporary suspension than a suspension. I still have the feeling that the suspension is not for a thousand years. If you suspend and then discover that your alarms were groundless, surely you can unsuspend. That would argue that you can temporarily suspend.

Dr. DUBRIDGE. If that is the case I think that is fine. It apparently needs to be made more explicit to the people who are doing the suspension because they do not feel that they have this authority.

Senator HART. Clearly they do not.

Are you yet in a position to advise whether you would support or recommend support of the suggestions for law changes made yesterday by Agriculture?

Dr. DUBRIDGE. I think it is fair to say that we would believe that these are proper moves. Again, as I say, we are not experts in the regulatory field and the legal field. What we tried to do is to find the science and technology that is applicable, and we leave it to the Congress and the legal authorities to determine what specific regulations and statutes are required.

But I think this additional flexibility does in principle sound very desirable to us, simply because research results, you know, are never the final answer unless they are extremely conclusive results of extreme danger.

It is almost never possible to say that all the research has been done and it proves that the thing is forever safe.

Senator HART. Conversely, forever unsafe.

There were several other suggestions that Agriculture made. One regarded the ineffectiveness of handling pesticide regulation by labeling. They were going to recommend restructuring the law to require a grading by degree of the hazards of a pesticide and to ensure that extremely hazardous products would be permitted to be handled only by individuals or institutions licensed to do so. Do you have any comment on that one?

Dr. DUBRIDGE. I think I have no very expert comment except to note the experience within my own family that labels on packages

are often not adequately read and that the labeling problem is a difficult one.

Senator HART. As Agriculture indicated, not a very reliable handle for protection against injury to health or environment.

Well, we would hope that you will lend your distinguished scientific support to the recommendations that Agriculture has made.

A couple of other questions, and this goes to the different actions that have been taken with respect to pesticides or herbicides by different departments of the Government.

Agriculture suspended I think you said about 20 percent of the use of 2,4,5-T.

Dr. DUBRIDGE. I did not intend to imply that was all Agriculture. I said the total suspension amounted to 20 percent of the total use.

Senator HART. It is my understanding that the Department of Defense has suspended it entirely for use in Vietnam.

Dr. DUBRIDGE. That is correct.

Senator HART. And the Department of Interior very recently suspended it for use on public lands; lands in its ownership.

Dr. DUBRIDGE. Yes.

Senator HART. How do we explain the different reactions from the several departments with respect to the same product?

Dr. DUBRIDGE. I do not know that I can fully explain it, but the situation in military operations is not necessarily the situation in normal peaceful operations in this country.

In military operations, by necessity, these chemicals are distributed by aircraft, and it is not always easy to control where they go and how far away they blow or even that the aircraft is hitting the right target. Therefore I think somewhat more prudence may be required.

When you are doing it in a normal way, in agricultural practice or land management, you can be much more careful and make sure that the material does not get on food crops or in your waters, which will contaminate the waters, or get on grazing lands on which animals will be grazing and therefore get into milk or meat.

Fortunately 2,4,5-T degrades quite rapidly. It is not like DDT. If you spray a pasture with 2,4,5-T, essentially all traces of it are gone after about three months' exposure to wind, rain, and sun. Therefore cattle can quite safely graze on grazing land treated with 2,4,5-T after this period.

Also, if it gets on food it is likely to degrade pretty rapidly, though it is desirable to have no tolerance for food. But where it is used in areas where there is no human population and where there is no danger of contaminating food or water, then a controlled use can be extremely valuable, and since no dangers would be resulting I think it is perfectly proper to have controlled use in this country.

Senator HART. What do you say, then, to Interior's prohibition for use on its lands?

Dr. DUBRIDGE. I guess I am not familiar with how extensive that use is.

Senator HART. I am told that Interior's action was taken only yesterday.

Dr. DUBRIDGE. I see. I am not familiar with the background for that action or the extent of it; or maybe they found that other materials could be used on public lands other than 2,4,5-T which would serve the purpose. I just do not know.

Senator HART. But it contributes to the uneasiness of the public when we see these seemingly conflicting reactions.

Dr. DUBRIDGE. This is one of the very delicate things that the Government faces; that is, not to overreact to situations which will do damage by overreaction. But there is an opposite injury of under reaction and not taking prompt or adequate action when dangers are evident. I would like to defer to the Department of the Interior in this case, and with your permission, have that Department submit a statement for the record.

(The information follows:)

STATEMENT ON INTERIOR PESTICIDE POLICY

The Department of the Interior policy statement, issued by Secretary Hickel on June 18, does not differ markedly from the one that has been followed for several years. Nevertheless, it adds some chemicals about which we have received additional data within the last year and recognizes the concern expressed by cooperating Departments on some others.

The prohibition against most of the chlorinated hydrocarbon insecticides had been in effect for several years and that on 2,4,5-T since October 1969. The hazards of mercury have been recognized for some time but were accentuated by monitoring results in the last six or eight months. Amitrol was included because of the objections of the Food and Drug Administration to the use of carcinogens.

The Department of the Interior policy is not intended as a Federal pesticide policy. It has long been the policy of this Department to set a standard in its use of pesticides that is beyond reproach from the standpoint of safety. Consequently, our position may be more strict than some others will wish to set. If research demonstrates that some of the pesticides listed may be less hazardous than we suspect then they may be restored for use on Interior lands.

Senator HART. You reminded me of a question I kicked myself yesterday for not having asked the Department of Agriculture witnesses. Perhaps you can help.

You mentioned DDT. As I recall the testimony yesterday, under the FIFRA Act, a science advisory committee is established when there is a cancellation procedure aimed at a product. They explained that in the case of DDT that some six months have passed since the cancellation procedure was initiated and no committees have been formed; hence the passage of time has been extended at last by this amount during which, under the cancellation procedures, continued marketing of the product goes on. Why the 6-month delay?

Dr. DUBRIDGE. I cannot explain that. I do not know why there should be a long lag between these two events. The only thing I can think of is since the Secretary's pesticide advisory commission has been continuously at work on the pesticide problem, especially with attention to DDT, they were depending on it to examine this particular problem.

Senator HART. I repeat, I should have asked them yesterday and I did not. But if they read so strictly the statute with respect to suspension, I would assume the same strict reading would tell them that they cannot substitute the Mrak Commission for the explicit statutory requirement that there be a science board established for each of these products.

Dr. DuBridge. I would agree. I think maybe the law does not set a time at which the science advisory commission shall be established.

Senator Hart. No; it does not. It was assumed that it would be established at least with all deliberate speed, and 6 months seems to be undue delay.

Dr. DuBridge. Yes, I agree. With your permission, I would like to ask the Department of Agriculture to provide an explanation of this apparent delay.

(The information follows:)

DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C. July 7, 1970.

Dr. LEE A. DUBRIDGE,
Executive Secretary, Council on Environmental Quality, Executive Office of the President, Washington, D.C.

DEAR DR. DUBRIDGE: In reference to the question raised at the Hart Committee hearing as to why it has taken so long to establish an advisory committee on DDT, we submit the following explanation:

(*a*) After the announcement of cancellation, the companies involved did not request an advisory committee or public hearing for the four uses of DDT to be cancelled until the latter part of the 30-day period provided for appeals by the Federal Insecticide, Fungicide, and Rodenticide Act.

(*b*) Meetings and discussions were held with representatives of the National Academy of Sciences on makeup of the committee.

(*c*) Previously we had asked for lists of names of persons to serve on advisory committees for other cancelled products, and they were already in the process of compiling them.

(*d*) Due to unfavorable publicity related to conflict-of-interest charges regarding authorities that served as consultants to the Department in the past, some experts wre not willing to serve.

(*e*) Two additional requests to NAS for candidates to serve, besides the original, were necessary in order to complete the committee.

(*f*) Two of three companies requesting advisory committees withdrew, leaving only one for a tracking powder use.

(*g*) Getting written position from DHEW as to whether tracking powder was considered an essential use from a public health standpoint.

(*h*) Contacting and getting approval of proposed candidates to serve on the committee.

(*i*) Notifying committee members that they were selected to serve on the committee.

(*j*) Conflict-of-interest review and evaluation within the USDA.

Sincerely,

NED D. BAYLEY,
Director, Science and Education.

Senator Hart. I would hope in connection with the cancellation proceeding on 2,4,5-T an advisory committee will be formed with less delay.

This next question bears directly on your broad background. One of the difficulties in this 2,4,5-T story was the difficulty experienced in obtaining information which might have been of public health significance.

Under what conditions do you suggest scientific information ought to be kept secret when a question is raised as to the safety of the product?

Dr. DuBridge. If you are talking about scientific information, I do not think it should be kept secret. When you are talking about information having to do with the manufacture of commercial products, that is a very different situation because the costs of development, testing and getting a commercial product into production are

very high. It is quite proper that the manufacturer or the inventor be protected so that he will have an opportunity to recover his costs. He should have a patent or a protection for his invention or his product so that he can recover the very large costs to develop it. Whereas, if he instantly published all the information about how to make this product so that others would instantly start making it without the expense of development, this would obviously be an unfair kind of competition.

Our whole system is based upon the fact that inventors of new processes and products have protection to regain their investment and recover their costs. Therefore I think the publication and the distribution of information with regard to the manufacture of products and materials is a proper trade secret.

On the other hand, when it is clear that human health is at stake I would assume there should be mechanisms by which Government agencies in proper authority could be told something about the composition of the product so that they would be able to determine whether or not there might be materials in the product which ought to be investigated for their harm.

I do not know exactly what the law is on this, but it would seem sensible.

Senator Hart. Your suggestion is that when a question of health is raised with respect to a product, data and information on the product should be made available to the appropriate Government agency for its determination as to a question of health and safety?

Dr. DuBridge. Yes, sir.

Senator Hart. That excludes, of necessity, the judgment and the comment of perhaps very gifted men and women of science in arriving at the determination of whether public health is or is not in jeopardy. This is not to suggest that the appropriate agency lacks qualified and competent people but surely they do not have a monopoly on that.

Is there some way, notwithstanding the obligation to protect trade secrets and encourage invention and discovery, we can do a better job of permitting the outsider, whether it is the head of the chemistry department at Cal Tech or someplace else, being brought in and having an opportunity to sharpen the judgment of everybody?

Dr. DuBridge. Well, I think that the various advisory mechanisms available to the various Government agencies ought in general to accomplish that objective. A science advisory group can be called in to consult on a particular problem, on the possible dangers of the particular chemicals that happen to be in a particular commercial product.

I am sure that they could tap the rest of the scientific community to find out whether chemical A or chemical B is of a nature that it would likely be harmful. They do not have to reveal the whole composition of the product in order to say this product happens to contain a certain amount of compound A, is there any evidence or any chance or any reason to believe that this compound A is harmful. I think the knowledge of the scientific community could be obtained.

Senator Hart. Should be obtained?

Dr. DuBridge. And should be, of course.

Senator HART. The suggestion has been made that all of us as a people would be better off if we had some centralized clearinghouse or data bank into which could be fed all of the information not subject to trade secrets. Have you given any thought to that suggestion?

Dr. DUBRIDGE. I understand that Dr. Steinfeld is going to discuss that question when he appears.

Senator HART. Your reaction would not stop him.

Dr. DUBRIDGE. He knows so much more about it. I do not want to anticipate it. It is this question of the dissemination of scientific information which is one of our most difficult problems.

In past years we always assumed that if you published in scientific journals and books that anybody had access to, anyone would just go to the library and look up what he wanted to know. The volume of scientific information has become great, the urgency of finding pieces of scientific information quickly has become great, and this has led to the question as to whether one can or cannot use modern scientific equipment to store and retrieve scientific information more expeditiously.

The only trouble is it is very expensive, and the development of techniques for putting it in suitable form for data processing, the question of how many agencies should be involved in feeding the information in and how to get it out—these are complex technological problems which together with the expense have not been worked out. I think it is a very urgent problem.

There are people in our office that are working on this and I hope we can find ways to have a storage of needed technical information, particularly in the health field.

Senator HART. I share in that feeling.

My last question, again, is a general one. We had an exchange yesterday with the Department of Agriculture witnesses on the old problem that is created in the minds of some when you have a department that is charged with the promotion of an activity undertaking also to regulate it. In this case, expanding agricultural production is a responsibility of the department, and at the same time we say make sure that herbicides are not permitted that do damage. Do you have any general rule as to whether promotional and regulatory functions should be separated?

Dr. DUBRIDGE. I do not think I would propose a general rule on that. In the particular case of pesticides it is true that Agriculture is involved. But under the interagency agreement, Health, Education, and Welfare and Interior act jointly with Agriculture on these questions. If there is an agricultural product that is in use and HEW has information that there may be health effects from this, they can immediately bring it to the attention of Agriculture and action can be taken then by joint agreement among these three departments.

I think this is one purpose of having this interdepartmental arrangement. I am sure that no Department is anxious to promote something that has danger to human health, and as soon as human health aspects are brought out HEW has the obligation and the authority to bring this to the attention of any other Department. In the case of pesticides they meet and take action jointly.

Senator HART. As I understand it, all those other fellows have a voice but only one fellow votes, and that is the Department of Agriculture.

Dr. DUBRIDGE. No, I do not think that is quite correct. I think it has been agreed that the unanimous consent of the three will be sought for specific action. I think this is a private agreement. I do not know whether it has been made public or not.

Senator HART. It is my understanding if there were disagreement the decision would be Agriculture's.

Mr. Bickwit?

Mr. BICKWIT. You have told us that the Department of Agriculture does not believe that they have certain authority that you would like to see them have in terms of temporary suspensions and the like. Have they communicated to you, as they communicated to us yesterday, that they would never have authority to ban the use of a hazardous pesticide on food crops when it was known that the ingestion of food which had been treated by that pesticide, was dangerous to man?

Dr. DUBRIDGE. When there is clear evidence of danger to man they have full authority, of course, to cancel or suspend the use of it. The problem comes when the evidence is not clear or is not conclusive or definitive.

Mr. BICKWIT. That was my impression as well. But they contend that the use of a pesticide on food crops will never create an imminent hazard to the public because it will take several months for that food to arrive on the tables of those people who ingest it, and therefore that the hazard created is not in fact imminent.

Dr. DUBRIDGE. Well, there is a legal determination and interpretation of the word "imminent." Sometimes food reaches your table promptly, sometimes it does not.

Mr. BICKWIT. Can we impute to Congress the intent to leave the public unprotected in such a case? As I understand it, there is no legislative history on the use of the terminology "imminent hazard" in the relevant act, and Congress has not defined that terminology in that act.

Dr. DUBRIDGE. As I understand it, imminent hazard leads to one kind of action but hazard present but not imminent leads to a different kind of action. One can have either suspension or cancellation in either case. Suspension occurs when there is imminent hazard, and suspension, though it sounds more temporary, really is not.

Mr. BICKWIT. It certainly is not, given the cancellation procedures may take as long as 3 years.

Dr. DUBRIDGE. They take time. So, there can be a suspension in the case of imminent hazard, there can be cancellation if there is hazard but not imminent. I do not know how you interpret imminent, whether it is a day, a week or a month or what.

Mr. BICKWIT. They interpreted it so that they would not be allowed to move in the case of known hazards to human health when the hazards result from the use of a hazardous pesticide on food crops.

Dr. DUBRIDGE. Then possibly a clarification of the statute would be desirable.

Mr. BICKWIT. I just wonder whether it is needed in view of the fact that it seems perverse to me to assume that Congress would intend to exclude protective action in cases such as that.

Dr. DUBRIDGE. Please do not ask me to understand the views of legal counsels for the various departments, or how they come to the various conclusions as to what their departments can or cannot do under the law.

Mr. BICKWIT. I will not if you do not ask me to understand it.

I have just one other question which relates to a legal term, but I would like to hear your reaction to it from a scientific standpoint without legal context attached to it.

Do you have any reasonable doubt about the safety of pesticides such as 2,4-D and Silvex?

Dr. DUBRIDGE. I have reasonable doubt about anything in which the research and testing have not been adequately carried out. The questions of substantial dangers in those cases I think have not been proved so I would be much more comfortable about the use of those than I would about 2,4,5-T where the teratogenic effect is now clearly established. For these others, I think imminent or serious hazards have not been found.

Mr. BICKWIT. Thank you very much.

Senator HART. Thank you.

Dr. Burger, is there anything you want to add in light of our exchange?

Dr. BURGER. No, I do not believe so, Senator.

Senator HART. I renew my apologies as I ask Dr. Steinfeld to come up. I know there are many things he would hope to be able to do this morning, which have been delayed.

Dr. Jesse Steinfeld, the Surgeon General.

STATEMENT OF DR. JESSE STEINFELD, SURGEON GENERAL, DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE; ACCOMPANIED BY DR. PAUL KOTIN, DIRECTOR, NATIONAL INSTITUTE OF ENVIRONMENT HEALTH SCIENCE; AND DR. WILLIAM M. UPHOLT, ACTING STAFF DIRECTOR, SECRETARY'S PESTICIDE ADVISORY COMMITTEE

Dr. STEINFELD. Thank you, Senator Hart.

With me this morning are Dr. Paul Kotin, who is the Director of the National Institute of Environmental Health Sciences. He is on my left. And on my right is Dr. William Upholt, who is the executive secretary of the Secretary's Pesticide Advisory Committee.

Before I begin, I would like to apologize for a number of misspelled words, run-on sentences and so forth in the statement of which you have a copy. It will be somewhat different than it is before you as I read it, if I may be permitted to read it.

Senator HART. You may be almost certain I won't spot the misspellings.

Dr. STEINFELD. I am pleased to appear before you today to discuss the actions that have been taken to protect the public health by the Department of Health, Education, and Welfare regarding the chlorophenoxyacid herbicides, particularly 2,4,5-T and 2,4-D.

During our last appearance before this committee, we took note of certain needs to increase the Federal Government's effectiveness in dealing with questions of hazards to the public health presented by the pesticides and pledged ourselves to action. We have made progress, even in the extremely short time since our April 15, 1970, appearance.

We are now defining how best to undertake to study the means for predicting, in laboratory animal systems, the potential hazards posed for man by chemical pesticides. It is certainly desirable, and may prove essential that we find some means of extrapolating the results from feeding animals very large doeses of pesticides to the real life situation in which man is exposed for a long period to very small amounts of these chemicals. However, I must emphasize that even with results based on studies in two species of mammals, uncertainties remain as to the significance of those studies when applied to man.

Complete information on the pesticides is essential to the efficient performance of all agencies concerned with the public health aspects of pesticides, be they Federal, State, or local. A centralized clearinghouse for information on all types of pesticides is being established jointly by the National Library of Medicine and the Food and Drug Administration. It is now being established. The Division of Toxicology of FDA and the National Library of Medicine are now sharing toxicological information and are building on this base to form the clearinghouse. I am very pleased with the progress on this information center to date.

The Food and Drug Administration has issued instructions that special attention to the extent of available resources is to be given to the analyses for residues of 2,4,5-T on food crops for which this herbicide was formerly registered for use. This step was taken as an additional precaution to prevent accidental exposure to residues of 2,4,5-T even though our surveillance activities had not detected significant residues of 2,4,5-T on these food crops.

The scientific research on which the April 15 announcement was based has continued.

The National Institute of Environmental Health Sciences is conducting further research on 2,4,5-T, certain related herbicide compounds and 2,3,7,8 tetrachlorodibenzoparadioxin which is the dioxin we referred to in our previous testimony.

Additional studies on the teratology of 2,4,5-T and tetrachlorodioxin in the random bred mouse have confirmed the earlier studies that, 2,4,5-T produces cleft palate in the mouse. One study which utilized a combination of tetrachlorodioxin and the purest 2,4,5-T available indicates that there is no synergistic effect of these two compounds on the production of cleft palate in the mouse.

Preliminary studies have been initiated with three esters of 2,4,5-T, namely, the isobutyl-ester, the isooctyl-ester, and the propylene-glycol-butyl-ester. The experiment design is the same as that used to study the acid form of 2,4,5-T earlier.

The results that are available to date are suggestive that at least some esters may be comparable in teratogenic activity to that of 2,4,5-T. At this time more definitive studies on these esters are underway.

In addition, a teratogenic evaluation of Silvex, a compound which is structurally related to 2,4,5-T will be begun shortly. Also, another dioxin, the octachlorodibenzoparadioxin will be evaluated for its teratogenic potential.

Another line of research currently in progress is the delineation of the sequence of toxicologic processes which develop upon administration of tetrachlorodioxin to adult rats. The test parameters being evaluated are hematology, clinical chemistry, enzyme chemistry, and histopathology factors.

This study is still in progress, but suggests major hepatic dysfunction as the primary toxicologic action of tetrachlorodioxin. In conjunction with this study, the octachlorodioxin will be studied for its toxicologic properties as well.

The Food and Drug Administration has launched a broad program of research to determine if herbicides such as 2,4,5-T and 2,4-D as they are now manufactured could pose a potential health hazard. The research on 2,4,5-T has led into a new area of investigation and I refer here to the finding of the dioxin contamination in production batches of 2,4,5-T.

This contamination has proven to be a series of chlorodibenzo-p-dioxin compounds containing various amounts and positional arrangements of chlorine atoms on the dioxin molecules. This contamination may arise through the unwanted synthesis of the dioxins during manufacture of 2,4,5-T from trichlorophenol, but the possibility exists that the dioxins are present in the chlorophenol material prior to its use in 2,4,5-T manufacture.

The chlorophenol class of chemicals is widely used in our environment. Pentachlorophenol, for instance, is one of the most useful compounds available for the preservation of wood. We have extended investigations to include dioxin contamination of chlorophenols.

The FDA has a continuing project underway to examine various chlorophenol compounds containing from one to five chlorine atoms for the presence of dioxin contamination. Some chlorophenols have been tested at a concentration of 40 parts per million in the chick embryo and found to be toxic. The tentative, and I must emphasize tentative, results from these studies indicate that various dioxins may occur in chlorophenols. Mass spectrometry has identified dioxins in some of these chlorophenols. This work is being done in conjunction with the effort to improve the analytic chemistry necessary to detect the dioxin contamination in the herbicides and in other compounds.

At this time the chick embryo toxicity test is the most sensitive biological indication of the presence of dioxins, particularly tetrachlorodibenzo-p-dioxin. It is slow however, and more rapid methods of detecting dioxins must be established.

The electron capture gas chromatographic method is now the most rapid and sensitive instrumental method available. In order to study the dioxins, it has been necessary to produce dioxins of known purity and known chlorine content. FDA has now produced a number of these.

FDA is starting a study at the Perrine, Fla., laboratory to determine the effect of various chlorophenols on mammalian systems using the golden hamster as the test animal. The golden hamster is

a useful laboratory animal for this purpose. It is of a convenient size, easily housed, and has a gestation period of only 15 days, giving a somewhat quicker test than the rat.

We are thus moving rapidly to develop adequate data from investigations designed to reveal any hazard to the public health from the use of chlorophenoxy herbicides such as 2,4,5-T and 2,4-D or the chlorophenol compounds. The restrictive measures taken against 2,4,5-T, when in my judgment a hazard to the public health existed, are familiar to all of us. Another widely used herbicide chemical, 2,4-D, must be studied intensively because of its uses on food crops. We must be certain that this compound does not constitute a health hazard.

At this writing, the FDA studies on 2,4,5-T in the golden hamster have served to confirm our earlier indications that 2,4,5-T per se, without detectable dioxins, could produce terata and embryotoxicity.

Samples of 2,4,5-T from two manufacturers, when given at 100 mg./kg. to hamsters by gastric intubation—introducing the material directly into the stomach—produced an increased incidence of fetal mortality and one sample also produced terata. Neither of these samples contained any measurable symmetrical tetrachlorodibenzo-p-dioxin. Additional studies will be made to measure the dose-response relationship for teratogenicity of pure 2,4,5-T in the hamster.

Preliminary studies at FDA with 2,4-D in the hamster show less effect than with 2,4,5-T in this species. A commercial sample of 2,4-D from a current plant production and one from a 1964 production from the same plant were tested. No sample of 2,4-D contained tetrachlorodibenzo-p-dioxin.

The details of these experiments, still in preliminary form, are included in the attached tables—tables 6 through 11. Also included are some data on 2,4,5-T with varying dioxin content.

The testing of 2,4-D at higher doses to establish a dose-response relationship will follow. Esters of 2,4-D which are also used as herbicides, will be studied for teratogenic potential.

Thus far the tetrachloro-p-dioxin has been shown to be responsible for teratological anomalies in animals, but information on other dioxins which may also be harmful is lacking. A number of pure dioxins will be tested in hamsters for teratogenic potential.

In toxicological evaluations, it is desirable to test a pesticide in more than one species, and studies with 2,4-D in rats are underway.

Tolerances for residues of 2,4-D have been established at 5 parts per million in or on apples, citrus fruits, pears and quinces; at 0.5 parts per million in or on the grain of, and at 20 parts per million in or on the forage of barley, oats, rye, and wheat. Such residue tolerances do not allow the presence of dioxins. If dioxins were detected on any of these raw agricultural commodities, they would be in violation of the Food, Drug, and Cosmetic Act and subject to seizure and/or other legal condemnation.

The pesticide surveillance activities of FDA are continuously examining food products for the chlorophenoxyacid class of herbicides. This surveillance effort has shown a very low level of 2,4-D residues in market food products. "Trace" levels are those most frequently reported and they correspond to less than 0.01 parts per million of 2,4-D.

Mr. Chairman, I have outlined in a very brief fashion our investigations involving the chlorophenoxy herbicides, the chlorophenols and the dioxins. I believe we are moving very rapidly in this area. Restrictions were placed on the use of 2,4,5-T because of the hazard, particularly to women of childbearing ages, that could result from exposures to residues of 2,4,5-T. We are now continuing our investigations of 2,4,5-T, and of the dioxins, and of the chlorophenols. We believe it imperative that our considerations of national policy for dealing with the questions posed by herbicides take account of the tremendous benefit our society receives from the use of herbicides to produce an abundant and nutritious food supply.

In view of the complexity of the issues, together with the limitations of our ability to assess potential hazards to human health, it is essential that we respond wisely and not resort to measures which the evidence does not warrant. The evidence that is available now does not, in my judgment, support a conclusion that formulations of 2,4-D as now marketed and under current uses present a hazard to the public health.

Should our evidence, or should other evidence lead us to conclude that a hazard does exist, we shall take prompt and appropriate action to protect the public health.

Thank you.

Senator HART. Thank you, Doctor.

I think it would be more useful for the record if I asked Mr. Bickwit to develop the questions we have here.

I have read the statement, but have not read the questions. I think it would be much more useful if he would direct the questions.

Mr. BICKWIT. Thank you, Mr. Chairman. Why did you advise cancellation rather than suspension of the use of 2,4,5-T on food crops, or did you in fact advise the action that was finally taken?

Dr. STEINFELD. I think the action was determined by the interagency group at meetings several months ago, and the actions on suspension and cancellation resulted therefrom.

We found an imminent hazard to public health, that is to pregnant women from the use of concentrated (liquid) formulations of 2,4,5-T around the home and in water areas. This finding of an imminent hazard led to suspension rather than cancellation.

Mr. BICKWIT. And it is your view that there is no imminent hazard from the use of 2,4,5-T on food crops?

Dr. STEINFELD. Yes, that is correct.

Mr. BICKWIT. Do you follow the same reasoning that the Department of Agriculture follows there, that the reason there is no imminent hazard is because the ingestion of crops treated with the hazardous product will not be consumed imminently?

Dr. STEINFELD. No.

I am not a lawyer, which is clearly obvious I think in my testimony. I think an imminent hazard is one about which you want to do something right now, and we felt that pregnant women should not be exposed to 2,4,5-T as of right now or at least at the time we made that recommendation.

Mr. BICKWIT. Do you see any difference in the imminence of the hazard caused by the use of liquid 2,4,5-T around the home and the powder 2,4,5-T around the home?

In one case suspension has been called for and in the other case cancellation has been called for.

Dr. STEINFELD. Dr. Upholt has a comment he would like to make in that respect.

Dr. UPHOLT. I think a little clarification is needed here. The powder forms are primarily mixed in with fertilizers and as such are very diluted and there is very little dust involved.

I think it is misleading to refer to it as a dust.

Mr. BICKWIT. So, it is again the danger that we are talking about, rather than the imminence of the danger, if imminence is defined, as the Department of Agriculture appears to define it, in terms of time.

Dr. STEINFELD. I spent most of my adult life in the field of cancer, and I will use my examples in that field.

If a carcinogen takes 20 years to produce cancer, it is nonetheless an imminent hazard, as far as I am concerned, and we should remove it. This is the definition upon which I would proceed.

I am not sure how I would do with the lawyers, but this is how I would proceed.

Mr. BICKWIT. Let me put to you then, the same question that we put to the Department of Agriculture yesterday.

If there were a pesticide which, if used on food crops, were known to produce teratogenic effects in humans in 75 percent of the cases in which food, after being treated with that pesticide was eaten, would you advocate suspension?

Would you regard that as an imminent hazard to health?

Dr. STEINFELD. I think if there were anything that caused a health problem in 75 percent of the humans who were exposed to it, I would consider that an imminent health hazard, yes.

Mr. BICKWIT. There is then some disagreement between the departments on that.

In view of the research that you have cited to us, do you have any reasonable doubt as to the safety of 2,4,5-T when used on pastures?

Dr. STEINFELD. You mean as to the safety for man?

I think in the absence of data on any scientific subject, I would always have a reasonable doubt. I think one must review the data and be certain that it is accurate and sufficient in order to form a judgment. I think we can never be certain that something is safe. We can always find things that are not safe.

Mr. BICKWIT. How about the use of 2,4-D around the home, do you have any reasonable doubt as to the safety of that?

I ask you this question actually because the Department of Agriculture asked me to ask you this question.

Dr. STEINFELD. That is very kind of them.

The data that we have on 2,4-D I would say are inconclusive. We had one preliminary experiment that showed some terata in hamsters. We had experiments then repeated twice without finding the terata.

I think the experiments with hamsters generally are difficult to interpret. One must know about the control group because they frequently and spontaneously have these problems.

This is the reason that Dr. Kotin's group and the Food and Drug Administration and other groups as well, are doing extensive additional studies so that we can firm up and form a conclusion. But

as of now, I don't believe the data on 2,4-D are sufficient to state that it is teratogenic in hamsters, let's say.

Mr. BICKWIT. Is it sufficient to say beyond a reasonable doubt that it is not teratogenic?

Dr. STEINFELD. Oh, no.

Mr. BICKWIT. Then a reasonable doubt does exist?

Dr. STEINFELD. And as to all other chemicals to which we are exposed.

Mr. BICKWIT. Including pentachlorophenol and hexochlorophene?

Dr. STEINFELD. Yes, and many other chemicals we would not even consider in this sort of discussion, and as new data accumulate, I think we must review the data and hopefully refine our judgments.

Mr. BICKWIT. These answers may surprise the Department of Agriculture, which has no such reasonable doubt as to the safety of these chemicals. They have said in a memo which they stood behind yesterday, that they regard cancellation as in order whenever such a reasonable doubt is created.

It seems to follow that if you communicate your doubts to them, that they may if they stick with the criteria they enunciated yesterday, reverse their position on many of these chemicals.

Dr. STEINFELD. That may be one conclusion, or it may be that Agriculture and at least I, speaking for HEW, differ as to the significance of the terms "reasonable doubt" and I think that is probably the key here.

Mr. BICKWIT. Clearly you do.

Dr. STEINFELD. Clearly we do.

Mr. BICKWIT. If you do not agree with their criteria, can you tell us what criteria you feel to be the proper ones for decisions on suspension and cancellation?

I know that is a difficult question.

Dr. STEINFELD. Yes, it is.

Mr. BICKWIT. Briefly, can you articulate how you go about it. How do you make a judgment?

Dr. STEINFELD. I think it is a very difficult question to answer. Our criteria may be similar, or perhaps identical. It is the terminology here regarding reasonable doubt that I think we are discussing.

Mr. BICKWIT. They have enunciated their criteria as being whenever a reasonable doubt as to safety exists, cancellation should ensue. You obviously do not share that view.

Dr. STEINFELD. I have a reasonable doubt about a great many things, but I think when we have data which clearly indicate that a compound is carcinogenic in sufficient number of animals, in an experiment that is as well carried out, with good controls, then I think we might wish to take action.

The same thing would hold for teratology. It is hard to specify in advance. I think one would have to look at the experiment and who was the experimenter.

This is another problem that I could speak of from my previous experience in cancer. There are some individuals who find each new chemical for treating cancer to be better than anything they have ever had before. After you try a few of these and find that it isn't or may be worthless, you tend to discount such an experiment or such reports.

So I would have to say we would have to look at the data on individual compounds and make a judgment thereupon.

Mr. BICKWIT. Would consideration of the utility of a pesticide come into your judgment as to whether or not it ought to be canceled or suspended?

Dr. STEINFELD. Not into our judgment. We are concerned with health.

Mr. BICKWIT. Under those circumstances, how do you communicate your judgment to the Department of Agriculture? You do not say I assume "We recommend cancellation or suspension." Do you say rather, "there is a reasonable doubt as to safety"?

Dr. STEINFELD. I doubt I would use the term "reasonable doubt." I think we have an interagency group——

Mr. BICKWIT. You say, "here are the data; we believe this establishes a reason for concern"?

Dr. STEINFELD. Yes, here are the data and we think the significance of the data is thus and so and we draw these conclusion from the data.

Mr. BICKWIT. Since you do have doubts about the safety of 2,4-D around the home, if there were alternatives to 2,4-D, would you advocate removing 2,4-D from the market?

Dr. STEINFELD. I do not think we really have any good evidence that 2,4-D is harmful to the species to whom it has been administered, much less to man at this point. I think we really should have that data and evaluate that data and reach that conclusion before we take the next step.

Mr. BICKWIT. Yes, but if alternative A and alternative B are both useful for the same purpose, and there are doubts associated with the safety of alternative A, ought we to continue to allow the use of alternative A if there are no corresponding doubts with regard to alternative B?

Dr. STEINFELD. Well, do you mean there are no tests regarding alternative B?

Mr. BICKWIT. Under the hypothesis, alternative B has conclusively been established to be safe.

Dr. STEINFELD. I do not think one can do that. I would think you would have to look at the actual data. If you have done some experiments with both compounds and you have found one to be toxic or to be teratogenic, you would make the recommendation, but this has not occurred. We do not have that data on 2,4-D.

Mr. BICKWIT. I know that, but you do have doubts.

Dr. STEINFELD. We do have some.

Mr. BICKWIT. You do have doubts as to 2,4-D, perhaps not substantial, but you have some doubts. If there were an alternative to 2,4-D about which you had no doubts whatsoever, should it not follow that exposure to 2,4-D would be needless exposure?

Dr. STEINFELD. I think you are speculating that there are compounds about which I have no doubts, and I have doubts about all compounds. I do not think you can ever prove anything is totally safe.

Mr. BICKWIT. Do you have any doubts about the safety of physical weeding in one's garden?

Dr. STEINFELD. I am glad my wife is not here.

No, I have no doubts about the effects of physical weeding, although I dare say there are people who have had myocardial infarctions from engaging in it too vigorously in the humid Washington summer.

Mr. BICKWIT. Do you have any doubts about the safety of letting the weeds grow in that case?

Dr. STEINFELD. If you are not allergic to them, no.

Mr. BICKWIT. Under those circumstances, if we do want to eliminate doubts as to the safety, doesn't it follow that we ought to think very hard about eliminating the use of 2,4-D around the home when we do have the known safe alternative, the physical weeder? This is hard I know.

Dr. STEINFELD. It is very difficult, because I do not feel that we have good data that would warrant taking action against 2,4-D. However, I might be here in another week or 2 weeks if we develop such data in which I would say I now have those——

Mr. BICKWIT. But are not the risks we are running in the interim needless risks?

Dr. STEINFELD. There are risks with all of the things we use, and perhaps they are all needless, but these things presumably have a beneficial result or else we do not use them.

Mr. BICKWIT. Apparently there are some chemical alternatives to 2,4-D as well if we do not like the alternative of risking strain on our backs. Again, under those circumstances, if these chemical alternatives are in your mind without doubts as to safety, should we not advocate their use to the exclusion of the use of chemicals about which you have doubts as to safety?

Dr. STEINFELD. Well, I think when we have data which demonstrate that a compound produces terata or cancer, we should take appropriate action. I think when we have data which we feel pretty comfortable with, but we do not feel that it is conclusive, we should take an action which is temporary but continue to collect additional data.

Mr. BICKWIT. What is so permanent about a suspension?

Dr. STEINFELD. You can always change it.

Mr. BICKWIT. That is right. Maybe that should be the appropriate temporary action.

Dr. STEINFELD. It would be when we have some information about which we feel fairly secure.

I was going to go one to say that I think the recomendations that the Department of Agriculture made yesterday are the result of our concern about that all-or-none phenomenon, and we do feel that we need additional flexibility in taking these actions and in protecting the public health. I have not really—the Department certainly has not had time to study these specific ones. We have talked about them informally, and I think they are a step in the right direction.

Mr. BICKWIT. In your statement you briefly described research actions being taken by HEW with respect to the dioxin that may contaminate 2,4,5-T and 2,4-D.

Dr. STEINFELD. I do not believe we have detected any dioxin contamination of 2,4-D.

Mr. BICKWIT. I did use the word "may."

We learned yesterday that USDA expects, in about 3 months, some results from their research into the contamination of other products by the dioxins. When do you expect to have results from your dioxin research—definitive results?

Dr. STEINFELD. We are continually developing data and I would hope we would continue to do research.

Dr. Kotin could perhaps address the questions of experiments that will be completed at a specified time.

Dr. KOTIN. Experiments analogous to those described by Agriculture are obviously beyond our purview in the sense of detection and the quantification of the dioxins in field crops and the like. In the terms of the problems relating to the anatomic and metabolic fate, as it were, of these compounds, how the body handles these compounds, we are already engaged in these studies and those Dr. Steinfeld mentioned in his testimony concerning some evidence of liver toxicity and the like.

So, depending on the end point you seek, I can give you an answer. We have some information now. More should be coming along at a regular rate as protocols are implemented and they are forthcoming.

Mr. BICKWIT. Thank you.

You said you do have a tolerance for 2,4-D on certain agricultural commodities and none for the dioxins.

Dr. STEINFELD. Yes.

Mr. BICKWIT. Are you monitoring food for dioxins now?

Dr. STEINFELD. We are trying to develop adequate techniques. The techniques are very difficult for the dioxins and, as you know, it is only relatively recently that we became aware of their toxicity, not only in terms of the embryo-toxicity as well. This certainly is a high priority subject for the FDA.

I might add that we are in touch with Canada and Britain and we meet regularly. Dr. Egeberg, Dr. Edwards, and I meet with our counterparts in these countries and exchanged information on subjects such as this.

Mr. BICKWIT. Might it not be wise to reconsider this tolerance temporarily in light of the possibility of dioxin contamination through 2,4-D, at least until you are able to monitor for dioxin levels on an adequate scale?

Dr. STEINFELD. I think we have checked 2,4-4's for dioxin contamination and have not found it. The process of manufacture of 2,4-D, as I understand it, would not be one that would likely lead to the presence of dioxins.

Mr. BICKWIT. We have heard some evidence that 2,4-dichlorophenol, the precursor to 2,4-D, does contain dioxins of the 6, 7, and 8 isomers.

Is it under those circumstances possible or perhaps likely that it would be carried forward to the end product, 2,4-D?

Dr. STEINFELD. I am not a chemist. I would say that we ought to look at that data and determine whether we did not look in the right way at the material and see whether or not indeed we can find such dioxins. I am not aware, that is what I am saying.

Mr. BICKWIT. While we are looking, again what would we lose by removing that tolerance?

Dr. STEINFELD. I think you could say that about almost any chemical that we use, because we are doing research on most of the drugs that we use to treat most of the diseases we have, and any time you may find additional information.

Mr. BICKWIT. So, if we can say that about any chemical that we are working with, and there are adequate alternatives to the chemical, ought not we to do it?

Dr. STEINFELD. I think you have just wiped out the chemical and drug industry in the United States, if not also the food industry.

Mr. BICKWIT. I do not think so, assuming my hypothesis to be correct that there are alternatives. If the food industry went under as a result of this of action, it would seem to follow that there were no alternatives to the chemicals we were using.

Dr. STEINFELD. I guess I do not accept the hypothesis that there are things about which I do not have reasonable doubt. We are finding, for example, that sugar in some individuals increases the triglyceride levels; and certain individuals who have had hyperdipemia should reduce their sugar ingestion. This is something we had not considered some years ago.

One must have a reasonable doubt, because we have not done all the experiments that can be done, and men are still dying of diseases for which we do not know the cause.

Mr. BICKWIT. I think the points have been made.

Thank you, and I am not as unsympathetic as I might sound.

Senator HART. Doctor, during the exchange I caught up with you when you said we were in the process of dismantling and destroying a whole series of industries. I hope that really is not our course.

Dr. STEINFELD. I am certain it is not, Senator.

Senator HART. I have undertaken things around here perhaps which have outraged, I hope only momentarily, certain segments of the economy. But I would hate to be known as the man who was unsympathetic with those millions of voters that want to get rid of crabgrass.

Gentlemen, thank you very much.

We are adjourned subject to the call of the Chair.

(Whereupon, at 1:10 p.m., the hearing was adjourned, subject to the call of the Chair.)

ADDITIONAL ARTICLES, LETTERS, AND STATEMENTS

June 16, 1970

HON. PHILIP A. HART,
Chairman, Subcommittee on Energy, Natural Resources, and the Environment, Senate Commerce Committee, Washington, D.C.

DEAR SENATOR HART: We understand that your subcommittee is holding hearings on June 17 and 18 on the effects of certain pesticides on man and the environment.

In this connection, we would like to submit for the hearing record a copy of an article on weed killers that appeared in the current issue of "Consumer Reports".

We hope it will be of use to you and your committee.

Sincerely,

DAVID A. SWANKIN,
Washington Representative.

(Enclosure)

WEED KILLERS

When it comes to weed control, the home gardener's options are few. His first, and best, option is to plant, fertilize and cultivate his lawn and flower gardens with such care that weeds never present more than a passing problem, easily solved in the course of regular gardening. As a second option, he can resign himself to hours of raking, hoeing, mulching, mowing, burning, or uprooting tenacious weeds by hand. As a third alternative, he can permit the weeds to take over and let his neighbors think what they will.

Or he can use chemical weed killers called herbicides, the subject of this report. Herbicides, however, may be harmful to more than weeds. Some herbicides kill nonselectively, destroying such desirable plants as fruits, vegetables, flowers and ornamental shrubs and trees right along with weeds. Some herbicides are dangerously persistent—they remain toxic long after the weeds have been killed. Some herbicides are toxic enough to kill pets, birds, fish and other wildlife. And some of these poisons contaminate air and water supplies with as yet undetermined effects on humans.

There are compelling reasons, then, for approaching the use of herbicides with great caution. If you can possibly weed by hand, do. Those unable to tackle the physical task of weeding by hand should choose the least toxic and the least persistent herbicide available for a given job. And shun "combination" products that claim to double as herbicide and insecticide, fungicide or fertilizer.

With safety uppermost in mind, CU's chemists and agricultural consultants examined 174 chemical weed killers that were purchased last summer by shoppers in seven market areas across the country. They noted each product's claimed uses and ingredients—information required by the U.S. Department of Agriculture to appear on the labels of all herbicides in interstate commerce. They checked each label for adequate warnings and cautions, another Federal requirement. They verified the clarity, completeness and correctness of the labeled instructions, which are supposed to tell exactly how, when, in what quantity and on what plants a herbicide should be applied. They made sure that the damages recommended (which amounted to only a few ounces of active herbicidal ingredient per 1000 square feet) did not exceed limits set in Federal regulations.* They evaluated each product's persistence and toxicity. And, finally, they considered the form of the products—liquids, powders, aero-

* Those limits are often published for food crop uses only, although the USDA has established recommended safe dosages for uses other than food crops as well. CU believes the USDA should put on the record the established safe dosages for all uses. Where we could not find published figures for nonfood crops, we used the dosages published for food crops as a guide to judging the safety of label recommendations.

sols and so forth—because the form determines to a considerable degree how safe and how convenient a herbicide will be in use.

Since the chemical properties of herbicide ingredients are a matter of established fact, there was no need to test the products for their practical weed-killing abilities. But knowledge of a given chemical's toxicity and persistence is in a state of flux; judgments on those factors are often a matter of controversy. This report represents the best information available to our consultants and staff chemists as of this writing. As more information becomes available from ecologists and others concerned with effects of herbicides on the world beyond the weeds, CU will update its advice.

Our concern for safety was amply motivated: Roughly three out of every four herbicides were judged unsuitable for use by the home gardener. To begin with, 38 products lacked a USDA registration number. That means they don't necessarily meet herbicidal safety standards set forth in the Federal Insecticide, Fungicide, and Rodenticide Act. We therefore eliminated all 38 from further consideration. Next we judged that many of the remaining herbicides were appallingly toxic, USDA criteria notwithstanding. Some are so highly toxic that just a taste could kill you; the law requires their labels to be marked with a skull and crossbones, the words "Danger" and (in red) "Poison," and to give an antidote. Some others are toxic enough so that less than a spoonful could kill a child; their labels are marked "Warning." Since there are a number of effective herbicides that do not pose so needless a hazard, we rated all products labeled "Danger" and "Warning" Not Acceptable. Finally, we rated some other weed killers. Not Acceptable *for one or more* reasons given in the Ratings. Some products, for example, contain ingredients judged dangerous persistent, sometimes for a year or more. Twenty-three brands contain 2,4,5-T, a chemical suspected of causing birth defects in humans and in animals. (In April, the Federal Government banned interstate sales of 2,4,5-T products in liquid form; nonliquid 2,4,5-T products remain in interstate commerce pending further hearings and possible appeals. The ban does not affect 2,4,5-T products still on the shelves of retail stores. CU considers *any* form of 2,4,5-T Not Acceptable for use around the home.) Six brands contain PCP, a chemical that may be irritating if inhaled. Some herbicides are incompletely or misleadingly labeled. And three were judged to pose a fire hazard.

That left just 48 products judged Acceptable for judicious use by the home gardener, but we have reservations about them, too. All bear the word "Caution" on their label; all rank as "slightly toxic" by USDA standards; and all might be dangerous if the labeled precautions, limitations and directions for their use are not followed to the letter.

Herbicides judged Acceptable for one task may be quite unacceptable for others; thus, a product safe for use on lawn weeds may destroy a vegetable or flower plot. Remember, again, that comparatively little is known at present of the adverse effects of herbicides: Current research may lead to a startling reappraisal of the listed herbicides.

PRE-EMERGENT WEED KILLERS

Herbicides that destroy germinating weeds before they come up are known as pre-emergent. Pre-emergents are the only class of herbicides that may be safe for use near vegetable plots, near fruit trees, on flower plots and lawns, and near ornamental trees and shrubs. Whether they are, in fact, recommended for a given use depends on their chemical agent. Table 1 on page 362 tells which pre-emergents are recommended for which uses.

Pre-emergents must be handled carefully, since they may kill the germinating seeds of desirable plants along with those of weeds. No pre-emergent should be applied around desirable plants that are not at least six inches tall, or on newly established lawns. (During a lawn's first year, use of a pre-emergent herbicide should be delayed until the lawn is well enough along to have gone through three mowings.) Once you've used a pre-emergent herbicide on a lawn, wait eight to 12 weeks before reseeding.

To be effective, pre-emergents must be in place in or on the soil even as the weed seeds are germinating. (Such herbicides do not destroy weeds that have had time to sprout, and, applied too early, they may simply dissipate in the soil.) To find out the best time to apply pre-emergents in your area we suggest you consult someone who knows precisely when germination takes place. Likely candidates: a staff member of a local agricultural college or your county agricultural agent in your state agricultural extension service. Since seeds of some plants can remain viable in the soil for years, reapplication may be necessary.

There are noteworthy differences among the chemical herbicides on which the Acceptable pre-emergents are based. As Table 1 shows, DCPA is far and away the most versatile. Only DCPA is recommended around melons, onions and eggplant. Unlike most pre-emergents, it's recommended for use on established grass lawns. DCPA destroys purslane and crabgrass, two ubiquitous annuals. (In our view, incidentally, pre-emergent treatment is the only recommended way for the home gardener to control crabgrass chemically. Crabgrass seeds are usually vulnerable to pre-emergents just about the time the forsythia stops blooming.) But DCPA can't handle the emergent broadleaf weeds often found on lawns, or eliminate dandelion or chickweed, whose seeds germinate in late summer, after a spring application of DCPA has lost its punch.

The trifluralin herbicides are decidedly less versatile and convenient than DCPA products. Though they destroy purslane, they are without effect on ragweed. They damage some actively growing grasses and stain hands or clothes yellow on contact. And, unlike DCPA, which is applied directly to the surface of the soil, trifluralin herbicides should be worked into the soil for their fumigant action to be effective.

EPTC is highly effective against weed grasses and many broadleaf weeds, but not against purslane. The diphenamid products are effective on purslane, but not on ragweed. And they're the *only* pre-emergents recommended for actively growing lawns of dichondra; however, diphenamid damages regular grass lawns. Siduron products are as outstandingly effective on crabgrass as DCPA. And they are unusually selective—they do no harm at all to actively growing grasses, or to the seed of bluegrass or to some of the bentgrasses. So you could reseed such grasses immediately after treatment with a siduron herbicide (other grasses, though, would have to wait the usual eight to 12 weeks for effective reseeding). Amiben is highly effective on ragweed and smartweed.

POST-EMERGENT WEED KILLERS

A post-emergent herbicide kills weeds that are up and growing. The Ratings list 27 Acceptable products that can destroy some common broadleaf lawn weeds in two to four weeks' time and with some degree of selectivity—properly used, that is, they should leave lawn grasses undamaged. Table II, which should be used in conjunction with the Ratings, tells which post-emergents kill which lawn weeds.

Certain risks attend the use of these Acceptable products. If applied in quantities greater than their labels recommend, they may damage a lawn's grasses. None should be used anywhere but on the lawn; they may harm or destroy ornamentals, fruits and vegetables. (Weeds that emerge in a vegetable garden should be pulled out by hand.) All these products are toxic enough to damage any but well-established lawns—those with grass sturdy enough to have survived at least three mowings. So allow about three months to elapse after a seeding or reseeding before you treat the lawn with one of these products. And since they may kill germinating seeds along with lawn weeds, it's a waste of time to reseed sooner than two months after treatment.

The Acceptable brands are not effective enough to cope with tall weeds. Weeds that measure a foot or more should be cut down before treatment. (But note that *very* short growths—the weed stubble left after mowing, say—won't respond to these herbicides, which are most effective on rapidly growing weeds. So let stubble grow a few inches, then treat the new foliage.) Reapplications, usually at six- to eight-week intervals, are sometimes necessary for lawn weed control; but a single application just before weeds flower in spring or fall may be all that's needed. Finally, to choose the right herbicide for a particular weed, you must be sure of the weed's identity (a bother you can forget if you just uproot the weed). Identification may be something of a problem: One botanist estimates the variety of weeds in the eastern United States at roughly 1200. Gardeners perplexed by the identity of a given weed can cart it, roots and all, to one of the specialists mentioned earlier, assuming the infestation is worth the effort. Or refer to one of the many reference books on the subject; at the end of this report, we list some publications judged particularly helpful.

The most versatile post-emergent type is a mixture of 2,4-D with silvex or—in the case of the *Antrol Jet Stream Weed Bomb* only—with dichlorprop. Such mixtures are effective on dandelion, plantain, curly dock, chickweed,

white clover, knotweed and most other broadleaf weeds. And because of their wide effectiveness, we judged the 2,4-D combinations, as a class, preferable to the other products for lawn-weed control. (Note, by the way, silvex is sometimes also labeled 2,4,5-TP. Don't confuse it with 2,4,5-T, which CU considers Not Acceptable.)

None of those products kill growing crabgrass, and you should steer clear of the highly toxic post-emergents that claim to. Our advice: Uproot crabgrass before it has gone to seed or live with the weed until the first killing frost destroys it, and then kill its seeds the following spring with one of the recommended DCPA or siduron products.

NONSELECTIVE WEED KILLERS

Some post-emergent herbicides can kill virtually all growing vegetation: desirable plants, weeds and sometimes germinating seeds as well. They are useful for such tasks as keeping paths and driveways totally weed-free when the job can't be done by hand. The length of their killing action varies, and reapplications may be necessary, especially to control hefty, well-established plants. But they're usually harmful, on contact, to the foliage and green bark of trees, shrubs and woody plants. And they are unsafe for use near such shallow-rooted plants as rhododendron.

The Ratings list five nonselective weed killers judged reasonably safe for spot treatment in home gardening. Table III tells which of the nonselective agents should be used on which class of plants.

One product contains a petroleum distillate. The distillate is unlikely to kill embedded germinating seeds; it's nonpersistent, so you can usually reseed or replant safely the day after you apply it; and it can kill the foliage of almost any plant in a day. It is particularly effective on annuals less than 12 inches tall, and on young, actively growing annuals and perennials. Older weeds and shallow-rooted perennials may need repeated applications. And this type of herbicide normally won't destroy deep-rooted perennials.

The other Acceptable products may take a few weeks to work, but they kill the roots as well as the foliage of most weeds. We judged the amitrole-based product, *Weedone Poison Ivy Killer*, best for poison ivy, a deep-rooted perennial, and also effective on such deep-rooted perennials as curly dock and thistle, though it may have to be applied more than once. But beware of getting amitrole on the foliage of shrubs or trees: It may kill them unless you wash it all off immediately with the garden hose.

AMS is a broad-spectrum herbicide—the only one we judged effective for killing live tree stumps. It's good, too, on deep-rooted perennials, including poison ivy. The two dalapon-based products are meant solely for killing grasses; we judged them better than any other at that specific job.

The Acceptable weed killers come in a wide variety of forms, noted in the Ratings. And the form of a product often determines the kind of weed control you can undertake. If your lawn or garden is smallish, or if weeds are no great problem, consider weeding with hand tools first. If that's impractical for some reason, consider next products that allow for handy spot control: granular herbicides in shaker cans, aerosol sprays and liquids in squirt cans. (The three Acceptable squirt-ons are for lawn weeds only.)

If weed infestation is extensive, consider products appropriate for area control. There are granular herbicides in bulk; you need a lawn spreader to apply them. And there are spray herbicides for which you usually need a lawn sprayer that will hold a gallon or so. Spray herbicides have to be mixed in the proper proportion with water. Be they liquid concentrate, soluble powder or wettable powder, that mixing can be a chore. One product, *Pop-In Weed Control Spray Packets*, comes in packets of soluble powder that are conveniently premeasured. We judged one of the wettable powders, *Acme Garden Weed Preventer Spray*, inconvenient indeed; after the bother of measuring and mxing, we had to agitate it steadily in spraying.

Four Acceptable products—herbicides in the form of wax bars—are in a class by themselves. Two—the *Ortho Weed-B-Gon Bar* and the *Weedex Wonder Bar*—are effective on lawn weeds. You might use either one for a kind of spot control, rubbing them on weed growths under shrubs or at the lawn's edges. Or you might use either to cover an entire lawn by trailing the bar in the wake of a lawn mower. The other two wax bar products are nonselective killers—usable for precision lawn-edging, but damaging to lawn grass.

Children and pregnant women should be kept away from lawns and garden treated with herbicide until a good rain or a watering lowers the hazard to some extent. Herbicides should also be stored away from children, in a cupboard or closet you can lock. (The drier the better, by the way; dampness makes dry formulations of weed killer deteriorate.) Never store herbicide in a container other than its own; its label provides information that could be vital in an emergency. When you apply weed killer, wear plastic or rubber gloves to protect your hands, and cuffless trousers to avoid accidentally collecting toxic chemicals. If herbicide touches your skin or eyes, wash it away promptly with copious quantities of plain cold water. Never use herbicidal sprays on a windy day; unpredictable spray drift is a hazard to plants and shrubs in its path. If you spray, try not to use the sprayer for anything but weed killer; if you must use it for other purposes, scrub it out vigorously and repeatedly beforehand with water and a detergent, then with a solution of household ammonia. Never burn unwanted herbicide to dispose of it—the vapors may be poisonous to humans or to plants. Take your surplus to a dump where refuse is used for land fill, or bury it yourself at least 18 inches deep in ground where there is no hazard of contaminating a water supply. Finally, buy weed killer in the minimum amounts needed for a single gardening season—some herbicides deteriorate in storage.

Two USDA publications we judged especially helpful to gardeners with a weed-control problem are: *Lawn Weed Control with Herbicides, USDA Home and Garden Bulletin No. 123*, 1968, 20¢ (211 pages) and *Suggested Guide for Weed Control, USDA Agricultural Handbook No. 332*, 1969, 70¢ (70 pages). They can be obtained from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. We also recommend "How to Know the Weeds" by H. E. Jaques, William C. Brown Co., Dubuque, Iowa, 1959, $3 in paperback (230 pages); "Weeds of Lawn and Garden" by J. M. Fogg, Jr., University of Pennsylvania Press, Philadelphia, 1956, $3 (215 pages); and "Handbook on Weed Control," Brooklyn Botanic Garden, Brooklyn, N.Y., 1966. $1.25 (81 pages).

LISTING OF ACCEPTABLE WEED KILLERS

(Listed by type. Within types, listed by chemical groups and within groups, alphabetically.)

PRE-EMERGENT WEED KILLERS

This list should be used in conjunction with Table I.

DCPA products

Acme Garden Weed Preventer. Granules in a shaker can.
Acme Garden Weed Preventer Spray. Wettable powder to be mixed with water for spraying. Judged inconvenient in use since spray tank must be agitated rather steadily to keep powder suspended in water.
Best Garden Weeder. Granules in a shaker can.
Heritage House Garden Weed Preventer. Granules in a shaker can.
May-Way Garden Weed Preventer. Granules in a shaker can.
Science Garden Weeder. Granules in a shaker can.
Squire Applegate Crabgrass Killer Granules. Granules in bulk.

Trifluralin products

Greenfield Preen, The Weed Preventer. Granules in bulk.
Security EZE Garden Weed Killer. Granules in a shaker can.

EPTC product

Stauffer Chemicals Eptam 2.3 Granular. Granules in a shaker can.

Diphenamid products

Greenfield Dymid Grass and Weed Control. Granules in a shaker can.
Tuco Enide Dichondra Weed Control. Wettable powder to be mixed with water for spraying.
Tuco Enide Liquid Dichondra Weed Control. Liquid concentrate to be mixed with water for spraying.

Siduron products

Du Pont Tupersan Siduron Weed Killer. Wettable powder to be mixed with water for spraying.
Rockland Crabgrass Preventer "T" with Tupersan. Granules in bulk.

Amiben product

Weedone Garden Weeder. Granules in a shaker can.

LAWN WEED KILLERS

This list should be used in conjunction with Table II.

2,4-D Combination products

Except as noted, the following products contain 2,4-D plus silvex.

Acme Weed-No-More Lawn Weed Killer. Liquid concentrate to be mixed with water for spraying.
Agrico Dandelion & Broadleaf Weed Control. Granules in bulk.
Antrol Jet Stream Bomb. Contains 2,4-D+dichlorprop. Aerosol.
Antrol Jet Stream Weed Killer. Aerosol.
Antrol Squeeze 'n Weed Dandelion Plantain-Poison Ivy and Chickweed Killer. Liquid in squirt can.
Antrol Wide-Stream Chickweed and Clover Killer. Aerosol.
Farmingdale 2,4-D Plus 2,4,5-TP Silvex Dandelion Killer. Granules in bulk.
Greenfield Dandelion & Broadleaf Weed Killer. Aerosol.
Greenfield Dandelion & Broadleaf Weed Killer. Granules in bulk.
New Era "Squeeze-Weeder" Dandelion Chickweed-Plantain and Poison Ivy Killer. Liquid in squirt can.
Ortho Weed-B-Gon. Liquid concentrate to be mixed with water for spraying.
Patco Weedkill. Granules in bulk.
Sears Lawn Weed Killer. Granules in bulk.

2,4-D products

Black Leaf Spot Weed Killer. Liquid in squirt can.
Ferti-Lome Dacamine Weed Killer. Liquid concentrate to be mixed with water for spraying.

TABLE I.—PRE-EMERGENT WEED KILLERS; WHICH FOR WHICH AREAS?

Vegetable plots	Near fruit trees	Flower plots	Near ornamental trees and shrubs	Grass lawns	Dichondra lawns
DCPA Trifluralin Diphenamid Amiben	DCPA Trifluralin Diphenamid	DCPA Trifluralin EPTC Amiben	DCPA Trifluralin EPTC Diphenamid Siduron Amiben	DCPA Siduron	Diphenamid

TABLE II.—LAWN WEED KILLERS: WHICH FOR WHICH WEEDS?

Dandelion, plantation, curly dock	Chickweed, white clover, knotweed	Most other broadleaf weeds
2,4-D combinations 2,4-D	2,4-D combinations Silvex	2,4-D combinations 2,4-D Silvex

TABLE III.—NONSELECTIVE WEED KILLERS: WHICH FOR WHICH PLANTS?

Annuals	Shallow-rooted perennials	Deep-rooted perennials
Petroleum distillate Amitrole AMS Dalapon	Petroleum distillate Amitrole AMS Dalapon	Amitrole AMS

Finelawn 2,4-D Weed Killer. Liquid concentrate to be mixed with water for spraying.
Garden Care Products, 2,4-D Lawn Weed & Dandelion Killer. Liquid concentrate to be mixed with water for spraying.
Ortho Weed-B-Gon Bar. Wax bar.
Patterson's 2-4-D Amine Weed Killer. Liquid concentrate to be mixed with water for spraying.
Pop-In-Weed Control Spray Packets. Premeasured packets of soluble powder to be mixed with water for spraying.
Raid Weed Killer. Aerosol.
Weedex Wonder Bar. Wax bar.

Silvex products

Black Leaf Clover and Chickweed Killer. Aerosol.
Farmingdale 2,4,5-TP Silvex Chickweed & Clover Killer, Liquid concentrate to be mixed with water for spraying.
Finelawn 2,4,5-TP Chickweed Killer. Liquid concentrate to be mixed with water for spraying.
Ortho Chickweed & Clover Killer. Liquid concentrate to be mixed with water for spraying.
Weedone Chickweed Killer. Liquid concentrate to be mixed with water for spraying.

NONSELECTIVE WEED KILLERS

This list should be used in conjunction with Table III.

Petroleum distillate product

Destruxol Nonselective Contact Weed Killer. Liquid concentrate to be mixed with water for spraying.

Amitrole product

Weedone Poison Ivy Killer. Aerosol.

AMS product

Du Pont Ammate – Weed & Brush Killer. Soluble powder to be mixed with water for spraying.

Dalapon products

Green Light Dowpon Grass Killer Bar. Wax bar.
Sears Grass Killer Bar. Wax bar.

NOT ACCEPTABLE

The following products contain active ingredients (such as 2,4,5-T, paraquat or arsenics) judged to be too poisonous for home use, or active ingredients (such as methancarsonates) suspected of being too poisonous for home use. Listed alphabetically.

Acme Crab Grass Killer, Contains AMA
Acme Poison Ivy Killer Foam Marker
Acme Weed Killer
Antrol Jet Stream Crabgrass Killer
Antrol Jet Stream Crabgrass Killer Spot Kills
Black Leaf Crab Grass Killer
Black Leaf Crab Grass Killer Spray Bomb
Black Leaf Lawn Weed Killer
Black Leaf Lawn Weed Killer Spray Bomb
F & B Weed Killer (Sodium Arsenite Solution)
Farmingdale A-5 Weed Killer
Farmingdale A.M.A. Plus 2,4-D Crabgrass and Lawn Weed Killer
Ferti-Lome Nutgrass Killer
Finelawn 2,4-D—2,4,5-T Clover and Poison Ivy Killer
Finelawn Disod Crab Grass Killer
Germain's Spot Treatment Weed Killer
Gordon's Lawn Weed Killer, Low Volatile Type
Greenfield Broadleaf Weed and Crab Grass Killer
Greenfield Non-Drift Broadleaf Weed Killer
Green Light Liquid Crabgrass Killer

Green L[illegible] Non-Hormone Clover, Winter Grass and Weed Killer
Green Light Weed Killer, 2,4-D Plus 2,4,5-T
Happy Home Spot Weed Killer
Linck's Di-Met Plus-2 Kills Crabgrass & Lawn Weeds
Ortho Brush Killer
Ortho Crab Grass Killer
Ortho Poison Ivy Killer
Ortho Spot Weed and Grass Killer
Ortho Weed-B-Gon Bomb
Ortho Weed-B-Gon Spot Weeder
Patco's Crabkill With DSMA Plus 2,4-D
Patterson's Renew Herbicide
Pratt A-5 Weed Killer, Non-Selective
Pratt's Crabgrass & Broadleaf Weed Killer
Scott's Clout
Scott's Erase
Sears Lawn Renovator and Grass & Weed Killer
Sears Liquid Crabgrass Killer
Security 40% Solution Sodium Arsenite
Silvero's Auto/Home/Garden Spray Gun Weed Killer Refill Tablets
T & C Weeds-A-Way Lawn Weed Killer
Termicide 5-15
Turf King Lawn Weed Killer
Vigoro Crabgrass Killer
Vigoro Lawn Weed Killer
Vigoro Lawn Weed Killer Concentrated
Vigoro Spot Weeder Jet Spray Foam Marker
Vigoro Weed and Grass "Topkill"
Weedone Clover Killer
Weedone Crab Grass Killer

The following products contained active ingredients (such as dicamba or simazine) judged too persistent for use in home gardening or active ingredients (such as erbon) suspected of being too persistent for home use. Listed alphabetically.

Acme Vegetation Killer, Non-Arsenical
Angel City Total Weed Killer
Borden Chemical Nutro Turf Weed Killer
Cooke Oxalis Control for Dichondra Lawns Only
E-Z Edge Chemical Edging Tape
Ferti-Lome New Broad Spectrum Weed Killer
Germain's Non-Selective Weed Killer
Glorion Lawn Weed Killer
Gordon's Super 6 Lawn Weed Killer
Green Light Liquid Edger
May-Way Lawn Weed Killer
Miller's Improved Lawn Weed Killer
Ortho Triox Granular Vegetation Killer
Ortho Triox Liquid Vegetation Killer
Real-Kill Guaranteed Spot Weed Killer
Real-Kill Guaranteed Spot Weed Killer Concentrate
Scott's Kansel Weed Control
Scott's Spot Weeder
Sears Broad Leaf Weed Killer
Sears Grass and Weed Killer
Sears Weed and Grass Killer
Sears Weed Killer
Super D Weedone Lawn Weed Killer
Vigoro Chickweed, Clover and Weed Killer
Vigoro Weed and Grass Killer

Labels on the following products were judged inadequate or could lead to dosages judged excessive for home use. Listed alphabetically.

Anchem Weedazol Amino Triazole Weed Killer
Black Leaf Grass, Weed & Vegetation Killer Spray Bomb
Farmingdale's Ready Mixed Hose Spray, 2,4-D Lawn Weed & Dandelion Killer
Glorion Pre-Emerge Crabgrass Seedling Killer

Greenfield Dandelion & Chickweed Killer
Greenfield Preen Grass & Weed Control
Killer Kane Kartridges
Pill Kill Weed Killer for Broadleaf Weeds
Vigoro Garden Weeder
Weyerhaeuser Weedicide for Shrubs and Flower Beds

The chemicals in the following products were judged to pose a possible fire hazard. Listed alphabetically.

Borden Chemical Nutro Weed Bomb
Ferti-Lome New Perma-Trim
Ferti-Lome Spot Weed Killer

[From New Yorker magazine, Feb. 7, 1970]

(The following article and letters were referred to on p. 2.)

A REPORTER AT LARGE

DEFOLIATION

Late in 1961, the United States Military Advisory Group in Vietnam began, as a minor test operation, the defoliation, by aerial spraying, of trees along the sides of roads and canals east of Saigon. The purpose of the operation was to increase visibility and thus safeguard against ambushes of allied troops and make more vulnerable any Vietcong who might be concealed under cover of the dense foliage. The number of acres sprayed does not appear to have been publicly recorded, but the test was adjudged a success militarily. In January, 1962, following a formal announcement by South Vietnamese and American officials that a program of such spraying was to be put into effect, and that it was intended "to improve the country's economy by permitting freer communication as well as to facilitate the Vietnamese Army's task of keeping these avenues free of Vietcong harassments," military defoliation operations really got under way. According to an article that month in the New York *Times*, "a high South Vietnamese official" announced that a seventy-mile stretch of road between Saigon and the coast was sprayed "to remove foliage hiding Communist guerrillas."

The South Vietnamese spokesman also announced that defoliant chemicals would be sprayed on Vietcong plantations of manioc and sweet potatoes in the Highlands. The program was gathering momentum. It was doing so in spite of certain private misgivings among American officials, particularly in the State Department, who feared, first, that the operations might open the United States to charges of engaging in chemical and biological warfare, and, second, that they were not all that militarily effective. Roger Hilsman, now a professor of government at Columbia University, and then Director of Intelligence and Research for the State Department, reported, after a trip to Vietnam, that defoliation operations "had political disadvantages" and, furthermore, that they were of questionable military value, particularly in accomplishing their supposed purpose of reducing cover for ambushes. Hilsman later recalled in his book, "To Move a Nation," his visit to Vietnam, in March, 1962: "I had flown down a stretch of road that had been used for a test and found that the results were not very impressive. . . . Later, the senior Australian military representative in Saigon, Colonel Serong, also pointed out that defoliation actually aided the ambushers—if the vegetation was close to the road those who were ambushed could take cover quickly; when it was removed the guerrillas had a better field of fire." According to Hilsman, "The National Security Council spent tense sessions debating the matter."

Nonetheless, the Joint Chiefs of Staff and their Chairman, General Maxwell Taylor, agreed that chemical defoliation was a useful military weapon. In 1962, the American military "treated" 4,940 acres of the Vietnamese countryside with herbicides. In 1963, the area sprayed increased fivefold, to a total of 24,700 acres. In 1964, the defoliated area was more than tripled. In 1965, the 1964 figure was doubled, increasing to 155,610 acres. In 1966, the sprayed area was again increased fivefold, to 741,247 acres, and in 1967 it was doubled once again over the previous year, to 1,486,446 acres. Thus, the areas defoliated in Vietnam had increased approximately three hundredfold in five years, but now adverse opinion among scientists and other people who were concerned about the effects of de-

foliation on the Vietnamese ecology at last began to have a braking effect on the program. In 1968, 1,267,110 acres were sprayed, and in 1969 perhaps a million acres. Since 1962, the defoliation operations have covered almost five million acres, an area equivalent to about twelve per cent of the entire territory of South Vietnam, and about the size of the state of Massachusetts. Between 1962 and 1967, the deliberate destruction of plots of rice, manioc, beans, and other foodstuffs through herbicidal spraying—the word "deliberate" is used here to exclude the many reported instances of accidental spraying of Vietnamese plots—increased three hundredfold, from an estimated 741 acres to 221,312 acres, and by the end of 1969 the Vietnamese crop-growing area that since 1962 had been sprayed with herbicides totalled at least half a million acres. By then, in many areas the original purpose of the defoliation had been all but forgotten. The military had discoveerd that a more effective way of keeping roadsides clear was to bulldoze them. But by the time of that discovery defoliation had settled in as a general policy and taken on a life of its own—mainly justified on the ground that it made enemy infiltration from the North much more difficult by removing vegetation that concealed jungle roads and trails.

During all the time since the program began in 1961, no American military or civilian official has ever publicly characterized it as an operation of either chemical or biological warfare, although there can be no doubt that it is an operation of chemical warfare in that it involves the aerial spraying of chemical substances with the aim of gaining a military advantage, and that it is an operation of biological warfare in that it is aimed at a deliberate disruption of the biological conditions prevailing in a given area. Such distinctions simply do not appear in official United States statements or documents; they were long ago shrouded under heavy verbal cover. Thus, a State Department report, made public in March, 1966, saying that about twenty thousand acres of crops in South Vietnam had been destroyed by defoliation to deny food to guerrillas, described the areas involved as "remote and thinly populated," and gave a firm assurance that the materials sprayed on the crops were of a mild and transient potency: "The herbicides used are nontoxic and not dangerous to man or animal life. The land is not affected for future use."

However comforting the statements issued by our government during seven years of herbicidal operations in Vietnam, the fact is that the major development of defoliant chemicals (whose existence had been known in the thirties) and other herbicidal agents came about in military programs for biological warfare. The direction of this work was set during the Second World War, when Professor E. J. Kraus, who then headed the Botany Department of the University of Chicago, brought certain scientific possibilities to the attention of a committee that had been set up by Henry L. Stimson, the Secretary of War, under the National Research Council, to provide the military with advice on various aspects of biological warfare. Kraus, referring to the existence of hormone-like substances that experimentation had shown would kill certain plants or disrupt their growth, suggested to the committee in 1941 that it might be inerested in "the toxic properties of growth-regulating substances for the destruction of crops or the limitation of crop production." Military research on herbicides thereupon got under way, principally at Camp (later Fort) Detrick, Maryland, the Army center for biological-warfare research. According to George Merck, a chemist, who headed Stimson's biological-warfare advisory committee, "Only the rapid ending of the war prevented field trials in an active theatre of synthetic agents that would, without injury to human or animal life, affect the growing crops and make them useless."

After the war, many of the herbicidal materials that had been developed and tested for biological-warfare use were marked for civilian purposes and used by farmers and homeowners for killing weeds and controlling brush. The most powerful of the herbicides were the two chemicals 2,4-dichlorophenoxyacetic acid, generally known as 2,4-D, and 2,4,5-trichlorophenoxyacetic acid, known as 2,4,5-T. The direct toxicity levels of these chemicals as they affected experimental animals, and, by scientific estimates, men, appeared then to be low (although these estimates have later been challenged), and the United States Department of Agriculture, the Food and Drug Administration, and the Fish and Wildlife Service all sanctioned the widespread sale and use of both. The chemicals were also reported to be shortlived in soil after their application. 2,4-D was the bigger seller of the two, partly because it was cheaper, and suburbanites commonly used mixtures containing 2,4-D on their lawns to control dandelions

and other weeds. Commercially, 2,4-D and 2,4,5-T were used to clear railroad rights-of-way and power-line routes, and, in cattle country, to get rid of woody brush, 2,4,5-T being favored for the last, because it was considered to have a more effective herbicidal action on woody plants. Very often, however, the two chemicals were used in combination. Between 1945 and 1963, the production of herbicides jumped from nine hundred and seventeen thousand pounds to about a hundred and fifty million pounds in this country; since 1963, their use has risen two hundred and seventy-one per cent—more than double the rate of increase in the use of pesticides, though pesticides are still far more extensively used. By 1960, an area equivalent to more than three per cent of the entire United States was being sprayed each year with herbicides.

Considering the rapidly growing civilian use of these products, it is perhaps not surprising that the defoliation operations in Vietnam escaped any significant comment in the press, and that the American public remained unaware of the extent to which these uses had their origin in planning for chemical and biological warfare. Nevertheless, between 1941 and the present, testing and experimentation in the use of 2,4-D, 2,4,5-T, and other herbicides as military weapons were going forward very actively at Fort Detrick. While homeowners were using herbicidal mixtures to keep their lawns free of weeds, the military were screening some twelve hundred compounds for their usefulness in biological-warfare operations. The most promising of these compounds were test-sprayed on tropical vegetation in Puerto Rico and Thailand, and by the time full-scale defoliation operations got under way in Vietnam the U.S. military had settled on the use of four herbicidal spray materials there. These went under the names Agent Orange, Agent Purple, Agent White, and Agent Blue—designations derived from color-coded stripes girding the shipping drums of each type of material. Of these materials, Agent Orange, the most widely used as a general defoliant, consists of a fifty-fifty mixture of n butyl esters and of 2,4-D and 2,4,5-T. Agent Purple, which is interchangeable with Agent Orange, consists of the same substances with slight molecular variations. Agent White, which is used mostly for forest defoliation, is a combination of 2,4-D and Picloram, produced by the Dow Chemical Company. Unlike 2,4-D or 2,4,5-T, which, after application, is said to be decomposable by micro-organisms in soil over a period of weeks or months (one field test of 2,4,5-T in this country showed that significant quantities persisted in soil for ninety-three days after application), Picloram—whose use the Department of Agriculture has not authorized in the cultivation of any American crop—is one of the most persistent herbicides known.

Dr. Arthur W. Galston, professor of biology at Yale, has described Picloram as "a herbicidal analog of DDT," and an article in a Dow Chemical Company publication called "Down to Earth" reported that in field trials of Picloram in various California soils between eighty and ninety-six and a half per cent of the substance remained in the soils four hundred and sixty-seven days after application. (The rate at which Picloram decomposes in tropical soils may, however, be higher.) Agent Blue consists of a solution of cacodylic acid, a substance that contains fifty-four per cent arsenic, and it is used in Vietnam to destroy rice crops. According to the authoritative "Merck Index," a source book on chemicals, this material is "poisonous." It can be used on agricultural crops in this country only under certain restrictions imposed by the Department of Agriculture. It is being used herbicidally on Vietnamese rice fields at seven and a half times the concentration permitted for weed-killing purposes in this country, and so far in Vietnam something like five thousand tons is estimated to have been sprayed on paddies and vegetable fields.

Defoliation operations in Vietnam are carried out by a special flight of the 12th Air Commando Squadron of the United States Air Force, from a base at Bien Hoa, just outside Saigon, with specially equipped C-123 cargo planes. Each of these aircraft has been fitted out with tanks capable of holding a thousand gallons. On defoliation missions, the herbicide carried in these tanks is sprayed from an altitude of around a hundred and fifty feet, under pressure, from thirty-six nozzles on the wings and tail of the plane, and usually several spray planes work in formation, laying down broad blankets of spray. The normal crew of a military herbicidal-spray plane consists of a pilot, a co-pilot, and a technician, who sits in the tail area and operates a console regulating the spray. The equipment is calibrated to spray a thousand gallons of herbicidal mixture at a rate that works out, when all goes well, to about three gallons per acre. Spraying a thousand-gallon tankload takes five minutes. In an emergency, the tank can be

emptied in thirty seconds—a fact that has particular significance because of what has recently been learned about the nature of at least one of the herbicidal substances.

The official code name for the program is Operation Hades, but a more friendly code name, Operation Ranch Hand, is commonly used. In similar fashion, military public-relations men refer to the herbicidal spraying of crops supposedly grown for Vietcong use in Vietnam, when they refer to it at all, as a "food-denial program." By contrast, an American biologist who is less than enthusiastic about the effort, has called it, in its current phase, "escalation to a program of starvation of the population in the affected area." Dr. Jean Mayer, the Harvard professor who now is President Nixon's special adviser on nutrition, contended in an article in *Science and Citizen* in 1967 that the ultmate target of herbicidal operations against rice and other crops in Vietnam was "the weakest element of the civilian population"—that is, women, children, and the elderly—because in the sprayed areas "Vietcong soldiers may . . . be expected to get the fighter's share of whatever food there is." He pointed out that malnutrition is endemic in many parts of Southeast Asia but that in wartime South Vietnam, where diseases associated with malnutrition, such as beriberi, anemia, kwashiorkor (the disease that has decimated the Biafran population), and tuberculosis, are particularly widespread, "there can be no doubt that if the [crop-destruction] program is continued, [the] problems will grow."

Whether a particular mission involves defoliation or crop destruction, American military spokesmen insist that a mission never takes place without careful consideration of all the factors involved, including the welfare of friendly inhabitants and the safety of American personnel. (There can be little doubt that defoliation missions are extremely hazardous to the members of the planes' crews, for the planes are required to fly very low and only slightly above stalling speed, and they are often targets of automatic-weapons fire from the ground.) The process of setting up targets and approving specific herbicidal operations is theoretically subject to elaborate review through two parallel chains of command: one chain consisting of South Vietnamese district and province chiefs—who can themselves initiate such missions—and South Vietnamese Army commanders at various levels; the other a United States chain, consisting of a district adviser, a sector adviser, a divisional senior adviser, a corps senior adviser, the United States Military Assistance Command n South Vetnam, and the American Embassy in Saigon, ending up with the American ambassador himself. Positive justification of the military advantage likely to be gained from each operation is theoretically required, and applications without such positive justification are theoretically disapproved. However, according to one of a series of articles by Elizabeth Pond that appeared toward the end of 1967 in the *Christian Science Monitor*:

"In practice, [American] corps advisers find it very difficult to turn down defoliation requests from province level because they simply do not have sufficient specific knowledge to call a proposed operation into question. And with the momentum of six years' use of defoliants, the practice, in the words of one source, has long since been 'set in cement.'

"The real burden of proof has long since shifted from the positive one of justifying an operation by its [military] gains to the negative one of denying an operation because of [specific] drawbacks. There is thus a great deal of pressure, especially above province level, to approve recommendations sent up from below as a matter of course."

Miss Pond reported that American military sources in Saigon were "enthusiastic" about the defoliation program, and that American commanders and spotter-plane pilots were "clamoring for more of the same." She was given firm assurance as to the mild nature of the chemicals used in the spray operations:

"The defoliants used, according to the military spokesman contacted, are the same herbicides . . . as those used commercially over some four million acres in the United States. In the strengths used in Vietnam they are not at all harmful to humans or animals, the spokesman pointed out, and in illustration of this he dabbed onto his tongue a bit of liquid from one of . . . three bottles setting on his desk."

As the apparently inexorable advance of defoliation operations in South Vietnam continued, a number of scientists in the United States began to protest the military use of herbicides, contending that Vietnam was being used, in effect,

as a proving ground for chemical and biological warfare. Early in 1966, a group of twenty-nine scientists, under the leadership of Dr. John Edsall, a professor of biochemistry at Harvard, appealed to President Johnson to prohibit the use of defoliants and crop-destroying herbicides, and called the use of these substances in Vietnam "barbarous because they are indiscriminate." In the late summer of 1966, this protest was followed by a letter of petition to President Johnson from twenty-two scientists, including seven Nobel laureates. The petition pointed out that the "large-scale use of anticrop and 'non-lethal' antipersonnel chemical weapons in Vietnam" constituted "a dangerous precedent" in chemical and biological warfare, and it asked the President to order it stopped. Before the end of that year, Dr. Edsall and Dr. Matthew S. Meselson, a Harvard professor of biology, obtained the signatures of five thousand scientists to co-sponsor the petition. Despite these protests, the area covered by defoliation operations in Vietnam in 1967 was double that covered in 1966, and the acreage of crops destroyed was nearly doubled.

These figures relate only to areas that were sprayed intentionally. There is no known way of spraying an area with herbicides from the air in a really accurate manner, because the material used is so highly volatile, especially under tropical conditions, that even light wind drift can cause extensive damage to foliage and crops outside the deliberately sprayed area. Crops are so sensitive to the herbicidal spray that it can cause damage to fields and gardens as much as fifteen miles away from the target zone. Particularly severe accidental damage is reported, from time to time, to so-called "friendly" crops in the III Corps area, which all but surrounds Saigon and extends in a rough square from the coastline to the Cambodian border. Most of the spraying in III Corps is now done in War Zones C and D, which are classified as free fire zones, where, as one American official has put it, "everything that moves in Zones C and D is considered Charlie." A press dispatch from Saigon in 1967 quoted another American official as saying that every Vietnamese farmer in that corps area knew of the defoliation program and disapproved of it. Dr. Galston, the Yale biologist, who is one of the most persistent critics of American policy concerning herbicidal operations in Vietnam, recently said in an interview, "We know that most of the truck crops grown along roads, canals, and trails and formerly brought into Saigon have been essentially abandoned because of the deliberate or inadvertent falling of these defoliant sprays; many crops in the Saigon area are simply not being harvested." He also cited reports that in some instances in which the inhabitants of Vietnamese villages have been suspected of being Vietcong sympathizers the destruction of food crops has brought about complete abandonment of the villages. In 1965, herbicidal operations caused extensive inadvertent damage, through wind drift, to a very large rubber plantation northwest of Saigon owned by the Michelin rubber interests. As the result of claims made for this damage, the South Vietnamese authorities paid the corporate owners, through the American military, nearly a million dollars.

The extent of the known inadvertent damage to crops in Vietnam can be inferred from the South Vietnamese budget—in reality, the American military budget—for settling such claims. In 1967, the budget for this compensation was three million six hundred thousand dollars. This sum, however, probably reflects only the barest emergency claims of the people affected.

According to Representative Richard D. McCarthy, a Democrat from upstate New York who has been a strong critic of the program, the policy of allowing applications for defoliation operations to flow, usually without question, from the level of the South Vietnamese provincial or district chiefs has meant that these local functionaries would order repeated sprayings of areas that they had not visited in months, or even years. The thought that a Vietnamese district chief can initiate such wholesale spraying, in effect without much likelihood of serious hindrance by American military advisers, is a disquieting one to a number of biologists. Something that disquiets many of them even more is what they believe the long-range effects of nine years of defoliation operations will be on the ecology of South Vietnam. Dr. Galston, testifying recently before a congressional subcommittee on chemical and biological warfare, made these observations:

"It has already been well documented that some kinds of plant associations subject to spray, especially by Agent Orange, containing 2,4-D and 2,4,5-T, have been irreversibly damaged. I refer specifically to the mangrove association that line the estuaries, especially around the Saigon River. Up to a hundred thou-

sand acres of these mangroves have been sprayed. . . . Some [mangrove areas] had been sprayed as early as 1961 and have shown no substantial signs of recovery. . . . Ecologists have known for a long time that the mangroves lining estuaries furnish one of the most important ecological niches for the completion of the life cycle of certain shell-fish and migratory fish. If these plant communities are not in a healthy state, secondary effects on the whole interlocked web of organisms are bound to occur. . . . In the years ahead the Vietnamese, who do not have overabundant sources of proteins anyhow, are probably going to suffer dietarily because of the deprivation of food in the form of fish and shellfish.

Damage to the soil is another possible consequence of extensive defoliation. . . . We know that the soil is not a dead, inert mass but, rather, that it is a vibrant, living community. . . . If you knock the leaves off of trees once, twice, or three times . . . you change the quality of the soil. . . . Certain tropical soils—and it has been estimated that in Vietnam up to fifty per cent of all the soils fall into this category—are laterizable; that is, they may be irreversibly converted to rock as a result of the deprivation of organic matter. . . . If . . . you deprive trees of leaves and photosynthesis stops, organic matter in the soil declines and laterization, the making of brick, may occur on a very extensive scale. I would emphasize that this brick is irreversibly hardened; it can't be made back into soil. . . .

"Another ecological consequence is the invasion of an area by undesirable plants. One of the main plants that invade an area that has been defoliated is bamboo. Bamboo is one of the most difficult of all plants to destroy once it becomes established where you don't want it. It is not amenable to killing by herbicides. Frequently it has to be burned over, and this causes tremendous dislocations to agriculture."

Dr. Fred H. Tschirley, assistant chief of the Crops Protection Research Branch of the Department of Agriculture, who made a month's visit to Vietnam in the spring of 1968 in behalf of the State Department to report on the ecological effects of herbicidal operations there, does not agree with Dr. Galston's view that laterization of the soil is a serious probability. However, he reported to the State Department that in the Rung Sat area, southeast of Saigon, where about a hundred thousand acres of mangrove trees had been sprayed with defoliant, each single application of Agent Orange had killed ninety to a hundred per cent of the mangroves touched by the spray, and he estimated that the regeneration of the mangroves in this area would take another twenty years, at least. Dr. Tschirley agrees with Dr. Galston that a biological danger attending the defoliation of mangroves is an invasion of virtually ineradicable bamboo.

A fairly well-documented example not only of the ecological consequences of defoliation operations but also of their disruptive effects on human life was provided last year by a rubber-plantation area in Kompong Cham Province, Cambodia, which lies just across the border from Vietnam's Tay Ninh Province. On June 2, 1969, the Cambodian government, in an angry diplomatic note to the United States government, charged the United States with major defoliation damage to rubber plantations, and also to farm and garden crops in the province, through herbicidal operations deliberately conducted on Cambodian soil. It demanded compensation of eight and a half million dollars for destruction or serious damage to twenty-four thousand acres of trees and crops. After some delay, the State Department conceded that the alleged damage might be connected with "accidental drift" of spray over the border from herbicidal operations in Tay Ninh Province. The Defense Department flatly denied that the Cambodian areas had been deliberately sprayed. Late in June, the State Department sent a team of four American scientists to Cambodia, and they confirmed the extent of the area of damage that the Cambodians had claimed. They found that although some evidence of spray drift across the Vietnamese border existed, the extent and severity of damage in the area worst affected were such that "it is highly unlikely that this quantity could have drifted over the border from the Tay Ninh defoliation operations." Their report added, "The evidence we have seen, though circumstantial, suggests strongly that damage was caused in direct overflight."

A second report on herbicidal damage to the area was made after an unofficial party of American biologists, including Professor F. W. Pfeiffer, of the University of Montana, and Professor Arthur H. Westing, of Windham College, Vermont, visited Cambodia last December at the invitation of the Cambodian government. They found that about a third of all the rubber trees currently in production in

Cambodia had been damaged, and this had happened in an area that normally had the highest latex yield per acre of any in the world. A high proportion of two varieties of rubber trees in the area had died as a result of the damage, and Dr. Westing estimated that the damage to the latex-producing capacity of some varieties might persist for twenty years. Between May and November of last year, latex production in the affected plantations fell off by an average of between twenty-five and forty per cent. According to a report by the two scientists, "A large variety of garden crops were devastated in the seemingly endless number of small villages scattered throughout the affected area. Virtually all of the . . . local inhabitants . . . depend for their well-being upon their own local produce. These people saw their crops . . . literally wither before their eyes." The Cambodian claim is still pending.

Until the end of last year, the criticism by biologists of the dangers involved in the use of herbicides centered on their use in what were increasingly construed as biological-warfare operations, and on the disruptive effects of these chemicals upon civilian populations and upon the ecology of the regions in which they were used. Last year, however, certain biologists began to raise serious questions on another score—possible direct hazards to life from 2,4,5-T. On October 29th, as a result of these questions, a statement was publicly issued by Dr. Lee DuBridge, President Nixon's science adviser. In summary, the statement said that because a laboratory study of mice and rats that had been given relatively high oral doses of 2,4,5-T in early stages of pregnancy "showed a higher than expected number of deformities" in the offspring, the government would, as a precautionary measure, undertake a series of coordinated actions to restrict the use of 2,4,5-T in both domestic civilian applications and military herbicidal operations. The DuBridge statement identified the laboratory study as having been made by an organization called the Bionetics Research Laboratories, in Bethesda, Maryland, but gave no details of either the findings or the data on which they were based. This absence of specific information turned out to be characteristic of what has been made available to the public concerning this particular research project. From the beginning, it seems, there was an extraordinary reluctance to discuss details of the purported ill effects of 2,4,5-T on animals. Six weeks after the publication of the DuBridge statement, a journalist who was attempting to obtain a copy of the full report made by Bionetics and to discuss its detail with some of the government officials concerned encountered hard going.

At the Bionetics Laboratories, an official said that he couldn't talk about the study, because "we're under wraps to the National Institutes of Health"—the government agency that commissioned the study. Then, having been asked what the specific doses of 2,4,5-T were that were said to have increased birth defects in the fetuses of experimental animals, the Bionetics official cut off discussion by saying, "You're asking sophisticated quetsions that as a layman you don't have the equipment to understand the answers to." At the National Institutes of Health, an official who was asked for details of or a copy of the study on 2,4,5-T replied, "The position I'm in is that I have been requested not to distribute this information." He did say, however, that a continuing evaluation of the study was under way at the National Institute of Environmental Health Sciences, at Research Triangle Park, North Carolina. A telephone call to an officer of this organization brought a response whose tone varied from wariness to downright hostility and made it clear that the official had no intention of discussing details or results of the study with the press.

The Bionetics study on 2,4,5-T was part of a series carried out under contract to the National Cancer Institute, which is an arm of the National Institutes of Health, to investigate more than two hundred compounds, most of them pesticides, in order to determine whether they induced cancer-causing changes, fetus-deforming changes, or mutation-causing changes in experimental animals. The contract was a large one, involving more than two and a half million dollars' worth of research, and its primary purpose was to screen out suspicious-looking substances for further study. The first visible fruits of the Bionetics research were presented in March of last year before a convention of the American Association for the Advancement of Science, in the form of a study of possible carcinogenic properties of the fifty-three compounds; the findings on 2,4,5-T were that it did not appear to cause carcinogenic changes in the animals studied.

By the time the report on the carcinogenic properties of the substances was presented, the results of another part of the Bionetics studies, concerning the

teratogenic, or fetus-deforming, properties of the substances, were being compiled, but these results were not immediately made available to biologists outside the government. The data remained—somewhat frustratingly, in the view of some scientists who had been most curious about the effects of herbicides—out of sight, and a number of attempts by biologists who had heard about the teratological study of 2,4,5-T to get at its findings appear to have been thwarted by the authorities involved. Upon being asked to account for the apparent delay in making this information available to biologists, an official of the National Institute of Environmental Health Sciences (another branch of the National Institutes of Health) has declared, with some heat, that the results of the study itself and of a statistical summary of the findings prepared by the Institute were in fact passed on as they were completed to the Commission on Pesticides and Their Relationship to Environmental Health, a scientific group appointed by Secretary of Health, Education, and Welfare Robert Finch and known—after its chairman, Dr. E. M. Mrak, of the University of California—as the Mrak Commission. Dr. Samuel E. Epstein, chief of the Laboratories of Environmental Toxicology and Carcinogenesis at the Children's Cancer Research Foundation in Boston, who was co-chairman of the Mrak Commission panel considering the teratogenic potential of pesticides, tells a different story on the availability of the Bionetics study. He says that he first heard about it in February. At a meeting of his panel in August he asked for a copy of the report. Ten days later, the panel was told that the National Institute of Environmental Health Sciences would be willing to provide a statistical summary but that the group could not have access to the full report on which the summary was based. Dr. Epstein says that the panel eventually got the full report on September 24th "by pulling teeth."

Actually, as far back as February, officials at the National Cancer Institute had known, on the basis of a preliminary written outline from Bionetics, the findings of the Bionetics scientists on the fetus-deforming role of 2,4,5-T. Dr. Richard Bates, the officer of the National Institutes of Health who was in charge of coordinating the Bionetics project, has said that during the same month this information was put into the hands of officials of the Food and Drug Administration, the Department of Agriculture, and the Department of Defense. "We had a meeting with a couple of scientists from Fort Detrick, and we informed them of what we had learned," Dr. Bates said recently. "I don't know whether they were the right people for us to see. We didn't hear from them again until after the DuBridge announcement at the White House. Then they called up and asked for a copy of the Bionetics report."

At the Department of Agriculture, which Dr. Bates said had been informed in February of the preliminary Bionetics findings, Dr. Tschirley, one of the officials most intimately concerned with the permissible uses of herbicidal compounds, says that he first heard about the report on 2,4,5-T through the DuBridge announcement. At the Food and Drug Administration, where appropriate officials had been informed in February of the teratogenic potential of 2,4,5-T, no new action was taken to safeguard the public against 2,4,5-T in foodstuffs. In fact, it appears that no action at all was taken by the Food and Drug Administration on the matter during the whole of last year. The explanation that F.D.A. officials have offered for this inaction is that they were under instructions to leave the whole question alone at least until December, because the matter was under definitive study by the Mrak Commission—the very group whose members, as it turns out, had such extraordinary difficulty in obtaining the Bionetics data. The Food Toxicology Branch of the F.D.A. did not have access to the full Bionetics report on 2,4,5-T until after Dr. DuBridge issued his statement, at the end of October.

Thus, after the first word went to various agencies about the fetus-deforming potential of 2,4,5-T, and warning lights could have flashed on in every branch of the government and in the headquarters of every company manufacturing or handling it, literally almost nothing was done by the officials charged with protecting the public from exposure to dangerous or potentially dangerous materials—by the officials in the F.D.A., in the Department of Agriculture, and in the Department of Defense. It is conceivable that the Bionetics findings might still be hidden from the public if they had not been pried loose in midsummer through the activities of a group of young law students. The students were members of a team put together by the consumer-protection activist Ralph Nader—and often referred to as Nader's Raiders—to explore the labyrinthine

workings of the Food and Drug Administration. In the course of their investigations, one of the law students, a young woman named Anita Johnson, happened to see a copy of the preliminary report on the Bionetics findings that had been passed on to the F.D.A. in February, and its observations seemed quite disturbing to her. Miss Johnson wrote a report to Nader, and in September she showed a copy of the report to a friend who was a biology student at Harvard. In early October, Miss Johnson's friend, in a conversation with Professor Matthew Meselson, mentioned Miss Johnson's report on the preliminary Bionetics findings. This was the first that Dr. Meselson had heard of the existence of the Bionetics study. A few days previously, he had received a call from a scientist friend of his asking whether Dr. Meselson had heard of certain stories, originating with South Vietnamese journalists and other South Vietnamese, of an unusual incidence of birth defects in South Vietnam, which were alleged to be connected with defoliation operations there.

A few days later, after his friend sent him further information, Dr. Meselson decided to obtain a copy of the Bionetics report, and he called up an acquaintance in a government agency and asked for it. He was told that the report was "confidential and classified," and inaccessible to outsiders. Actually, in addition to the preliminary report there were now in existence the full Bionetics report and a statistical summary prepared by the National Institute of Environmental Health Sciences, and, by nagging various Washington friends, Dr. Meselson obtained bootlegged copies of the two latest reports. What he read seemed to him to have such serious implications that he got in touch wih acquaintances in the White House and also with someone in the Army to alert them to the problems of 2,4,5-T, in the hope that some new restrictions would be placed on its use. According to Dr. Meselson, the White House people apparently didn't know until that moment that the reports on the adverse effecs of 2,4,5-T even existed. (Around that time, according to a member of Nader's Raiders, "a tremendous lid was put on this thing" within government agencies, and on the subject of the Bionetics work and 2,4,5-T "people in government whom we'd been talking to freely for years just shut up and wouldn't say a word.") While Dr. Meselson awaited word on the matter, a colleague of his informed the press about the findings of the Bionetics report. Very shortly thereafter, Dr. DuBridge made his public announcement of the proposed restrictions on the use 2,4,5-T.

In certain respects, the DuBridge announcement is a curious document. In its approach to the facts about 2,4,5-T that were set forth in the Bionetics report, it reflects considerable sensitivity to the political and international issues that lie behind the widespread use of this powerful herbicide for civilian and military purposes, and the words in which it describes the reasons for restricting its use appear to have been very carefully chosen:

"The actions to control the use of the chemical were taken as a result of findings from a laboratory study conducted by Bionetics Research Laboratories which indicated that offspring of mice and rats given relatively large oral doses of the herbicide during early stages of pregnancy showed a higher than expected number of deformities.

"Although it seems improbable that any person could receive harmful amounts of this chemical from any of the existing uses of 2,4,5-T, and while the relationships of these effects in laboratory animals to effects in man are not entirely clear at this time, the actions taken will assure safety of the public while further evidence is being sought."

These actions, according to the statement, included decisions that the Department of Agriculture would cancel manufacturers' registrations of 2,4,5-T for use on food crops, effective at the beginning of 1970, "unless by that time the Food and Drug Administration has found a basis for establishing a safe legal tolerance in and on foods," and that the Departments of Agriculture and the Interior, in their own programs, would stop the use of 2,4,5-T in populated areas and in all other areas where residues of the substance could reach man. As for military uses of 2,4,5-T, the statement said, "The chemical is effective in defoliating trees and shrubs and its use in South Vietnam has resulted in reducing greatly the number of ambushes, thus saving lives." However, the statement continued, "the Department of Defense will [henceforth] restrict the use of 2,4,5-T to areas remote from the population."

All this sounds eminently fair and sensible, but whether it represents a candid exposition of the facts about 2,4,5-T and the Bionetics report is debatable. The White House statement that the Bionetics findings "indicated that offspring of

mice and rats given relatively large oral doses of the herbicide during early stages of pregnancy showed a higher than expected number of deformities" is, in the words of one eminent biologist who has studied the Bionetics data, "an understatement." He went on to say that "if the effects on experimental animals are applicable to people it's a very sad and serious situation." The actual Bionetics report described 2,4,5-T as producing "sufficiently prominent effects of seriously hazardous nature" in controlled experiments with pregnant mice to lead the authors "to categorize [it] as *probably dangerous*." The report also found 2,4-D "potentially dangerous but needing further study." As for 2,4,5-T, the report noted that, with the exception of very small subcutaneous dosages, "all dosages, routes, and strains resulted in increased incidence of abnormal fetuses" after its administration. The abnormalities in the fetuses included lack of eyes, faulty eyes, cystic kidneys, cleft palates, and enlarged livers. The Bionetics report went on to report on further experimental applications of 2,4,5-T to another species:

"Because of the potential importance of the findings in mice, an additional study was carried out in rats of the Sprague-Dawley strain. Using dosages of 21.5 and 46.4 mg/kg [that is, dosages scaled to represent 21.5 and 46.4 milligrams of 2,4,5-T per kilogram of the experimental animal's body weight] suspended in 50 per cent honey and given by the oral route on the 6th through 15th days of gestation, we observed excessive fetal mortality (almost 80 per cent) and a high incidence of abnormalities in the survivors. When the beginning of administration was delayed until the 10th day, fetal mortality was somewhat less but still quite high even when dosage was reduced to 4.6 mg/kg. The incidence of abnormal fetuses was threefold that in controls even with the smallest dosage and shortest period used. . . .

"It seems inescapable that 2,4,5-T is teratogenic in this strain of rats when given orally at the dosage schedules used here."

Considering the fetus-deforming effects of the *lowest* oral dosage of 2,4,5-T used in the Bionetics work on rats—to say nothing of the excessive fetal mortality—the White House statement that "relatively large oral doses of the herbicide . . . showed a higher than expected number of deformities" is hardly an accurate description of the results of the study. In fact, the statistical tables presented as part of the Bionetics report showed that at the lowest oral dosage of 2,4,5-T given to pregnant rats between the tenth and fifteenth days of gestation thirty-nine per cent of the fetuses produced were abnormal, or three times the figure for control animals. At what could without much question be described as "relatively large oral doses" of the herbicide—dosages of 21.5 and 46.4 milligrams per kilogram of body weight of rats, for example—the percentage of abnormal fetuses was ninety and a hundred per cent, respectively, or a good bit higher than one would be likely to deduce from the phrase "a higher than expected number of deformities." The assertion that "it seems improbable that any person could receive harmful amounts of this chemical from any of the existing uses of 2,4,5-T" also appears to be worth examining, for this is precisely what many biologists are most worried about in relation to 2,4,5-T and allied substances.

It seems fair, before going further, to quote a cautionary note in the DuBridge statement: "The study involved relatively small numbers of laboratory rats and mice. More extensive studies are needed and will be undertaken. At best it is difficult to extrapolate results obtained with laboratory animals to man—sensitivity to a given compound may be different in a man than in animal species. . . ." It would be difficult to get a biologist to disagree with these seemingly sound generalities. However, the first part of the statement does imply, at least to a layman, that the number of experimental animals used in the Bionetics study had been considerably smaller than the numbers used to test commercial compounds other than 2,4,5-T before they are approved by agencies such as the Food and Drug Administration and the Department of Agriculture. In this connection, the curious layman could reasonably begin with the recommendations, in 1963, of the President's Science Advisory Committee on the use of pesticides, which proposed that companies putting out pesticides should be required from then on to demonstrate the safety of their products by means of toxicity studies on two generations of at least two warm-blooded mammalian species. Subsequently, the F.D.A. set up new testing requirements, based on these recommendations, for companies producing pesticides. However, according to Dr. Joseph McLaughlin, of the Food Toxicology Branch of the F.D.A., the

organization actually requires applicants for permission to sell pesticides to present the results of tests on only *one* species (usually, in practice, the rat). According to Dr. McLaughlin, the average number of experimental animals used in studies of pesticides is between eighty and a hundred and sixty, including animals used as controls but excluding litters produced. The Bionetics studies of 2,4,5-T used both mice and rats, and their total number was, in fact, greater, not less, than this average. Including controls but excluding litters, the total number of animals used in the 2,4,5-T studies was two hundred and twenty-five. Analysis of the results by the National Institute of Environmental Health Sciences found them statistically "significant," and this is the real purpose of such a study: it is meant to act as a coarse screen to shake out of the data the larger lumps of bad news. Such a study is usually incapable of shaking out anything smaller; another kind of study is needed to do that.

Thus, the DuBridge statement seems to give rise to this question: If the Bionetics study, based on the effects of 2,4,5-T on two hundred and twenty-five experimental animals of two species, appears to be less than conclusive, on the ground that "the study involved relatively small numbers of laboratory rats and mice," what is one to think of the adequacy of the tests that the manufacturers of pesticides make? If, as the DuBridge statement says, "at best it is difficult to extrapolate results obtained with laboratory animals to man," what is one to say of the protection that the government affords the consumer when the results of tests of pesticidal substances on perhaps a hundred and twenty *rats are officially extrapolated to justify* the use of the substances by a population of two hundred million people—not to mention one to two million unborn babies being carried in their mothers' wombs?

The very coarseness of the screen used in all these tests—that is, the relatively small number of animals involved—means that the bad news that shows up in the data has to be taken with particular seriousness, because lesser effects tend not to be demonstrable at all. The inadequacy of the scale on which animal tests with, for instance, pesticides are currently being made in this country to gain F.D.A. approval is further indicated by the fact that a fetus-deforming effect that might show up if a thousand test animals were used is almost never picked up, since the studies are not conducted on that scale; yet if the material being tested turned out to have the same effect, quantitatively, on human beings, this would mean that it would cause between three and four thousand malformed babies to be produced each year. The teratogenic effects of 2,4,5-T on experimental animals used by the Bionetics people, however, were not on the order of one in a thousand. Even in the case of the lowest oral dose given rats, they were on the order of one in three.

Again, it fair to say that what is applicable to rats in such tests may not be applicable to human beings. But it is also fair to say that studies *involving rats are conducted not for the welfare of the rat kingdom but for the ultimate protection of human beings.* In the opinion of Dr. Epstein, the fact that the 2,4,5-T used in the Bionetics study produced teratogenic effects in *both* mice and rats underlines the seriousness of the study's implications. In the opinion of Dr. McLaughlin, this is even further underlined by another circumstance—that the rat, as a test animal, tends to be relatively resistant to tetratogenic effects of chemicals. For example, in the late nineteen-fifties, when thalidomide, that disastrously teratogenic compound, was being tested on rats in oral dosages ranging from low to very high, no discernible fetus-deforming effects were produced. And Dr. McLaughlin says that as far as thalidomide tests *on* rabbits were concerned, "You could give thalidomide to rabbits in oral doses at between fifty and two hundred times the comparable human level to show any comparable teratogenic effects." In babies born to women who took thalidomide, whether in small or large dosages and whether in single or multiple dosages, between the sixth and seventh weeks of pregnancy, the rate of deformation was estimated to be one in ten.

Because of the relatively coarse testing screen through which compounds like pesticides—and food additives as well—are sifted before they are approved for general or specialized use in this country, the Food and Drug Administration theoretically maintains a policy of stipulating, as a safety factor, that the maximum amount of such a substance allowable in the human diet range from one two-thousandth to one one-hundredth of the highest dosage level of the substance that produces no harmful effects in experimental animals. (In the case of pesticides, the World Health Organization takes a more conservative view,

considering one two-thousandth of the "no-effect" level in animal studies to be a reasonable safety level for human exposure.) According to the standards of safety established by F.D.A. policy, then, no human being anywhere should ever have been exposed to 2,4,5-T, because in the Bionetics study of rats *every* dosage level produced deformed fetuses. A "no-effect" level was never achieved.

To make a reasonable guess about the general safety of 2,4,5-T for human beings, as the material has been used up to now, the most appropriate population area to observe is probably not the relatively healthy and well-fed United States, where human beings are perhaps better equipped to withstand the assault of toxic substances, but South Vietnam, where great numbers of civilians are half-starved, ravaged by disease, and racked by the innumerable horrors of war. In considering any potentially harmful effects of 2,4,5-T on human beings in Vietnam, some attempt has to be made to estimate the amount of 2,4,5-T to which people, and particularly pregnant women, may have been exposed as a result of the repeated defoliation operations. To do so, a comparison of known rates of application of 2,4,5-T in the United States and in Vietnam is in order. In this country, according to Dr. Tschirley, the average recommended application of 2,4,5-T in aerial spraying for woody-plant control is between three-quarters of a pound and a pound per acre. There are about five manufacturers of 2,4,5-T in this country, of which the Dow Chemical Company is one of the biggest. One of Dow Chemical's best-sellers in the 2,4,5-T line is Esteron 245 Concentrate, and the cautionary notes that a drum of Esterone bears on its label are hardly reassuring to anyone lulled by prior allegations that 2,4,5-T is a substance of low toxicity:

CAUTION—MAY CAUSE SKIN IRRITATION
Avoid Contact with Eyes, Skin, and Clothing
Keep out of the reach of children

Under the word "WARNING" are a number of instructions concerning safe use of the material, and these include, presumably for good reason, the following admonition:

"Do not contaminate irrigation ditches or water used for domestic purposes."

Then comes a "notice":

"Seller makes no warranty of any kind, express or implied, concerning the use of this product. Buyer assumes all risk of use or handling, whether in accordance with directions or not."

The concentration of Esteron recommended—subject to all these warnings, cautions, and disclaimers—for aerial spraying in the United States varies with the type of vegetation to be sprayed, but probably a fair average would be three-quarters to one pound acid equivalent of the raw 2,4,5-T per acre. In Vietnam, however, the concentration of 2,4,5-T for each acre sprayed has been far higher. In Agent Orange, the concentrations of 2,4,5-T have averaged *thirteen times* the recommended concentrations used in the United States. The principal route through which quantities of 2,4,5-T might be expected to enter the human system in Vietnam is through drinking water, and in the areas sprayed most drinking water comes either from rainwater cisterns fed from house roofs or from very shallow wells. It has been calculated that, taking into account the average amount of 2,4,5-T in Agent Orange sprayed per acre in Vietnam by the military, and assuming a one-inch rainfall (which is quite common in South Vietnam) after a spraying, a forty-kilo (about eighty-eight-pound) Vietnamese woman drinking two litres (about 1.8 quarts) of contaminated water a day could very well be absorbing into her system a hundred and twenty milligrams, or about one two-hundred-and-fiftieth of an ounce, of 2,4,5-T a day; that is, a daily oral dosage of three milligrams of 2,4,5-T per kilo of body weight. Thus, if a Vietnamese woman who was exposed to Agent Orange was pregnant, she might very well be absorbing into her system a percentage of 2,4,5-T only slightly less than the percentage that deformed one out of every three fetuses of the pregnant experimental rats. To pursue further the question of exposure of Vietnamese to 2,4,5-T concentrations in relation to concentrations officially considered safe for Americans, an advisory subcommittee to the Secretary of the Interior, in setting up guidelines for maximum safe contamination of surface water by pesticides and allied substances some time ago, recommended a concentration of one-tenth of a milligram of 2,4,5-T in one litre of drinking water as the maximum safe concentration. Thus, a pregnant Vietnamese woman who ingested a hundred and twenty milligrams of 2,4,5-T in two litres of water a day would be exposed to 2,4,5-T at six hundred times the concentration officially considered safe for Americans.

Moreover, the level of exposure of Vietnamese people in sprayed areas is not necessarily limited to the concentrations shown in Dr. Meselson's calculations. Sometimes the level may be far higher. Dr. Pfeiffer, the University of Montana biologist, says that when difficulties arise with the spray planes or the spray apparatus, or when other accidents occur, an entire thousand-gallon load of herbicidal agent containing 2,4,5-T may be dumped in one area by means of the thirty-second emergency-dumping procedure. Dr. Pfeiffer has recalled going along as an observer on a United States defoliation mission last March, over the Plain of Reeds area of Vietnam, near the Cambodian border, during which the technician at the spray controls was unable to get the apparatus to work, and thereupon dumped his whole load. "This rained down a dose of 2,4,5-T that must have been fantastically concentrated," Dr. Pfeiffer has said, "It was released on a very watery spot that looked like headwaters draining into the Mekong River, which hundreds of thousands of people use." In another instance, he has recalled, a pilot going over the area of the supposedly "friendly" Catholic refugee village of Ho Nai, near Bien Hoa, had serious engine trouble and dumped his whole spray load of herbicide on or near the village. In such instances, the concentration of 2,4,5-T dumped upon an inhabited area in Vietnam probably averaged about a hundred and thirty times the concentration recommended by 2,4,5-T manufacturers as both effective and safe for use in the United States.

Theoretically, the dangers inherent in the use of 2,4,5-T should have been removed by means of the steps promised in the White House announcement last October. A quick reading of the statement by Dr. DuBridge (who is also the executive secretary of the President's Environmental Quality Council) certainly seemed to convey the impression that from that day onward there would be a change in Department of Defense policy on the use of 2,4,5-T in Vietnam, just as there would be a change in the policies of the Departments of Agriculture and the Interior on the domestic use of 2,4,5-T. But did the White House mean what it certainly seemed to be saying about the future military use of 2,4,5-T in Vietnam? The White House statement was issued on October 29th. On October 30th, the Pentagon announced that no change would be made in the policy governing the military use of 2,4,5-T in South Vietnam, because—so the Washington *Post* reported on October 31st—"the Defense Department feels its present policy conforms to the new Presidential directive." The *Post* article went on:

"A Pentagon spokesman's explanation of the policy, read at a morning press briefing, differed markedly from the written version given reporters later.

"When the written statement was distributed, reporters were told not to use *the spokesman's [previous] comment that the defoliant . . . is used against enemy* 'training and regroupment centers.'

"The statement was expunged after a reporter asked how use against such centers conformed to the Defense Department's stated policy of prohibiting its use in 'populated areas.'"

But the statement wasn't so easily expunged. A short time later, it was made again, in essence, by Rear Admiral William F. Lemos, of the Policy Plans and National Security Council Affairs Office of the Department of Defense, in testimony before a subcommittee of the House Foreign Affairs Committee, the only difference being that the phrase "training and regroupment centers" became "enemy base camps." And in testifying that the military was mounting herbicidal operations on alleged enemy base camps Rear Admiral Lemos said:

"We know . . . that the enemy will move from areas that have been sprayed. Therefore, enemy base camps or unit headquarters are sprayed in order to make him move to avoid exposing himself to aerial observation."

If one adds to the words "enemy base camps" the expunged words "training and regroupment centers"—centers that are unlikely to operate without an accompanying civilian population—what the Defense Department seems actually to be indicating is that the "areas remote from the population" against which the United States is conducting military herbicidal operations are "remote from the population" at least in part *because* of these operations.

As for the Bionetics findings on the teratogenic effects of 2,4,5-T on experimental animals, the Department of Defense indicated that it put little stock in the dangers suggested by the report. A reporter for the *Yale Daily News* who telephoned the Pentagon during the first week in December to inquire about the Defense Department's attitude toward its use of 2,4,5-T in the light of the Bionetics report was assured that "there is no cause for alarm about defoliants." A week or so later, he received a letter from the Directorate for Defense Information at the Pentagon which described the Bionetics results as based on "evidence

that 2,4,5-T, when fed in large amounts to highly inbred and susceptible mice and rats, gave a higher incidence of birth defects than was normal for these animals." After reading this letter, the *Yale Daily News* reporter again telephoned the Pentagon, and asked, "Does [the Department of Defense] think defoliants could be affecting embryo growth in any way in Vietnam?" The Pentagon spokesman said, "No." And that was that. The experimental animals were highly susceptible; the civilian Vietnamese population, which even under "normal" circumstances is the victim of a statistically incalculable but clearly very high abortion and infant-mortality rate, was not.

Nearly a month after Dr. DuBridge's statement, another was issued, this one by the President himself, on United States policy on chemical and biological warfare. The President, noting that "biological weapons have massive, unpredictable, and potentially uncontrollable consequences" that might "impair the health of future generations," announced it as his decision that thenceforward "the United States shall renounce the use of lethal biological agents and weapons and all other methods of biological warfare." Later, a White House spokesman, in answer to questions by reporters whether this included the use of herbicidal, defoliant, or crop-killing chemicals in Vietnam, made it clear that the new policy did not encompass herbicides.

Since the President's statement did specifically renounce "all other methods of biological warfare," the reasonable assumption is that the United States government does not consider herbicidal, defoliant, and crop-killing operations against military and civilian populations to be part of biological warfare. The question therefore remains: What does the United States government consider biological warfare to consist of? The best place to look for an authoritative definition is a work known as the Joint Chiefs of Staff Dictionary, an official publication that governs proper word usage within the military establishment. In the current edition of the Joint Chiefs of Staff Dictionary, "biological warfare" is defined as the "employment of living organisms, toxic biological products, and plant-growth regulators to produce death or casualties in man, animals, or plants or defense against such action." But the term "plant-growth regulators" is nowhere defined in the Joint Chiefs of Staff Dictionary, and since a certain technical distinction might be made (by weed-control scientists, for example) between plant-growth regulators and defoliants, the question of whether the Joint Chiefs consider military defoliation operations part of biological warfare is left unclear. As for "defoliant agents," the Dictionary defines such an agent only as "a chemical which causes trees, shrubs, and other plants to shed their leaves prematurely." All this is hardly a surprise to anyone familiar with the fast semantic legerdemain involved in all official statements on biological warfare, in which defoliation has the bafflingly evanescent half-existence of a pea under a shell.

To find that pea in the official literature is not easy. But it is reasonable to assume that if the Department of Defense were to concede officially that "defoliant agents" were in the same category as "plant-growth regulators" that "produce death . . . in plants," it would thereby also be conceding that it is in fact engaging in the biological warfare that President Nixon has renounced. And such a concession seems to have been run to earth in the current edition of a Department of the Army publication entitled "Manual on Use of Herbicides for Military Purposes," in which "antiplant agents" are defined as "chemical agents which possess a high offensive potential for destroying or seriously limiting the production of food and defoliating vegetation," and goes on, "These compounds include herbicides that kill or inhibit the growth of plants; plant-growth regulators that either regulate or inhibit plant growth, sometimes causing plant death. . . ." The admission that the Department of Defense is indeed engaging, through its defoliation and herbicidal operations in Vietnam, in biological warfare, as this is defined by the Joint Chiefs and as it has been formally renounced by the President, seems inescapable.

Since the DuBridge statement, allegations, apparently originating in part with the Dow Chemical Company, have been made to the effect that the 2,4,5-T used in the Bionetics study was unrepresentative of the 2,4,5-T generally produced in this country, in that it contained comparatively large amounts of a certain contaminant, which, according to the Dow people, is ordinarily present in 2,4,5-T only in trace quantities. Accordingly, it has been suggested that the real cause of the teratogenic effects of the 2,4,5-T used in the Bionetics study may not have been the 2,4,5-T itself but, rather, the contaminant in the sample used. The chemical name of the contaminant thus suspected by the Dow people

is 2,3,6,7-tetrachlorodibenzo-*p*-dioxin, often referred to simply as dioxin. The 2,4,5-T used by Bionetics was obtained in 1965 from the Diamond Alkali Company, now known as the Diamond-Shamrock Company and no longer in the business of manufacturing 2,4,5-T. It appears that the presence of a dioxin contaminant in the process of manufacturing 2,4,5-T is a constant problem among all manufacturers.

Three years ago, Dow was obliged to close down its 2,4,5-T plant in Midland, Michigan, for several months and partly rebuild it because of what Dow people variously described as " a problem" and "an accident." The problem—or accident—was that workers exposed to the dioxin contaminant during the process of manufacturer came down with an acute skin irritation known as chlor-acne. The Dow people, who speak with considerable pride of their toxicological work ("We established our toxicology lab the year Ralph Nader was born," a Dow public-relations man said recently, showing, at any rate, that Dow is keenly aware of Nader and his career), say that the chlor-acne problem has long since been cleared up, and that the current level of the dioxin contaminant in Dow's 2,4,5-T is less than one part per million, as opposed to the dioxin level in the 2,4,5-T used in the Bionetics study, which is alleged to have been between fifteen and thirty parts per million. A scientist at the DuBridge office, which has become a coördinating agency for information having to do with the 2,4,5-T question, says that the 2,4,5-T used by Bionetics was "probably representative" of 2,4,5-T being used in this country—and presumably in Vietnam—at the time is was obtained but that considerably less of the contaminant is present in the 2,4,5-T now being produced. Evidently, the degree of dioxin contamination present in 2,4,5-T varies from manufacturer to manufacturer. What degree of contamination, high or low, was present in the quantities of 2,4,5-T shipped to South Vietnam at various times this spokesman didn't seem to know.

The point about the dioxin contamination of 2,4,5-T is an extremely important one, because if the suspicions of the Dow people are correct and the cause of the fetus deformities cited in the Bionetics study is not the 2,4,5-T but the dioxin contaminant, then this contaminant may be among the most teratogenically powerful agents ever known. Dr. McLaughlin has calculated that if the dioxin present in the Bionetics 2,4,5-T was indeed responsible for the teratogenic effects on the experimental animals, it looks as though the contaminant would have to be at least ten thousand times more teratogenically active in rats than thalidomide was found to be in rabbits. Furtherfore, it raises alarming questions about the prevalence of the dioxin material in our environment. It appears that under high heat the dioxin material can be produced in a whole class of chemical substances known as trichlorophenols and pentachlorophenols. These substances include components of certain fatty acids used in detergents and in animal feed.

As a consequence of studies that have been made of the deaths of millions of young chicks in this country after the chicks had eaten certain kinds of chicken feed, government scientists are now seriously speculating on the possibility that the deaths were at the end of a chain that began with the spraying of corn crops with 2,4,5-T. The hypothesis is that residues of dioxin present in the 2,4,5-T remained in the harvested corn and were concentrated into certain byproducts that were then sold to manufacturers of chicken feed, and that the dioxin became absorbed into the systems of the young chicks. One particularly disquieting sign of the potential of the dioxin material is the fact that bio-assays made on chick embryos in another study revealed that all the embroyos were killed by one twenty-millionth of a gram of dioxin per egg.

Perhaps an even more disquieting speculation about the dioxin is that 2,4,5-T may not be the only material in which it appears. Among the compounds that several experienced biologists and toxicologists suspect might contain or produce dioxin are the trichlorophenols and pentachlorophenols, which are rather widely present in the environment in various forms. For example, a number of the trichlorophenols and pentachlorophenols are used as slime-killing agents in paper-pulp manufacture, and are present in a wide range of consumer products, including adhesives, water-based and oil-based paints, varnishes and lacquers, and paper and paper coatings. They are used to prevent slime in pasteurizers and fungus on vats in breweries and are also used in hair shampoo. Along with the 2,4,5-T used inthe Bionetics study ,one trichlorophenol and one pentachlorophenol were tested without teratogenic results. But Dr. McLaughlin points out that since there are many such compounds put out by various companies, these particular samples might turn out to be—by the reasoning of the allegation that the 2,4,5-T used by Bionetics was unusually dirty—unusually clean.

Dr. McLaughlin tends to consider significant, in view of the now known extreme toxicity and possible extreme teratogenicity of dioxin, the existence of even very small amounts of the trichlorophenols and pentachlorophenols in food wrappings and other consumer products. Since the production of dioxin appears to be associated with high-temperature conditions, a question arises whether these thermal conditions are met at *any* stage of production or subsequent use or disposal of such materials, even in minute amounts. One of the problems here seems to be, as Dr. Epstein has put it, "The moment you introduce something into the environment it's likely to be burned sooner or later—that's the way we get rid of nearly everything." And most of these consumer products may wind up in municipal incinerators, and when they are burned, the thermal and other conditions for creating dioxin materials may quite possibly be met. If so, this could mean a release of dioxin material into the entire environment through the atmosphere.

Yet so far the dioxin material now suspected of causing the fetus-deforming effects in experimental animals has never been put through any formal teratological tests by any company or any government agency. If the speculation over the connection between dioxin in 2,4,5-T and the deaths of millions of baby chicks is borne out, it might mean that, quite contrary to the assumptions made up to now that 2,4,5-T is rapidly decomposable in soil, the dioxin material may be extremely persistent as well as extremely deadly.

So far, nobody knows—and it is probable that nobody will know for some time—whether the fetus deformities in the Bionetics study were caused by the 2,4,5-T itself, by the dioxin contaminant, or by some other substance, or substances present in the 2,4,5-T, or whether human fetuses react to 2,4,5-T in the same way as the fetuses of the experimental animals in the Bionetics study. However, the experience so far with the employment of 2,4,5-T and substances chemically allied to it ought to be instructive. The history of 2,4,5-T is related to preparation for biological warfare, although nobody in the United States government seems to want to admit this, and it has wound up being used for purposes of biological warfare, although nobody in the United States government seems to want to admit *this*, either. Since 2,4,5-T was developed, the United States government has allowed it to be used on a very large scale on our own fields and countryside without adequate tests of its effects. In South Vietnam—a nation we are attempting to save—for seven full years the American military has sprayed or dumped this biological-warfare material on the countryside, on villages, and on South Vietnamese *men* and *women* in staggering amounts. In that time, the military has sprayed or dumped on Vietnam *fifty thousand tons* of herbicide, of which twenty thousand tons have apparently been straight 2,4,5-T. In addition the American military has apparently made incursions into a neutral country, Cambodia, and rained down on an area inhabited by thirty thousand civilians a vast quantity of 2,4,5-T. Yet in the quarter of a century since the Department of Defense first developed the biological-warfare uses of this material it has not completed a single series of formal teratological tests on pregnant animals to determine whether it has an effect on their unborn offspring.

Similarly, officials of the Dow Chemical Company, one of the largest producers of 2,4,5-T, although they refuse to divulge how much 2,4,5-T they are and have been producing, admit that in all the years that they had produced the chemical before the DuBridge statement they had never made formal teratological tests on their 2,4,5-T, which they are now doing. The Monsanto Chemical Company, another big producer, had, as far as is known, never made such tests, either, nor, according to an official in the White House, had any other manufacturer. The Department of Agriculture has never required any such tests from manufacturers. The Food and Drug Administration has never required any such tests from manufacturers. The first tests to determine the teratogenic effects of 2,4,5-T were not made until the National Institutes of Health contracted for them with Bionetics Laboratories. And even then, when the adverse results of the tests became apparent, it was, as Dr. Epstein said, like "pulling teeth" to get the *data* out of the institutions involved. And when the data were obtained and the White House was obliged, partly by outside pressure and publicity, to act, the President's science adviser publicly presented the facts in a less than candid manner, while the Department of Defense, for all practical purposes, ignored the whole business and announced its intention of going on doing what it had been doing all along.

There have been a number of reports from Vietnam both of animal abortions and of malformed human babies that are thought to have resulted from spraying operations in which 2,4,5-T was used. But such scattered reports, however well founded, cannot really shed much more light on the situation. The fact is that

even in this country, the best-fed, richest, and certainly most statistics-minded of all countries on earth, the standards for testing materials that are put into the environment, into drugs, and into the human diet are grossly inadequate. The screening system is so coarse that, as a teratology panel of the Mrak Commission warned recently, in connection with thalidomide, "the teratogenicity of thalidomide might have been missed had it not produced malformations rarely encountered." In other words, had it not been for the fact that very unusual and particularly terrible malformations appeared in an obvious pattern—for example, similarly malformed babies in the same hospital at about the same time—pregnant women might still be using thalidomide, and lesser deformations would, so to speak, disappear into the general statistical background. As for more subtle effects, such as brain damage and damage to the central-nervous system, they would probably never show up as such at all. If such risks existed under orderly, normal medical conditions in a highly developed country, how is one ever to measure the harm that might be done to unborn children in rural Vietnam, in the midst of the malnutrition, the disease, the trauma, the poverty, and the general shambles of war?

—THOMAS WHITESIDE.

[From New Yorker magazine, Mar. 14, 1970]

DEPARTMENT OF AMPLIFICATION

NEW YORK, *March 5, 1970.*

The Editors, The New Yorker,

DEAR SIRS: In an article that appeared in *The New Yorker* on February 7th, I wrote that Dr. Lee DuBridge, the President's science adviser, issued a statement last October at the White House saying that because a laboratory study had shown a "higher than expected number of deformities" in the fetuses of mice and rats exposed to the herbicide 2,4,5–T, agencies of the United States government would take action to restrict the use of that substance in this country and in Vietnam, where it was being used in extensive military defoliation operations. This action, Dr. DuBridge announced, would include the cancellation, by January 1st of this year, of Department of Agriculture permits for the use of 2,4,5-T on some American food crops unless the Food and Drug Administration had by then been able to determine a safe concentration of the herbicide in foods. Dr. DuBridge further announced that the Department of Defense would thenceforth "restrict the use of 2,4,5—T to areas remote from the population" in Vietnam. His statement added that these actions and others "will assure the safety of the public while further evidence [of the alleged harmful effects of 2,4,5-T] is being sought."

Four months have passed, and 2,4,5-T is still being used as widely as ever. The Department of Agriculture has yet to cancel its permits for the use of the herbicide on food crops in this country, and the Department of Defense is continuing to use it in populated areas of Vietnam. In the meantime, officials of the Dow Chemical Company, which is one of the largest producers of 2,4,5-T, have been maintaining that the samples of 2,4,5-T used in the study cited by Dr. DuBridge, which was done by the Bionetics Research Laboratories, of Bethesda, Maryland, were uncharecteristic of the 2,4,5-T currently being produced, because the material tested by Bionetics—which did not come from Dow—was contaminated to an unusual extent by a toxic substance identified as symmetrical 2,3,6,7-tetrachlorodibenzo-*p*-dioxin. This contaminant, usually called dioxin, was alleged by the Dow people to be present in the Bionetics samples at a concentration of approximately twenty-seven parts per million, and they claim that the 2,4,5-T that Dow is currently producing contains the dioxin contaminant in concentrations of less than one part per million. The Dow people maintain that their currently produced 2,4,5-T does not appear to have the effect of deforming rat fetuses. In January, a Dow official told the Department of Health, Education, and Welfare, "We strongly urge that action concerning the status of 2,4,5-T be held in abeyance until [Dow's] testing program is completed [in] April." The United States government's failure so far to place the promised restrictions on the use of 2,4,5-T in this country may in part be attributed to this plea.

Because of the seriousness of the issues involved, it seems to me that the government's failure to act on the use of 2,4,5-T here and in Vietnam calls for much

fuller public discussion. Even though the dioxin contaminant may now be present in 2,4,5-T in what the Dow Chemical Company apparently considers to be no more than tolerable amounts, the substance is of such potency that its release even in small concentrations must prompt deep concern. In the presumably more heavily dioxin-contaminated samples of 2,4,5-T that were used in the Bionetics work, the smallest dosages of 2,4,5-T that the test animals were given caused extensive deformities in fetuses. In more recent studies of the dioxin contaminant, conducted by Dr. Jacqueline Verrett, of the Food and Drug Administration (who earlier was responsible for revealing the carcinogenicity of cyclamates), extensive teratogenic, or fetus-deforming, effects were discovered in chick embryos when the dioxin, or a distillate predominantly consisting of it, was present at concentrations of little more than a trillionth of a gram per gram of the egg. The magnitude of this effect on chick embryos may be gathered from the fact that, according to Dr. Verrett's studies, the dioxin appears to be a million times as potent a fetus-deforming agent as the notorious teratogen thalidomide was found to be in tests on chicks. Of course, chick embryos are far down the biological ladder from human fetuses, and they are also extremely sensitive to many substances.

But even if, for theoretical purposes, we reduced the teratogenic power of the dioxin, as shown in Dr. Verrett's chick-embryo studies, approximately a million times, we would *still* have to consider that we were dealing with a substance as teratogenically potent as thalidomide. That the United States government permits the presence, even in minute amounts, of such a substance in herbicidal mixtures to be sold for spraying on food crops and on suburban lawns—where some of the chemical may enter shallow wells and other drinking-water supplies—is hardly reassuring. And it is particularly disturbing when one reflects that in the quarter of a century in which 2,4,5-T was used prior to Dr. DuBridge's announcement not a single regulatory agency of the United States government, not the Department of Defense—which has been spreading huge quantities of 2,4,5-T on vast areas of Vietnam—and not, as far as is known, the researchers for any one of the half-dozen large American chemical companies producing the material had ever so much as opened up a pregnant mouse to determine whether 2,4,5-T or the dioxin contaminant in it did any systemic or pathogenic harm to the fetus. Several studies of the sort are now under way, but the United States government still seems to take the position that the 2,4,5-T produced by Dow and other large chemical companies should be considered innocent until it is proved to be otherwise. Meanwhile, 2,4,5-T is being sprayed on certain crops and on areas where it may come into contact with human beings, cattle, and wildlife. In Vietnam, it is still being sprayed by the military in concentrations that average thirteen times as great as those that the manufacturers themselves recommend as safe and effective for use in this country.

It is true that the teratogenicity of dioxin—as distinct from dioxin-contaminated 2,4,5-T—has not yet been established in tests conducted on experimental animals of mammalian species. However, the direct toxic, or body-poisoning, effects—as distinct from fetus-deforming effects—of dioxin are known to be very high both in animals and in human beings. In past studies on rats, dosages of forty-five millionths of a gram per kilo of the mother's body weight have been found to kill fifty per cent of the offspring. When dioxin was given orally to pregnant rats in recent tests, it was found, on preliminary investigation, to kill all fetuses with dosages of eight millionths of a gram per kilo of the mother's body weight, and to damage fetuses with dosages of a half-millionth of a gram per kilo.

Further, the effects of dioxin on human beings, even in small dosages, are known to be serious. In the past, in plants manufacturing 2,4,5-T an illness called chloracne seems to have been widespread among the workers. In the mid-sixties, Dow was obliged to close down part of a 2,4,5-T plant in Midland, Michigan, for some time because about sixty workers contracted chloracne as a result of contact with dioxin, which seems to be always present in varying degrees during the process of manufacturing 2,4,5-T and in the finished 2,4,5-T itself. The symptoms of this disease include extensive skin eruptions, disorders of the central nervous system, chronic fatigue, lassitude, and depression. Workers at a 2,4,5-T plant in New Jersey run by another company suffered similar symptoms in the mid-sixties, and six years later some of them were reported to be still suffering from the effects of the disease. In Germany, since the mid-fifties, workers in factory after factory producing 2,4,5-T and polychlorophenolic compounds have been

afflicted with chloracne after absorbing apparently only minute amounts of the dioxin contaminant; their symptoms have been described in several medical papers as including liver damage, nervous and mental disorders, depression, loss of appetite and weight, and markedly reduced sexual drive.

A few weeks ago, when a reporter approached an official in Dr. DuBridge's office for information on 2,4,5-T he was told that he would be given White House coöperation "only to a certain extent," because the official didn't want "wild speculation" stirred up. He cited as an example of "wild speculation" the recent controversy over the birth-control pill, which, he said, had "caused millions of women to get hysterical with worry." The reporter replied that he didn't think the analogy between 2,4,5-T and the Pill was a particularly good one, for the reason that a woman using the Pill could employ alternative methods of contraception, whereas a Vietnamese woman exposed to herbicidal spray put down by the American military had no choice in the matter.

But perhaps the comparison between 2,4,5-T (and its dioxin contaminant) and commonly used pills is worth pursuing. Suppose that such a dangerous substance as dioxin were found to be contained in a pill offered for human consumption in this country, and suppose that the contaminant were present in such minute amounts that an adult following the prescribed dosages might ingest a hundredth of a millionth of a grain of the contaminant per day. There is no doubt whatever that, according to existing Food and Drug Administration standards, the F.D.A. would immediately ban production and sale of the pill on the ground that it was highly dangerous to public health; in fact, the amount of such a potent contaminant that the F.D.A. would permit in a pill under the agency's present policy on toxicity would almost certainly be zero.

While 2,4,5-T, with or without the dioxin contaminant, doesn't come in pill form, it may be worthwhile to try to calculate, on the basis of a hypothetical pill, how much 2,4,5-T (and dioxin) a Vietnamese woman living in an area sprayed by the American military might ingest in a day. It has already been calculated by reputable biologists that, if one takes into account the average amount of 2,4,5-T sprayed per acre in Vietnam, and also takes into account a one-inch rainfall—such as is common there—after a spraying, a forty-kilo (about eighty-eight-pound) Vietnamese woman drinking two litres (about two quarts) of 2,4,5-T-contaminated water per day could be ingesting about a hundred and twenty milligrams (about a two-hundred-and-fiftieth of an ounce) of 2,4,5-T a day. If the 2,4,5-T contained the dioxin contaminant at a level of one part per million—which is what the Dow people say is the maximum amount present in the 2,4,5-T they are currently producing—the Vietnamese woman would be absorbing a little over a tenth of a microgram of dioxin per day, or ten times the amount of dioxin entering the system of an adult from the hypothetical pill that the F.D.A. would certainly find dangerous to human health. Further, if this Vietnamese woman were to conceive a child two weeks, say, after the spraying, the weight of the dioxin that by these same calculations would have accumulated in her system (the evidence thus far is that dioxin accumulates in mammalian tissue in the same manner as the chlorinated hydrocarbons, such as DDT) would be more than the weight of the just-fertilized ovum. Considering existing evidence of the frightening degree of teragenicity of the dioxin in chick embryos and its highly toxic effects on mammalian fetuses, the presence of this much dioxin in a mother's body at the very beginning of a human life study has ominous implications.

Now, what about the safety of 2,4,5-T itself? Admittedly, the dioxin contaminant seems to be a residue from one stage of its manufacture. But if by some future chemical miracle the very last trace of dioxin could be removed from the finished 2,4,5-T, would the resultant "pure" 2,4,5-T be harmless? The fact seems to be that even then 2,4,5-T, as produced in this country, would have to be viewed with suspicion, for the breakdown products of 2,4,5-T, when subjected to heat and other conditions, are themselves capable, according to a number of responsible biologists, of producing dioxin. Given this potential, the ultimate folly in our defoliation operations in Vietnam was possibly achieved during 1965 and 1966, when the military made large-scale efforts in two defoliated areas to create fire storms—that is, fires so huge that all the oxygen in those areas would be exhausted. The apparent intention was to render the soil barren. (A fire storm would also, of course, have the result of burning or suffocating any living beings remaining in the area.) Operation Sherwood Forest, conducted in 1965, was an attempt to burn a defoliated section of the Bai Loi

Woods. In October, 1966, the military began Operation Pink Rose, a similar project. Neither of the projects, in which tons of napalm were thrown down on top of the residue of tons of sprayed 2,4,5-T, succeeded in creating the desired effect; whether they released into the atmosphere dioxin produced by the breakdown products of the 2,4,5-T will probably never be known.

There are also less spectacular ways in which conditions suitable for the release of dioxin in Vietnam may have been created. For example, after areas accessible by road have been defoliated, woodcutters move in to chop up the dead timber, which is then carted off to nearby towns and sold as firewood. Large quantities of it are said to have been entering Saigon for years. Since the fires are customarily tended by Vietnamese women, and since many of them are certainly pregnant, the hazards to health and to the lives of unborn children surely cannot be ignored.

In the United States, the potential hazards from the present use of 2,4,5-T are considerably less than they are in Vietnam. In the first place, the recommended concentrations of 2,4,5-T for spraying here are, as I have pointed out, about a thirteenth of what the Vietnamese population is sometimes subjected to. And, in the second place, a great deal, if not most, of the 2,4,5-T that would otherwise have been sprayed on American crops and grazing areas has for several years been sent to Vietnam. However, the shortage of 2,4,5-T in this country does not necessarily mean that the potential hazards are at a minimum. The substances known as the trichlorophenols and compounds of pentachlorophenol, which officials of the F.D.A. believe may be chemical precursors of dioxin under certain thermal and other conditions, are used widely in the manufacture of a large variety of consumer products, ranging from paper to laundry starch and hair shampoo. Dow Chemical puts out a whole line of polychlorophenolic chemicals known as Dowicide Products. Monsanto Chemical also puts out a line of pentachlorophenol substances, known as Penta Compounds. Since a very great may consumer products wind up being burned sooner or later, and since the polychlorophenolic compounds are suspected of being capable, under particular thermal and other conditions, of releasing dioxin, the alarming question arise whether, and to what extent, dioxin is being released into the environment through the atmosphere. Pentachlorophenol, used in certain herbicides, is readily decomposed in sunlight, and in its breakdown process a number of products, including chemical precursors of chlorodibenzo-*p*-dioxin compounds, are produced. Because of these factors, a whole range of pesticides, as well as of herbicides, now must come under suspicion of producing dioxin compounds.

Although the chemical companies that manufacture 2,4,5-T have long taken pride in pointing out that 2,4,5-T itself is quite readily decomposable in soil, the crucial matters of how stable the dioxin contaminant is and to what extent it is cumulative in animal tissues have apparently been neglected. Consequently, the fact that traces of compounds virtualy indistinguishable from dioxin have already been detected in this country in the human food chain—in the livers of chickens and in edible oils—clearly indicates that dioxin should be considered a hazard to man. Why, under all these inauspicious circumstances, the production and the use here and in Vietnam of 2,4,5-T has not summarily been stopped by the United States government is hard to understand.

Sincerely,

THOMAS WHITESIDE.

[From the New Yorker magazine, July 4, 1970]

DEPARTMENT OF AMPLIFICATION

NEW YORK, *June 24, 1970.*

The Editors, the New Yorker.

DEAR SIRS: In the pages of *The New Yorker* in February, in March, and earlier this month, I discussed evidence of the potential hazards to human beings, including those still to be born, from the use of the herbicides 2,4,5-T and 2,4-D. Thanks to the pressure of public opinion, the repeatedly expressed concern of a number of responsible biologists, and an investigation of the subject by the Senate Subcommittee on Energy, Resources, and the Environment, headed by Senator Philip A. Hart, of Michigan, the government, on April 15th, placed restrictions on the use of 2,4,5-T in this country. On the same date, David Packard, Deputy Secretary of Defense, announced that the use of 2,4,5-T for

destroying crops and defoliating trails in Communist-controlled areas of South Vietnam would be discontinued "pending a more thorough evaluation" of the safety of the chemical. It has recently become known that all herbicidal-spraying operations in Vietnam have been suspended since Deputy Secretary Packard's announcement. However, it has also been made known that this suspension stems primarily from the exigencies of the Cambodian invasion and that the Department of Defense reserves the option of resuming such operations.

In the June 20th issue of this magazine, I discussed the ineffectual nature of the restrictions that the Administration had placed on the use of 2,4,5-T in this country and the consequent continuing dangers to public health. I would now like to discuss some further implications of our herbicidal warfare in Vietnam. Throughout the nine years in which the United States has waged this warfare, the Department of Defense has insisted that "the herbicides used are nontoxic and not dangerous to man or animal life." Unfortunately, this assurance was not based on scientifically established fact; the truth is that some twenty years after the development of 2,4,5-T, by the American chemical-warfare people during the Second World War, not a single study had ever been made of possible harmful effects of 2,4,5-T on the unborn. In 1966, the Bionetics Research Laboratories, of Bethesda, Maryland, operating under a contract with the National Cancer Institute to study the teratogenic, or fetus-deforming, effects of a number of industrial and pesticidal compounds, did adduce data showing that 2,4,5-T had marked teratogenic effects on experimental mice and rats, but this information did not become public until late last year, owing to dilatoriness on the part of government agencies and a general reluctance on the part of members of the Administration, including the President's own science advisers, to inform the public forthrightly of the potential dangers. And after this information was forced out of the Administration, spokesmen for the Department of Defense continued up to mid-April of this year to insist that the use of 2,4,5-T in Vietnam presented no potential hazards to human health. At that time, the Surgeon General of the United States conceded before the Hart subcommittee that 2,4,5-T did indeed present enough of a hazard to women of childbearing age to warrant suspension of its use around homes and gardens.

At the time the Department of Defense announced its suspension of the use of 2,4,5-T, the American military had sprayed from the air onto the countryside and the inhabitants of Vietnam a total of at least twenty thousand tons of the compound. There, 2,4,5-T has been used principally in a formulation, bearing the designation Agent Orange, that is an equal mixture of 2,4,5-T and 2,4-D. The latter has also never been shown to be non-hazardous to the unborn. Last year, a report summarizing the results of the same Bionetics Laboratories study that showed 2,4,5-T to be teratogenic characterized 2,4-D as "potentially dangerous" and "needing further study" as to teratogenicity. Since that time, another study, conducted by the Food and Drug Administration and using a formulation of 2,4-D on pregnant golden hamsters, is reported to have revealed teratogenic effects. The Surgeon General has said that he is not convinced that this study is conclusive evidence. However, another study within the F.D.A. has shown 2,4-D to have strong teratogenic effects on chick embryos.

If it is confirmed that 2,4-D poses dangers similar to those of 2,4,5-T, the American military will have unloaded not just twenty thousand but forty thousand tons of teratogenic chemicals upon the Vietnamese countryside. The suspension of the use of 2,4,5-T in Vietnam has led to the suspension of the use of Agent Orange, and the Defense Department has consequently curtailed its defoliation operations—for the time being. According to a Department of Defense spokesman I talked with last week, the Department is now compiling a report on the incidence of birth defects in South Vietnam to determine whether any of these can be connected with defoliation operations. I do not know what the findings of this survey will be, but it seems to me most improbable that, in the midst of all the chaos, disease, malnutrition, and various dislocations of war, any really accurate statistics concerning the causes of birth defects can be obtained. Certainly even in the United States, the compilation of reliable statistics on birth defects and their causes is very inadequate; that the American military can make an accurate survey in Vietnam, where reliable statistics on birth defects are virtually nonexistent, seems more than dubious.

The history of herbicidal warfare in Vietnam is the history of a program that quickly overwhelmed its original, limited objectives, took on a life of its own, and grew into a thing of devouring and destructive proportions. Putting an end to such a program obviously runs counter to many special military and economic

interest. The sales representatives of the great chemical companies have been extremely active during the expanding herbicidal-warfare program in Vietnam when the demand for 2,4,5-T and Agent Orange there reached its peak, it exceeded the available supply, and the companies were ready to propose alternatives.

The military requirements in respect to 2,4,5-T in Vietnam grew from two hundred thousand gallons in 1965 to one million three hundred thousand gallons in 1966, and to three million gallons in 1967—requirements that far exceeded the output. While that was happening, the management of the Dow Chemical Company, one of the largest manufacturers of 2,4,5-T, sent representatives to Vietnam to confer with the military on ways of supplementing the 2,4,5-T, and apparently they agreed on an alternative to Agent Orange consisting of 2,4-D and a herbicide called picloram—a mixture that Dow was selling under the trade name of Tordon. Without any significant field tests in Vietnam, very large quantities of the 2,4-D-*picloram* mixture were sent out from the Dow factories in 1966 and 1967 and were put into use as a defoliant under the code name Agent White. (Dow was, and still is, its sole producer.) Now, picloram is one of the most persistent and long-lived of all herbicides. An article in a Dow publication on tests of the material in California reported that only three and a half per cent of it disappeared from certain clay soils after a period of four hundred and sixty-seven days. In this country, the use of picloram on food crops is not permitted; four Department of Agriculture scientists warned in a recent scientific paper, "Minute amounts of this potent herbicide irrigated on sensitive crops could have disastrous results." A spray operation using picloram to defoliate sections of the border between Canada and the United States, which our government started in 1966, was recently discontinued. It appears that even scientists working for the Army at Fort Detrick, Maryland, its research center for chemical and biological warfare, were not happy about the use of picloram in Vietnam, and in 1968, after production of Agent Orange picked up, the use of Agent White dropped off sharply.

Considering this situation, in which the military, abetted by solicitous chemical salesmen, willingly supplemented the wholesale use of one incompletely tested chemical with the wholesale use of another incompletely tested chemical, it seems proper to wonder whether the military might be considering the reintroduction of picloram into defoliation operations in Vietnam. In this connection, it is hardly reassuring to learn of a communication this month from a Dow vice-president to Senator Hart's subcommittee revealing that there has been recent discussion between Dow and the Defense Department about further procurement of Agent White for Vietnam.

Agent Orange and Agent White have been used primarily, though not exclusively, for forest defoliation in Vietnam. Meanwhile, for crop destruction there, the military have primarily used Agent Blue, an aqueous solution of cacodylic acid. Since 1962, approximately half a million acres of crops, mostly rice, have been deliberately destroyed from the air in a "food-denial program," designed to deprive the Vietcong of rations. According to pronouncements by American military spokesmen, these operations have been carried out only in "thinly populated" and "remote" areas "known to be used to produce food for Vietcong military units." In terms of depriving Vietcong units in the affected areas of food, and thus reducing their military efficiency, the operations have been publicly characterized by the military as successful. However, I believe that the notion that the principal losers as a result of the program are the Vietcong is a fallacious one. The principal losers are members of the civilian population within and around the sprayed areas. If one takes the total figure of five hundred thousand acres of crops destroyed in Vietnam to represent rice crops, as it mainly does, it is possible, on the basis of the average yield of rice per acre, to calculate that about two hundred thousand tons of growing rice have been destroyed so far. Three-quarters of what the Vietnamese people eat is rice, and, on the average, a Vietnamese consumes about five hundred grams of rice a day, for a total of about one-fifth of a ton per year. Assuming that people in the affected areas have been practicing subsistence agriculture, one can calculate that the spraying of half a million acres would destroy enough rice to feed a million people for a year.

Of those people, how many were Vietcong? If one accepts the Defense Department's claim that the affected areas are "thinly populated," one has to assume that the Department is calculating this population density in terms of a broad

area. In terms of broad areas, the average Vietcong population is about two per cent of the total Vietnamese civilian population. Thus, it can be estimated that the American military destroyed the rice supply of a million people with the aim of denying food to twenty thousand Vietcong. Or, to put it another way, in order to deprive the Vietcong of one ton of rice the American military has to destroy fifty tons of rice that would ordinarily support members of the civilian population. Yet if you deprive a million Vietnamese civilians of food in order to deprive twenty thousand Vietcong of food, does it follow that the Vietcong are in fact deprived of food? It seems that occasionally local Vietcong units have indeed suffered food shortage but prisoner-of-war reports indicate that on the whole the Vietcong have continued to be adequately fed, crop destruction or no crop destruction. In the history of warfare, as many competent biologists and nutritionists—including Professor Jean Mayer, formerly of Harvard, who is President Nixon's special adviser on nutrition—have pointed out, it has always been the fighting men who had first claim to whatever food was available, and it has been the civilians who suffered the shortages. Guerrilla war in Vietnam is no exception to this rule, and the fact seems to be that, as a whole, the crop-destruction program has not achieved its purpose. At least a million people have been denied the equivalent of a year's supply of food, and at least a million gallons of a solution of cacodylic acid, which is fifty-four per cent arsenic, and is described in the authoritative "Merck Index" as "poisonous," has been sprayed on a country we are supposedly defending. The Department of Defense has always insisted that the formulation of cacodylic acid that is used in Vietnam is harmless to men and animals alike. However, the Defense Department for years gave us the same kind of assurance about 2,4,5-T without ever having initiated the necessary tests for teratogenic, mutagenic, or carcinogenic effects to determine if in fact it was harmless. A military document known as Combined Campaign Plan, Joint U.S. Psychological Warfare Directive, instructs personnel:

"In defoliation operations, explain the necessity for the operation, explain the effect of the chemicals with emphasis on the fact that they are not toxic to human beings or animals, explain the indemnification program, and encourage the people to become refugees and leave the area that is to become permanently defoliated."

An official in the Pentagon who is connected with the herbicidal program recently told a visitor that pilots carrying out American herbicidal-spraying missions "hate" Agent Blue, because it takes the paint off their planes" and has a generally corrosive effect. As the Pentagon sees it, apparently, Agent Blue is not toxic to men or to animals; it is toxic only to airplanes.

While the military may have officially expressed the opinion that the defoliation and crop-destruction operations in Vietnam have been successful, the private views of many people connected with the programs there are not nearly so positive. I have heard it reported by people close to the operations that as far back as 1967, at the peak of the crop-destruction program, internal reviews made by the military indicated that the primary effect was upon civilians, and that the operations did not affect the military power of the Vietcong to any substantial degree. At least certain civilian employees of the Pentagon seem to have been made aware, by prisoner-of-war and other reports, of the extreme bitterness that the defoliation and crop-destruction operations have engendered among the Vietnamese peasants, whose rice crops, growing on their ancestral ground, represent their lifework, their security, and their hopes. This bitterness has undoubtedly contributed to the successful recruitment of civilians to the Vietcong cause, and therefore one sees that quite a few of the Vietcong whom the American military have tried unsuccessfully to starve out are likely to be replaced thanks to the "food-denial program." Very recently, a responsible civilian in the Pentagon with whom I talked about herbicidal warfare began to wonder out loud whether, in view of all the difficulties involved, the game, as he put it, was really worth the candle. Yet the urge to go on with the game, if that is the word, remains. The Defense Department contemplates further crop-destruction sorties after the pullout of American forces from Cambodia. "We're just now getting into some harvesting times," a military source in Saigon was quoted as saying in the *Times* of June 23rd.

The last thing the people responsible for herbicidal warfare are willing to say is that the program should be stopped altogether. They do understand the value of appearing to give ground to critics. But one of the military men in charge of the entire herbicidal-warfare program in Vietnam is reliably reported to have told a visitor some time ago that he didn't really know how effective the program was but that he thought the fact of its existence would help the cause of the chemical-

...e people in the Army. As a man who is very familiar with the program in Vietnam told me recently, "What's going on now is that as the pullout from Vietnam continues, the people in charge of different weapons systems are struggling among themselves for a piece of the postwar pie. There's intense competition over the question of what programs are going to survive. This includes the herbicidal-program people. They are ready enough to curtail their operations now just so long as they can keep the program somehow ticking over and keep the principle alive."

It seems to me that not only the program but the principle should be killed off. It seems to me that the nine-year disaster of herbicidal warfare in Vietnam can and should be ended now by the force of public opinion. The manner in which the employment of hazardous and untested chemical herbicides in Vietnam has grown, feeding on itself, and inflicting suffering, hardship, and the risk of damage to the unborn upon the Vietnamese population, brings it altogether too close to the monstrous vision of full-scale chemical and biological warfare.

Last November, President Nixon proclaimed that the United States was renouncing the first use of lethal or incapacitating chemical weapons, and that under no circumstances, even in retaliation, would it use biological weapons. He also announced that he was submitting to the Senate for ratification the Geneva Protocol of 1925, which prohibits the use of chemical and biological weapons in warfare. The President did not include chemical defoliants and crop-destroying agents among weapons we renounce. I believe that the time has come for the President to put a formal end to herbicidal warfare, in Vietnam now and anywhere else in the future, and for our government to make it clear that the United States regards herbicidal-warfare agents as banned weapons under the Geneva Protocol.

Although the Protocol, which was drawn up before the invention of chemical defoliants and crop-destroying agents, does not specifically mention herbicides, it is known to have been deliberately written in broad language in order to include in its prohibitions a wide spectrum of noxious warfare agents. Last winter, a resolution holding that the Geneva Protocol prohibits the use in war of all chemical agents directed at men, animals, or plants was introduced at the United Nations General Assembly by Sweden and twenty other nations, and although the United States voted against it and brought pressure on many other delegations to do likewise, the resolution was passed by a vote of eighty to three.

In a letter to the *Times* last December, Philip Noel-Baker recalled a conversation he had with Henri Bonnet, who, like Mr. Noel-Baker, served in the League of Nations Secretariat. According to Mr. Noel-Baker, M. Bonnet assured him. "The form of words [in the Protocol] is good. It prohibts every kind of chemical or bacterial weapon that anyone could possibly devise. And it has to. Perhaps someday a criminal lunatic might invent some devilish thing that would destroy animals and crops."

Sincerely,

THOMAS WHITESIDE.