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HUMAC

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

HEARINGS

BEFORE THE

SUBCOMMITTEE ON ENERGY, NATURAL RESOURCES, AND THE ENVIRONMENT

U.S. Congress, Senate

OF THE

COMMITTEE ON COMMERCE

UNITED STATES SENATE

NINETY-FIRST CONGRESS

SECOND SESSION

ON

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

APRIL 7 AND 15, 1970

Serial 91-60

Printed for the use of the Committee on Commerce



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Congressman R.D. McCarthy's  
"Probe into USE of Herbicides -  
Globe, Arizona, 13 FEB 70"

p.p.m. 2,4,5-T. The milk had been distributed before analysis was complete, processing of the sugar-beets removes the chemical. If food is found to contain finite residues of 2,4,5-T, it is subject to removal from the market.

#### STATUS OF 2,4,5-T UNDER THE FEDERAL FOOD, DRUG, AND COSMETIC ACT

No finite tolerances have been established for residues of 2,4,5-T or the dioxins in food. In the absence of established tolerances any detectable amount of either chemical in food would make the contaminated food illegal and subject to seizure if found in the channels of interstate commerce.

A petition was filed in December, 1967 requesting the establishment of tolerances of 0.2 p.p.m. for residues of 2,4,5-T on apples, barley, blueberries, oats, rice, rye, sugarcane, and wheat. Neither the petition as originally submitted or as later supplemented provided data to support affirmative action; the petitioner withdrew his petition on December 29, 1969, as provided under the pesticide regulations.

Petitions to establish a safe tolerance level for residues of 2,4,5-T in food may again be submitted to the FDA in the future. However, any such submission must include scientific research data to resolve the questions that have been raised concerning toxicity of 2,4,5-T and the dioxins.

#### CONCLUSION

The Department of Health, Education, and Welfare is continuing investigations to determine the potential hazards from the possible presence of residues of 2,4,5-T and dioxins in foods, water, and other environmental sources to which the public may be exposed.

It is to be emphasized that there is no tolerance for 2,4,5-T in food today. The testing of food over the past several years has revealed no significant problem of food contamination.

#### Appendix 5

#### FROM INTO USE OF HERBICIDES BY CONGRESSMAN RICHARD D. MCCARTHY, D-N.Y.

Globe, Ariz., February 13, 1970

Ladies and gentlemen, I think we should begin. I am Congressman Richard D. McCarthy, and the hearings will come to order.

For more than a decade scientists have had serious misgivings about the widespread use of herbicides and pesticides in the environment. The late Rachel Carson warned of the risk of the use of herbicides, whose effects were either harmful or unknown.

In the United States 120 million acres each year are sprayed with herbicides for the clearing of railroads, for brush control, for watershed management, and for other purposes. One of these is known as 2,4,5-T. It was developed and perfected at Fort Detrick, Md., the army's chief Biological Warfare Research Center. The herbicide 2,4,5-T, and 2,4-D, a related herbicide, collectively account for some 83 million pounds of production per year—that was the figure in 1968.

I've long been concerned with the widespread use of these herbicides in Vietnam. Each day some 100 tons are dropped on South Vietnam, and scientists for many months have been concerned about the adverse ecological effects of this herbicidal inundation.

Last summer in the course of my inquiry into the Army's germ and gas warfare policies, I learned that a study, by the Bionetics Research Laboratory for the National Cancer Institute showed that the herbicide 2,4,5-T produced birth defects in rats and mice.

When the conclusions of this study were known, the President's science adviser, in October, announced a ban on the herbicide beginning January 1, 1970, unless the F.D.A. had found safe legal tolerances. I was distressed a few days ago to learn that contrary to the White House's announcement, the Department of Agriculture continues to authorize the use of 2,4,5-T in the United States. It's incredible to me that someone, or some people should have succeeded in overruling the science adviser to the President of the United States.

We know from the thalidomide experience that if we are going to err, we should err on the side of caution, and not on the side of danger. It is my firm conviction that such chemicals should not be used unless full tests show that they are safe. It is also incredible to me that this herbicide, which has been in existence since its development some 25 years ago at the Germ Warfare Research Center, still has not been fully tested for its teratogenic effects on human beings—that is, its power to produce birth deformities.

We know that it produces birth deformities in test animals under laboratory conditions, and we continue to receive reports from Vietnam that civilian women living in this heavily defoliated area are bringing forth deformed offspring.

The Saigon Press has reported on these in considerable detail.

Now, we have the allegations, and complaints emanating from here, Globe, Ariz. It is my hope that my investigation into these complaints and allegations will assist me in continuing my inquiry into this whole matter. I wish to determine how the White House was overruled, and why it is that we continue to use this herbicide despite the warning signals that have arisen.

As the great French scientist physiologist, Claude Bernard, once said, "True science teaches us to doubt, and ignorance to refrain."

I want to welcome all the local State and Federal officials who are in attendance. I hope to have a chance to meet with you personally during our visit.

Our first witness is Prof. Arthur W. Galston, a professor of biology from Yale University.

Doctor Galston.

Professor Galston, I wonder if, for the record, you would identify yourself, and your background, and particular expertise in the matters under inquiry.

Dr. GALSTON. Very happy to do that, Congressman.

I'm currently a professor of biology at Yale University. I'm also lecturer in forestry, and director of the March Botanical Gardens at Yale. I've been a professor of plant physiology for about 27 years. I was trained at the New York State College of Agriculture at Cornell University.

I did my graduate work at the University of Illinois, where I earned a Ph.D. degree in 1943. I then went to work for the emergency rubber project for the U.S. Government, located at Cal-Tech. During World War I was agricultural officer for U.S. Navy Military Government on the Isle of Okinawa. I then worked at Cal-Tech for 10 years, and I've been at Yale for the last 15 years.

I've published books in the area of plant physiology, and I have over 100 articles in the subject.

Congressman McCARTHY. For the record, Doctor Galston, I wonder if you could give us a scientific information about the herbicide under investigation.

Dr. GALSTON. Congressmen, what I'd like to do is to give you and the audience here some appreciation of the feeling of a large number of scientists as exemplified in this report recently delivered to the Secretary of Health, Education, and Welfare, Finch.

It is called, "The Report of the Secretary's Commission on Pesticides and Their Relationship to Environmental Health." It's dated December 5, 1969, and was prepared by the distinguished panel shared by Doctor Emil Mraz, the chancellor emeritus of the University of California at Davis.

It included many academic people, and also the vice presidents of two important companies, Dow, and Eli Lilly, both of whom manufacture herbicides and other pesticides in wide use.

The Commission takes note of the fact that there are now more than 400 different kinds of chemicals which are being used as pesticides to combat insects, fungi, weeds, and other predators.

Our modern agriculture and highly technicalized food production activities demand that we do use chemicals in agriculture.

I'd like to make it clear that I'm not allying myself with people that say, "Stop all chemicals." That's ridiculous in this day and age. We are dependent upon chemicals, and we have to keep using them.

Nonetheless, some of these chemicals are terribly noxious when introduced into the environment.

All of us are now familiar with the fact that DDT may be more of a bane than a boom. It has become global. Even a penguin picked up on an ice flow in Antarctica is full of DDT, and that was 400 miles from the application of

DDT, and we know that DDT causes oversized livers, and alteration of steroid metabolism in everyone's genes.

This Commission agrees unanimously that DDT must be phased quickly as possible as a pesticide.

With that as a background, I think it's perfectly clear that as soon as information develops, we are going to want to examine every pesticide for possible harmful effects on man and his domestic animals, and his environment.

Here I must digress to tell you about the changes that have occurred in concept of what constitutes adequate testing for a compound of this kind.

It used to be that simple toxicology tests were conducted. A laboratory animal, such as a mouse or a rat was fed a certain amount of chemical, and that animal showed serious symptoms, the teratogenicity was calculated on the basis of how many milligrams per kilogram of body weight of this material produced the toxic effects.

We now have tables which tell us roughly how toxic given materials are.

Now, based on that kind of test, 2,4,5-T, for example, is not terribly toxic; it's only a mildly toxic compound in the order of 2 to 700 kilograms milligrams of body weight cause toxicity.

If, however, you use more subtle tests, you find out that 2,4,5-T may be dangerous.

Among these tests are: Does the compound cause cancer? That takes a much more serious look than simply feeding and watching the dying of animals.

Secondly, do the compounds cause genetic effects, that is, does it break chromosomes, or cause mutations.

Thirdly, does the compound cause birth abnormalities. The word to describe that is teratogenic; that is the formation of monsters.

Now, this report which I have alluded to has as its last chapter, a chapter on teratology, and I'd like to read you just a little bit out of this chapter, out of the summary which is written here, which gives you my concern.

"All currently used pesticides should be tested for teratogenicity in the future in two or more mammalian species chosen on the basis of the closest metabolic and pharmacologic similarity to human beings possible. Pesticides should be tested at various concentrations including levels substantially higher than those to which the human population are likely to be exposed. Test procedures should also reflect routes related to human exposures. Apart from the obvious route of ingestion, attention should be directed to other routes of exposure, including inhalation exposures from pesticide aerosols and vapors, pesticide strips used domestically, and exposures from skin absorption. Parenteral administration is an appropriate test route for pesticides to which humans are exposed by inhalation, or for pesticides, which are systemically absorbed following ingestion.

"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 exposures."

I'd like to repeat that: "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—" I'll skip a lot of names, 2,4-D and 2,4,5-T are listed.

Here's the Government's most distinguished panel saying that there is evidence that 2,4,5-T has produced teratogenic effects in one or more mammalian species, its use should be restricted immediately. They also said no new pesticide found to be teratogenic, should be used only in circumstances where risk of human exposure is minimal.

Congressman McCARTHY. What's the date of that report, Professor?

Dr. GALSTON. December 5, 1969, it's now only 2 months old, Congressman, and it says a scientific group, or commission should be charged with responsibility for continued surveillance of the whole problem of pesticide teratogenesis.

Now, the problem of determining whether a problem is teratogenic, when it's given rise to birth defects is terribly complicated. If you do a laboratory test where you have one group of mice getting the chemical, and one group not, there's no problem to determine teratogenicity. By this kind of test it has been determined that 2,4,5-T as tested is one of the most teratogenic chemicals.

known. Even as little as  $4\frac{1}{2}$  milligrams per kilo of body weight have trebled the rate of abnormal production in mice and in rats a 118 milligrams per kilo of body weight has produced 100 percent abnormal litters, and 70 percent abnormal individuals in those litters.

Congressman McCARTHY. I wonder if you could translate those figures into what a human being would be likely to receive in the United States, or in Vietnam.

Dr. GALSTON. Well, if you take the lowest of those figures,  $4\frac{1}{2}$  milligrams per kilogram of body weight, and you say you have a 50-kilogram woman, that's 110 pounds which is about the average weight of a Vietnamese woman, then she needs to digest only about 200 milligrams total to have a teratogenic dose, 100 milligrams per day. Now, we are spraying agent orange, which is a 1 to 1 mixture of 2,4-D, and 2,4,5-T, in Vietnam at the rate of 270 pounds per acre. I should note that is 10 times what we used locally.

Congressman McCARTHY. What would it be in Arizona?

Dr. GALSTON. I think our Forestry friends could tell us, it is in the order of two pounds per acre.

Congressman McCARTHY. We will get to that with them today or tomorrow, but that's about the range?

Dr. GALSTON. At the Vietnam dose rate, if you assume a 27-pound per acre sprayed, followed by a 1-inch rainfall, which is normal for that region and you know that the rainwater is collected off the roof, or stored in cisterns, or gotten from very shallow wells, then a woman need only consume less than 3 quarts of water per day in combined drinking and cooking operations to receive that teratogenic dose.

I have calculated on this basis that it's possible that in Vietnam people have been given this kind of teratogenic dose.

Congressman McCARTHY. Doctor, let me ask you this. Here we have the Biogenetics Research Laboratory test which showed that 2,4,5-T is teratogenic in test animals, mice and rats. Is it teratogenic in human beings—do we know?

Dr. GALSTON. One doesn't know for sure whether it's teratogenic in human beings, one doesn't experiment with pregnant women, feeding some of them 2,4,5-T, and not feeding others. That would be inhuman, we do not tolerate that kind of experimentation, but the paragraph I was about to read here in fact deals with this.

It says there are two ways that you can determine whether a chemical is teratogenic. "First, chemicals or other agents may be administered to experimental animals to determine whether they induce prenatal damage. Secondly, and on a post hoc basis, human populations may be epidemiologically surveyed to detect geographical, or temporal clusters of unusual types of frequencies of congenital malformations. Combinations of these approaches are likely to insure early detection and identification of teratogenic hazards."

Congressman McCARTHY. Now, to your knowledge, has that been done in Vietnam, or is it contemplated, is the American Association for the Advancement of Science going to do what you just read?

Dr. GALSTON. I think it's shocking that there are absolutely no studies on the possible teratogenicity of these chemicals either in Vietnam or in this country. That is why it's so important to gather data from places like globe, and from places like the Saigon area to attempt to correlate, if it's possible to do so, the use of any particular pesticide with the appearance of any birth abnormalities, or any physiological malfunctions.

Congressman McCARTHY: Doesn't the commission's study recommend that no herbicides like this be used until we are sure that it doesn't produce effects in human beings?

Dr. GALSTON. That's correct, the Commission recommends that given the suspicion that these materials are teratogenic, given their widespread use, but given also our wide dependency on these things in agriculture, we should immediately restrict the use so that we only use these herbicides where it is absolutely necessary to do so, and where there is no possibility of contact with human organisms. I believe that is the safe policy when you think you may be doing harm. You stop until you find out whether you are in fact doing harm.

Congressman McCARTHY. Do you have any information that you could give for the record here, which would suggest why The White House ban never went into effect? I have a letter here which I received just prior to leaving Washington, which needs further clarification. It is from Mr. Ned D. Bayley, director of science and education for the Department of the Interior.

response to a letter I'd addressed to Secretary Hardin, asking why The White House ban didn't go into effect. Among other things, here's what he said: "Now, data submitted to D.H.E.W., Department of Health, Education, and Welfare, relevant to this position is that the 2,4,5-T used in the bionetics study contained about 27ppm of—"

Dr. GALSTON: Dioxin is the way it's usually referred to.

Congressman MCCARTHY: It's t-e-t-r-a-c-h-l-o-r-o-d-i-b-e-n-z-o p-a-r-a dioxin.

Dr. GALSTON: Tetrachlorodibenzo para dioxin.

Congressman MCCARTHY: A highly toxic contaminant.

Dr. GALSTON: Yes.

Congressman MCCARTHY: I'm going to seek further clarification that one of the reasons the ban was lifted was this discovery. Now, do you know anything about this in the course of your inquiry?

Dr. GALSTON: Yes, Congressman, I became aware of this new development. 2,4,5-T is a chemical synthesized from the reactants that are put together in a vehicle. Depending on the method of synthesis, and the temperature of synthesis, you may or may not get certain impurities formed in that reaction that accompany the 2,4,5-T which is realized out of the reaction mixture. One of the impurities is tetrachlorodibenzo-p-dioxin.

Now, there's previous information that this compound is a highly noxious material. There have been several factory and laboratory accidents in which people exposed to this compound have developed very severe blistering, loss of sensation, and respiratory troubles. The Germans have had a similar experience.

So it's natural when you have a report of this kind about the toxicity of 2,4,5-T, to inquire whether the effect is due to the chemical itself, or to the impurity.

Congressman MCCARTHY: Does it matter?

Dr. GALSTON: I'll make this statement.

I think it does matter in the long run, Congressman, because if it's the impurity, then in the future we can learn possibly how to make the chemical without the impurity, and continue its use.

Congressman MCCARTHY: I've read in the long article by Mr. Whiteside in the latest issue of New Yorker Magazine, at least he made the point that you can't make 2,4,5-T without getting some dioxin.

Now, is that right?

Dr. GALSTON: That's correct, I don't know if any sample that has less than a part per million of dioxin, so all of the 2,4,5-T that has been sprayed both at home and abroad has some dioxin.

The question is: Can you lessen the dioxin level down to the point where it is no longer so dangerous?

Congressman MCCARTHY: Is there any other way that dioxin can be produced after it's sprayed?

Dr. GALSTON: Oh, yes, even if you sprayed 2,4,5-T without any dioxin it might form chemicals in this Arizona sunshine. Putting all that light energy in I could easily imagine compounds like the dioxin being formed.

If there were a little fire somewhere, that's just the condition which would form the dioxin from 2,4,5-T. The only hard data on the teratogenicity of 2,4,5-T are right in this book that I have. There are no data which tell me, or anybody else, that it's the dioxin and not the 2,4,5-T that's responsible for these teratogenic effects.

I've had telephone conversations with people who have alleged this.—

Congressman MCCARTHY: Who are they?

Dr. GALSTON: Well, one of them is a member of this Commission, Doctor Julius Johnson of Dow who is an old friend of mine, and I think he is very terribly concerned about this development. Naturally, he would be since Dow is the manufacturer of some of this, and he told me that there are tests going on now which are not finished. He said he would not care to quote the data at all of the present moment.

Congressman MCCARTHY: Mr. James Hansen of the Dow Chemical Co. visited my office last week and alluded to, I assume, the same tests.

Dr. GALSTON: Yes.

Congressman MCCARTHY: That the Dow Co. itself was carrying out the following-up on this possibility that it is the dioxin.

Now, in this letter from Mr. Bayley he said new data submitted to D.H.E.W. relevant to this position indicates that the 2,4,5-T contained the dioxin.

Well, it sounds as if it's the same thing. What I don't understand is how the Dow Chemical Co. could, in effect, by intervening, countermand, or negate White House orders.

Now, have you discussed this with any other people in the Government, or outside the Government?

Dr. GALSTON. I have not, Congressman. I don't have any information on how this operation came about. I would only say that to me it's unthinkable that, in absence of hard data, and to protect the lives and welfare of people in the country, I don't see how this order could fail to be enforced.

We must be safe before we are sorry. I would say let's get the facts before we resume spraying with this 2,4,5-T and at the present time there are no published data that I, or any other scientists have seen, that would say that 2,4,5-T is not the culpable agent. I think it's very peculiar that the orders of Doctor DuBridge are not being followed by the Department of Agriculture and the Department of Interior. The Department of Defense, said it announced immediately it would not follow this directive.

Congressman McCARTHY. That's right. The next day on October 30th, the spokesman for the Department of Defense contradicted the DuBridge order in a verbal briefing to newsmen. He said that the 2,4,5-T would continue to be sprayed in training and regroupment areas where obviously populated areas, and of course as you know it has been sprayed in rubber plantations in Cambodia, which are also populated.

Well, Professor Galston, I appreciate very much your testimony here.

Dr. GALSTON. Do you mind if I make one more brief statement?

Congressman McCARTHY. No, please do.

Dr. GALSTON. As a biologist, I'm terribly concerned about this because I believe in herbicides, I want to see that they continue to be used. I'm afraid there may be overreaction on the part of the public. I would like to say that there are probably ways that we can safely use these compounds, and the first recommendation of this Commission—I would like to read you just two paragraphs, short ones, because they outline to me what would be a safe procedure.

It says: "A new interagency agreement is needed to strengthen cooperative action among the Department of Health, Education and Welfare, U.S. Department of Agriculture, and the U.S. Department of Interior, to protect public health, and the quality of environment from pesticides danger provided by the Secretaries of H.E.W. and Interior, as well as Agriculture, should be required for all pesticides registration, pesticide use determined by any of the three Secretaries to be hazardous should be restricted, or eliminated.

"The agreement should further require the continuous review of new scientific information on pesticides now in use with the formal reviews made 2 years after initial registration, and subsequent formal reviews by the three agencies at 5-year intervals."

That seems to be loudly, essential for the continued safe use of pesticides and it's coupled with the establishment of a national testing center for pesticides, which is also recommended, I would say that we would be well on our way for the safe use of pesticides.

Congressman McCARTHY. Do you think it's proper to delegate to the manufacturer of such a chemical the responsibility for testing its teratogenicity and carcinogenicity?

Dr. GALSTON. Well, you can certainly accept the data that are contributed by the manufacturer as relevant to the solution of the problem. I think these people have shown necessary testing laboratories which give honest data, but I would not depend on those alone. I would want to see the FDA or some other agency independently test these same compounds also, under completely different conditions. That's only a scientific rule, you don't believe anything anybody tells you, it has to be confirmed once or twice before you can believe it.

I would certainly hope the FDA, or some other agency, HEW would continue conducting further tests on these toxic chemicals.

Congressman McCARTHY. And not really solely on the research of Dow, or other manufacturers?

Dr. GALSTON. That's correct.

Congressman McCARTHY. Professor, I wonder if you would be kind enough to sit with us here, I'd like to use you as a resource person when we have the other witnesses.

Our next witness is Mr. John Pierovich, Assistant Regional Forester, from Albuquerque.

Is he in the room?

If you would be seated and identify yourself for the record, and your responsibilities in areas under scrutiny here.

Mr. PIZOVICH. Yes, sir, I'm John Pizerovich, Assistant Regional Forester in Albuquerque, N. Mex. My responsibilities related to this matter are in connection with the complaints we've received here at Globe, and the overall evaluation of our Chaparral program, and our Chaparral program guidelines.

The primary reason the Forest Service is here today is because this is a Forest Service project. I think that we need to be cognizant of such hearings as this, and we do try to keep informed through the literature of regulatory rules and concerns.

In fact, we share quite deeply the concern of the people in this community with their environment, we wouldn't want to do anything that would jeopardize their safety.

They're our neighbors, we also live here.

At the same time, we've been asked repeatedly to announce that we would not spray again in the Globe area, and like Doctor Galston, I think that we wouldn't want to overreact at this time. So we've said that such an announcement would be premature, we have our own studies going forward, and that these studies must be resolved before we can reach decisions on herbicide's use, or on the Chaparral program.

In addition to that we believe that it would be also unwise to base decisions on herbicides used particularly from the current allegations, or suspicions here in this area.

These matters need to be studied deeply, and we hope to have them studied deeply, and frankly welcome this inquiry because it will help to daylight some of the areas of concern.

That's essentially our position, Mr. Congressman. I'd be glad to answer any questions you might have.

Congressman McCARTHY. Thank you very much.

In the course of my study, I have come into possession of documents that have been exchanged between the Department of Agriculture and citizens in the area. Here is one from John A. Williams for the Task Group, U.S. Department of Agriculture, Forest Service. Are you familiar with Mr. Williams?

Mr. PIZOVICH. Yes, I am.

Congressman McCARTHY. Is he an associate of yours?

Mr. PIZOVICH. He works in our regional office.

Congressman McCARTHY. Is he here today?

Mr. PIZOVICH. No, he's not.

Congressman McCARTHY. I'd like to read you some of the things that he says: "Paul Boffin (phonetic) called a Dow Chemical representative at Davis, Calif., and requested information about Silverx. This man called Supervisor Courtney later and indicated that a publicity release was being prepared for submission to the news media concerning the known toxicity of Silverx. This is accepted and used by the news media will go a long way towards improving the situation, and dispelling the fear of Silverx as a highly toxic, or poisonous agent."

He then goes on to say in his conclusions, "We are fully convinced that many of the people in this area honestly believe they were being subjected to a highly toxic and extremely poisonous compound with a high degree of persistence and one which would increase in concentration in the water supplies, and in the bodies of humans, and animals. These ideas are not in any way supported by research findings."

Now, that is dated July 22, 1969, and if I just would ask Professor Galston when was the Bionetics study brought to light?

Dr. GALSTON. It was handed over to the Department of Health, Education, and Welfare in December of 1968, to the best of our knowledge.

Congressman McCARTHY. So that to the best of your knowledge, the Department of Agriculture—

Dr. GALSTON. Might have had access to that information.

Congressman McCARTHY. Actually, the tests were run in 1967. Now, Mr. Williams obviously either did not know about the Bionetics report, and I would—I would accept that, I don't think he did just from the tone of the letter, but I'll ask you to comment—

Now, which do you think it was?

Mr. PIRSOVICH. First of all, Mr. Williams was heading a group for a general survey of the effects here in the Globe area at the request of the Forest Supervisor, and after the initial complaints. We've had subsequent studies go forward, one of these coming out as a second task force report which is somewhat more in depth. Mr. Williams' information was then of a general nature for an initial report for the forest supervisors. Williams himself is not an herbicide man. Mr. Boffin is, and his reason for talking with the Dow was to get more information.

The second question you've asked regarding the Bionetics study was not known to these people, and only known to a few people within the Forest Service but the word of mouth communication that took place following the review of the Bionetics study for publication.

This has precipitated a lot of discussion among the science community, and in the

—  
Congressman McCARTHY. Are you alluding to the Whiteside article in New Yorker Magazine?

Mr. PIRSOVICH. No, that's the most recent and clarifying article, at least I found it very informative.

Congressman McCARTHY. When did you first learn about the Bionetics findings on teratogenicity?

Mr. PIRSOVICH. I personally learned about it in November when I was assigned to this problem area, and I learned about it through reading in the literature, seeing the discussions among others.

Congressman McCARTHY. Was the present science advisors ordered ban ever transmitted to you, or here in the area?

Mr. PIRSOVICH. We were furnished a policy statement from the Secretary of Agriculture in December which referred to the DuBridge statement.

Congressman McCARTHY. Did you take that as a directive not to continue using 2,4,5-T?

Mr. PIRSOVICH. We understood it to be directed towards crops, and that it was not at that time being restricted in range-land use. However, we could infer from this, and from discussions with our Washington counterparts, we learned that there were other studies underway on this compound, and as you perhaps have noted, we did defer our chaparral program in October. The last spraying on this project was in June, and these events have unfolded since that time.

It's currently our position here in this region not to use herbicides until some of these matters are researched. The studies that are underway should be most helpful to us in this regard.

Congressman McCARTHY. I think there's a little confusion about just what the DuBridge announcement banned. Doctor DuBridge said—this is October 29, 1969.

That 2,4,5-T would be prohibited for use on American agricultural products after January 1, 1970, until the Food and Drug Administration could develop information showing that it could be used with safety.

Dr. DuBridge also announced that the use of 2,4,5-T in Vietnam would be restricted in areas remote from population.

Mr. PIRSOVICH. This is where we found our references to the crop production area, and the Secretary has interpreted this way. As I said the ban on crops is in effect at this time, and as near as we can tell we are also examining the future of the 2,4,5-T as it is compounded today.

Dr. GALSTON. Congressman, could I make a comment here?

Congressman McCARTHY. Yes.

Dr. GALSTON. I was unable to understand why when Dr. DuBridge issued this statement he did not also take care to specify prohibition of use in regions where 2,4,5-T might find its way into drinking water. For example, supposing you are using 2,4,5-T to clear shrubs from under a power line, and that power line is going through a town where people have wells, and they draw water from these wells. Don't we need to know if the 2,4,5-T is going to seep down in the water cable and get to these people? It seems to me applying the ban to the food crops is only a halfway measure.

Mr. PIRSOVICH. I think we need to be concerned by this, and this is why we monitor water from treatment areas. It's significant in this Globe area. Our reference—or the Federal water quality control criterion of one-tenth part per million, this level has never been reached in any of the water analyzed that we've had run, or had been brought to our attention.

Congressman McCARTHY. You say you received the directive November—  
 Mr. PIEROVICH. We received the Secretary's explanatory information December as I recall.

Congressman McCARTHY. Were you ever advised that the ban had been pending?

Mr. PIEROVICH. No, sir.

Congressman McCARTHY. So the last you had was the DuBridge directive?

Mr. PIEROVICH. Yes, and a statement from our Secretary to agriculture agencies of which we are, telling us that 2,4,5-T was not to be used in crops, and incidentally, the Secretary has added to his statement that we would use alternative methods whenever these are available and practical, and is stressing within the department a use of nonchemical means where these are available to us.

Now, this is all developments since the last spraying here at Globe, I believe this is clear.

Congressman McCARTHY. Are you spraying in other parts of your region?

Mr. PIEROVICH. No, sir, and we have no plans to spray during current, or coming fiscal year at this time.

Now, if we have some break-throughs, I'm sure we will be talking about this. Again, it would be premature to say.

Congressman McCARTHY. What's the basic rationale behind the spraying here at Globe?

Mr. PIEROVICH. You mean—

Congressman McCARTHY: What's the purpose of it?

Mr. PIEROVICH (continuing): The purpose of the project. This is the part of the region, and the Tonto National Forest chaparral management project. This program has many objectives for—if I may take a minute—fire is a very common ingredient in the life history of chaparral, and in trying to bring management to Chaparral Forest, we have excluded fire, or we are using, if by prescription, rather than have the chance of holocaust. In doing this, we attempt to bring a break to the fuels in large continuous masses by developing grassy ridge tops, or grassy openings. These have other advantages for people who want to use the forest, and for game.

It happens that the project here in the area was a water-yield project. We have learned through research at the 2-Bar experimental area, and particularly that we can substantially reach the flow of streams, particularly in the winter months where the vegetation is not using the amounts of water that the chaparral vegetation does.

Now, herbicides were used here at Globe partially because of the known flooding potential of these streams, and that they also know that fire over a large area could cause floods. So rather than use prescribed fire as initial treatment, herbicides were used.

We have plans to use some small amount of fire to continue our work here.

Congressman McCARTHY. Doesn't it say right on the container that this should not be used over water?

Mr. PIEROVICH. That's correct, and as the project instructions were followed here, the applicator pilot was to interrupt his spray everytime he passed a major stream channel.

Congressman McCARTHY. "Interrupt his spray," you mean from a helicopter?

Mr. PIEROVICH. From his helicopter, yes.

Congressman McCARTHY. Do you think that is that the answer?

Mr. PIEROVICH. Well, I think it's quite practical, sir.

Congressman McCARTHY. Well, wind might carry. Aren't there restrictions under the circumstances in which you use it?

Mr. PIEROVICH. First, let me explain in spraying this area the primary concern would be along, or parallel, or to a water course so that it isn't necessary to turn valves off as you may each time he crosses at the creek, but he is going to be crossing streams at the same time he has been spraying. So it would be than instructed to interrupt the spray before making such a crossing. Some drift did occur into the bayous, we have found some of the Sycamores in the Kellner area, the tops have been hit. We don't feel that a substantial amount of herbicide came to the water course, and the pilot was instructed not to apply this over water.

Water residues again haven't indicated any great amount of the herbicide in the water.

**Congressman McCARTHY.** Are they instructed only to spray when the wind is blowing at a certain mile per hour?

**Mr. PIEROVICH.** Yes, that's right.

**Congressman McCARTHY.** What is it, eight?

**Mr. PIEROVICH.** In some projects it's 5-miles per hour, in this case it was 10.

**Congressman McCARTHY.** Ten?

**Mr. PIEROVICH.** Yes.

**Congressman McCARTHY.** Is that rigidly adhered to?

**Mr. PIEROVICH.** Well, I would hope that it is, here we are depending on other people to do our work, but we have a project area officer, and this project had a project area officer who works from the helispot where the copter is operating, using a pocket anemometer, and as he noticed the wind picking up he would take the pocket anemometer out and keep track of the gusts. Whenever it approaches 10-miles per hour, the project would be shut down.

I have records here with me of the shut-down on this project, if you are interested.

**Congressman McCARTHY.** You are undoubtedly aware that some of the residents in the area charge that spraying went on in much stronger wind velocities?

**Mr. PIEROVICH.** Yes, sir, I am, and I am aware that there has been drifts, and we are attempting to identify how far this drift went. In the task force 2 report, we identified a visual effects drift line, we are currently working on infrared interpretation, and I would be very happy to furnish you with a map which delineates how far the dead vegetation that shows up. That's not available to see by the naked eye.

**Congressman McCARTHY.** That would be very good to fill out the record. I would like to have that documentation very much.

**Dr. GALSTON.** Do you mind if I ask a question at this point?

As a scientist, I'm interested in following up one line of questioning here. The benefits that one wishes to derive from this program has to do with increased water flow?

**Mr. PIEROVICH.** In part.

**Dr. GALSTON.** And the other part is, I presume, to have a more accessible and manageable terrain where the Chaparral vegetation is?

**Mr. PIEROVICH.** That's a good generalization among other things. We would like the esthetic qualities of the area to be an indication.

**Dr. GALSTON.** Do you see any deleterious consequences of partial denudation of the hillsides where Chaparral is growing?

**Mr. PIEROVICH.** It's not our intent to denude the hillside.

**Dr. GALSTON.** I said partial.

**Mr. PIEROVICH.** In the course of making a conversion, one often has to take a compromise, and we do compromise to the extent that we will—say for example, in burning—taking out an area, we will burn only so long a slope here because any more we would have an overflow of plants and water, and erosion while it is bare from burning, it is an opportunity for a torrential thunderstorm, or wind to cause erosion. But this is also one of the compromises that a farmer must make when he plows his field.

**Dr. GALSTON.** And this is something you think you can keep under pretty good control with applied herbicides?

**Mr. PIEROVICH.** In this case we used herbicides for that reason, yes.

**Dr. GALSTON.** Was there any measurement for the relevant erosion rates before and after herbicide use in a given area?

**Mr. PIEROVICH.** In the 3-Bar area this is being noted at this time. The studies have been in progress for some time, I don't have those data with me, but I could find them for you.

**Dr. GALSTON.** I, personally, would be very interested in having those data. It's been my impression that some programs have been gone into fairly massively without the comfortable feeling that there's a lot of scientific data behind the original studies to tell us that this is really what we ought to do, and in calculating returns per acre, in terms of where we've applied, I think we have to have a negative quantity in there for possibly deleterious effects, that possibly are not measured.

**Congressman McCARTHY.** I'd be eager to see those.

**Mr. PIEROVICH.** I'd be happy to furnish them for you. I think something we have going right now, you may notice in the statement we've furnished you,

we are looking at alternatives, and tolerable levels, and we are approaching that very thing using projects that have been installed as a basis for arriving at this.

**Congressman McCARTHY.** On that I wonder if I could ask you, are you giving licenses for the use of Kuron?

**Mr. PIRSOVICH.** We give no licenses for chemical uses. The answer would be no.

**Congressman McCARTHY.** I see. From whom do they get these licenses?

**Mr. PIRSOVICH.** The use of chemicals is done by—in our case, the approval of a project proposal by a regional and national pesticide committee. Once a forest officer who has a project wants to apply a herbicide he prepares a formal proposal. It's submitted to our regional committee, if they approve, to the national committee. And I'll tell you right at this point, our committee would approve such a use, but we don't license.

**Congressman McCARTHY.** Well, thank you very much.

Will you be available today and tomorrow?

**Mr. PIRSOVICH.** Yes, sir, I will, as will the ranger and the acting supervisor here.

**Congressman McCARTHY.** Thank you very much.

Our next witness is Dr. F. I. Skinner, veterinarian from Globe.

Is Dr. Skinner here?

**Dr. Skinner,** I'm pleased to have a veterinarian testify in light of recent indications that the use of 2,4,5-T spray may have had harmful effects on animal fetuses. I wonder if you would, for the record, identify yourself, your background and experience.

**Dr. SKINNER.** I am Dr. Skinner, local veterinarian, I've been in the area 10 years, graduate of Kansas State University with a degree of T.B.M.

Now, these are my people, and I've lived amongst them. Now, any questions you'd like to ask I'll try to answer.

**Congressman McCARTHY.** Would you recommend the use of this Silver Kuron spray after tests have shown that it has teratogenic effects on animals?

**Dr. SKINNER.** No, I wouldn't recommend it without further study, further research.

**Congressman McCARTHY.** You think it should be stopped until—

**Dr. SKINNER.** Yes, sir.

**Congressman McCARTHY.** You have some question about the Bionetics findings of the effects of this on animals?

**Dr. SKINNER.** I'm a clinician, I'm not research. I have not seen any effects of animals in this area—definitely, clinically. Now, as I say I'm not research, I'm a clinician. I don't set myself up to be an expert on it, but I have not seen any abortions, malformations of fetuses in this area that I can clinically say it was caused by Silver, or 2,4-D, or pesticides.

**Congressman McCARTHY.** As I understand it, and we hope to hear from others, that there have been allegations made that the 2,4,5-T sprayed did cause malformation in animals.

**Dr. SKINNER.** I cannot speak for those, I have not seen them myself.

**Congressman McCARTHY.** You did not. Were you ever asked to examine the animals in question?

**Dr. SKINNER.** No, sir.

**Congressman McCARTHY.** You were not—

**Dr. SKINNER.** No, sir.

**Congressman McCARTHY.** So that you just don't know?

**Dr. SKINNER.** I don't know, I don't pretend to know.

**Congressman McCARTHY.** All right. Well, maybe they will be calling on you.

**Dr. SKINNER.** I hope so.

**Congressman McCARTHY.** Well, thank you very much, Doctor Skinner.

**Dr. SKINNER.** Thank you, Congressman McCarthy.

**Congressman McCARTHY.** Our next witness we'd like to call is Mr. Robert McKusiak.

**Mr. McKusiak?**

**Mr. SKOMR.** Sir, I represent Mr. McKusiak as an attorney, and he has requested that he be called later. Can you pass him at this time? He wants to pass at this immediate time.

**Congressman McCARTHY.** Surely.

In that event we'd like to call Mrs. Billie Shoecraft.

**Mrs. Shoecraft,** I wonder if you'd identify yourself for the record, and —

Mrs. SHOECRAFT. Billie Shoecraft, Ice House Canyon, Globe, Ariz.

Congressman McCARTHY. And if you would tell us a little bit about how long you've lived here, and your own experience with the chaparral spray program?

Mrs. SHOECRAFT. We have been in the area since 1947—Mr. Shoecraft a little longer than that.

Congressman McCARTHY. I wonder if you could tell us about your experiences with the spray program, and some of the correspondence you've had with the various agencies of government in this connection.

Mrs. SHOECRAFT. I'd be glad to, thank you.

We first became aware that they were going to spray a chemical, which they asserted was harmless—

Congressman McCARTHY. You say, "they"—

Mrs. SHOECRAFT. The Forest Service.

Congressman McCARTHY. U.S. Forest Service?

Mrs. SHOECRAFT. Right, in 1965. They had published in the local paper a news item dated August the 19th, 1965, in which they said the herbicide will be 2,4-D, and 2,4,5-T mixed with diesel oil, and water. The diesel oil will serve as a weight factor to insure against wind drift. Neither 2,4-D or 2,4,5-T is harmful to birds, insects, fish, wildlife, or humans.

Congressman McCARTHY. Do you have a date and name on that?

What was the publication, what newspaper is it?

Mrs. SHOECRAFT. From the Arizona Record.

Congressman McCARTHY. Of what date?

Mrs. SHOECRAFT. Of August the 19th, 1965.

I also have the typed-up version when he initiated at that time from which he deleted the word. "I anticipate honest inquiry from many individuals and groups concerning the project I also anticipate adverse criticism and harassment from those who devote their lives to criticizing and harassing."

I forgot to read the part where he invited the general public to come and see them spray.

If you are as curious as I am, you will want to drive up and watch the operation. I hope you will.

Again, I read from the report No. 16, Georgia Forest Research Council, Macon, Ga., 1965. On page 28 it says, "Possible harmful effects: 2,4-D and 2,4,5-T have a low toxicity, although spray applications leave no toxic residue, a tolerance of five parts per million has been established on or in apples, citrus fruits, asparagus, pears, and quinces. We can find nothing in the Department of Agriculture to back this up."

Then, they further said, "Since some persons may be allergic to the oil in the herbicide mixture, skin contact should be avoided, and when treatments are used a respirator is also a desirable piece of safety equipment."

Congressman McCARTHY. Who is saying this?

Mrs. SHOECRAFT. This is from the Southwestern Forest Experiment Station, Forest Service, U.S. Department of Agriculture, Asheville, N.C.

Congressman McCARTHY. And the day on that, please?

Mrs. SHOECRAFT. The date on this was 1965. It further says—after mentioning the respirator, the odor, or vapors may bring on a case of nausea. The Forest Service Health and Safety cautioned that 2,4-D and 2,4,5-T are mildly poisonous, and flammable in an oil base. However, we were invited to come and see the spray.

Congressman McCARTHY. Do you have any more documents that cast some—

Mrs. SHOECRAFT. Oh, I've many.

I have here this little item that was given to us, there were a few missing pages, it only had four, so I got in touch with Dr. Holston (phonetic) at Belleville, Md., because this is the U.S. Department of Agriculture, and I wondered where the rest of the pages were. So Dr. Holston from Belleville mailed me a package in which was included the rest of it, it totaled 25 pages, and this concerning the toxicity of some organic herbicide to cattle, sheep, and chickens. It tells about some of the things that they found in relation to the herbicides that we've been sprayed with. We don't know exactly because the reports have varied, but they have said they used 2,4-D, 2,4,5-T, and Silver. They further said it one form, then the tests showed different forms. I quote: "We concluded—that the enlargements were caused by the chemical reaction of the diluted herbicide formulation. The scroopy—the liver was enlarged and viable. The kidneys were congested. A small abscess was found in the parotid

lymph node. In one year that developed a swelling in the region related to chemical reaction. Associated other lymph nodes of the body were enlarged and hemologic."

Congressman McCARTHY. Mrs. Shoecraft, I wonder if just for the record might just interrupt you briefly. I would like to ask Professor Galston if he would explain the difference between Silver Kuron, 2,4,5-T, and 2,4-D just for the record.

Dr. GALSTON. These are very closely related materials, and I think from a toxicology point of view, and from the points of view—the presence of any of these impurities like the dioxin we were talking about, they would all be the same bag.

2,4-D is 2,4-dichlorophenoxyacetic acid, 2,4,5-T has one more, that is 2,4,5-trichlorophenoxyacetic acid, and Kuron is simply a trade name for a similar preparation that I believe is a Dow product.

Is that correct, I don't know whether the foresters here would—

Mr. FRENCH. Yes, that's correct.

Congressman McCARTHY. Is there anything significantly different between 2,4,5-T and Silver?

Dr. GALSTON. I would say none whatsoever from the point of view we are talking about. The toxicity would not be due to the length of the chain, due to the fluorinated aromatic nucleus, as a chemist would call it.

Congressman McCARTHY. Mrs. Shoecraft, I realize you have many comments, and we would like if we could to have any of these you would care to submit for the record.

Mrs. SHOECRAFT. I'd be glad to.

Congressman McCARTHY. Would you, this would help very much.

Mrs. SHOECRAFT. Yes.

Congressman McCARTHY. However, now, if there are any particularly salient quotations that—without being overly lengthy, you think should go into the record at this point, we would like to have those.

Mrs. SHOECRAFT. May I submit Farmers Bulletin Number 2153, U.S. Department of Agriculture, issued April 1961, slightly revised, August 1969, referring to what their rules are on what the wind velocity should be.

Congressman McCARTHY. What does that say?

Mrs. SHOECRAFT. It says, "Apply the spray when the wind velocity is less than 6 miles per hour, and the air temperature is 90° or less. Again use coarse spray—"

They did not use a coarse spray, they used a fine spray. "Use a slow vaporizing formulation."

They did not use a slow vaporizing formulation, they substituted water for oil in a very small amount and released it at very high altitudes on a hot and windy day, and they kept no records—weather records on the job.

Congressman McCARTHY. Can you substantiate those points?

Mrs. SHOECRAFT. Yes, I can.

Congressman McCARTHY. How?

Mrs. SHOECRAFT. I'm reading from file No. 2520, and it states in this hand corner of the file, it's from William H. Moehn, district ranger.

Congressman McCARTHY. How do you spell that?

Mrs. SHOECRAFT. M-o-e-h-n, district ranger, date July 11, 1969, subject: Wildlife protection, Kellner Russell chemical maintenance, fiscal year 1969.

This memo is a resume of the fiscal year 1969, maintenance project.

"The spraying done on June 8, 9, 10, and 11, 1969, were started at 6:40 a.m. on Sunday, June 8, and the hilltop located on the Icehouse Canyon Trail at 6:51 a.m. after the third load was through, the pilot flew to the O.C.C. Camp to check his spray. When he landed Mrs. Shoecraft arrived and told him the pilot of the spray had landed on her. The pilot returned at the hill at 7:14 a.m. and said someone should go talk to her.

"I left the spray job at that time and did not locate Mrs. Shoecraft."

In fact, I called Washington on the third day, but they didn't find me, they could have if they had looked.

"I left the spray job and we continued to spray from the helispot at 10:57 a.m. when we landed at the helispot the wind was coming out of the East from 6:40 a.m. to 10:57 a.m., we left and went to the Pinal Road helispot and began to spray. We continued to spray until 15.05 a.m., at which time the wind reached 10 miles per hour plus, and we shut down. We resumed spraying

at 5:03 p.m. when the wind dropped below 10 miles per hour and continued on until 7:35 p.m.

"On July 9, the first load was off the ground at 5:35 p.m. We continued to spray until 10:13 p.m., at which time we shut down because of winds in excess of 10 miles per hour. We did not spray anymore on the 9th.

"We started at 6:02 a.m. on June 10, 8 days after Mrs. Shoecraft had notified, and flew until 11:15 a.m., when wind forced us to shut down. We did not spray anymore on the 10th.

"On June 11, we started at 5:18 a.m., and flew until the project was completed. A total of 977 gallons of Silvex was used at a rate of 2 pounds acid, equivalent per acre. The total rate per acre was 8 gallons. 1,900 acres were treated. We did not keep weather records on this project.

"The wind speed and direction at the Globe Ranger Station at 1 p.m., each day of the spray job are listed on the next pages, and it shows on June 11, a speed of 16 miles per hour southwest.

"Signed and stamped by William H. Moehn."

Congressman McCARTHY. So that even in his own records he acknowledges that he exceeded the limits that had been set?

Mrs. SHOECRAFT. Yes, he did. I refer further to the Department of the Army's Circular 33061. I have a letter here from Representative Steiger's office, to apply back in 120 days, but I didn't choose to apply in 120 days. I called the Adjutant General's office, I said we needed it now, I'm one of the victims. I was informed by the Department Office that they sent it out to the printer's. My suggestion was you either get it from the printer's, or you get a copy, I need it now. I received it in 3 days.

In this it refers to the formulation which they call, Orange, and it says that it is one part 2,4,5-T, and one part 2,4-D. I have before me a letter dated October 6, 1969, from the USDA, in Phoenix. The branch of the Forest Service, the Tonto National Forest Service, signed by Mr. Jenkins for Mr. R. E. Cortney, Forest Service. He says:

Dear Mrs. Shoecraft, following is a list of chemicals purchased by the Tonto Forest as requested by you. The mixture was two gallons chemical with seven and one-half gallons per acre. In a few cases more water was used, and all of them are 2,4-D and 2,4,5-T.

Since I was curious because there was no Silvex, I further proceeded to say who bought the Silvex, and I was finally informed by Mr. Moore at Salt River Project they made the decision to purchase the Silvex. They did not purchase it as they said in the Forest Service. They have lied, it's the only word I'd like to use because it's lying when it covers things when they know better.

Congressman McCARTHY. I wonder if you could submit those documents to Mr. Riddleberger for our records?

Mrs. SHOECRAFT. All right.

Congressman McCARTHY. And if you are available we hope to go out this afternoon and tour the area.

Mrs. SHOECRAFT. Be pleased to.

Congressman McCARTHY. Thank you very much.

We would like to move on now and hear from Mr. McKusiak.

Mrs. SHOECRAFT. I had requested analysis that were done on our plant back in September before another task force is to arrive, which I understand is next week. I've spoken with Mr. Tschirley this morning, he called, I told him before I wanted anymore samples taken I would like the reports of what they took in September. They seem to be still evaluating these water samples we went in, and for your information I just learned this morning the samples taken from our own drinking water last week are still highly contaminated, and I suppose I'm the first human to go on record to be able to say that they have now found 2,4-D in my pound of flesh, and that was as of this morning from two different laboratories.

Congressman McCARTHY. That's important, could you elaborate on that? Do you have those laboratory findings?

Mrs. SHOECRAFT. These were found in the G.H.T. Laboratories in California, the other laboratory I'm not even aware of the name where the samples were sent.

Congressman McCARTHY. What's that, G. H.—

Mrs. SHOECRAFT. That's the laboratory where the Department of Agriculture, Doctor Hemton (phonetic) had recommended that the samples be sent on the plant life originally. There will be a longer report on it this afternoon.

Congressman McCARTHY. We will check that out. Did you mean to say that a biopsy has been applied on your tissues, and 2,4-D has been found in your—

Mrs. SHOECRAFT. As of this morning they were not complete.

Congressman McCARTHY. Thank you very much.

We'd like to call Mr. McKusiak now.

Mr. McKUSIAK, do you care to be accompanied by counsel? If you do, perfectly all right.

Mr. SKOMP. We have no objection.

Congressman McCARTHY. All right. Mr. McKusiak, I wonder would you testify yourself for the record, please, your name and your background, and long you've resided here.

Mr. McKUSIAK. I'm Robert McKusiak, and I've been an Artist in tile mosaic for some 22 years. I have a background prior to that time, and that time also in science. I majored in chemistry in college.

Congressman McCARTHY. What was that?

Mr. McKUSIAK. University of Arizona, I do not hold a degree.

Congressman McCARTHY. How long have you resided here?

Mr. McKUSIAK. I've lived in this area since 1932 with the exception of time that I attended the University of Arizona.

Congressman McCARTHY. Now, I wonder if you would verbally give us a realization of your experience with the Forest Service spray program?

Mr. McKUSIAK. My experience with the Forest Service spray program didn't come into being fully until 1969 following the June spraying. When we came back up, it came into being in about May 31, 1968. I was aware prior to that time that they had been spraying, but I was not aware that the things that they were spraying were particularly harmful. I had seen unusual things taking place, but I didn't know what to attribute them to.

Congressman McCARTHY. What unusual effects, could you cite a couple?

Mr. McKUSIAK. Yes, one in particular which I would prefer that Mr. McKusiak documented for you because that's her field, and not mine, but specifically in 1968, in May of 1968, the brown pewee population, these are birds that live in our canyon area, suddenly started dying in great numbers in our yard. We have a waterer that birds come to, and there were birds all around during May which had matter in their eyes, and seemed to be having respiratory trouble, and were dying, and at that time we continued spraying it.

Congressman McCARTHY. You don't happen to have any photographs of it, do you?

Mr. McKUSIAK. No, I don't, I would prefer on a discussion of birds to Mr. McKusiak go into this because that was her field. But, in 1968, on May 31st of May, I was up at my property where I get my clay, it's private land, the area that was sprayed, it was included in the area sprayed. I had my wife and three children, and the two dogs up there, and the spraying was taking place down canyon. The helicopter came up the canyon, we have a stock pond that was between us and the edge of the property, so to speak, and the helicopter came up the canyon and made a turn southerly, in other words, it made a right-angle turn toward the mountains, and it approached. We were within our arms because we didn't want to be sprayed. He made a turn and he was so close to us, and the spray descended upon us, and upon the pond, and upon our kids and dogs, and so forth. At that time we weren't really aware of anything was wrong with it except we both rushed home, my wife and I, and both had headaches from it.

Congressman McCARTHY. The pond, is that drinking water?

Mr. McKUSIAK. This is a pond which is used for livestock water, but it is private land.

Congressman McCARTHY. Now, you heard undoubtedly the Forest Service that they stopped spraying when they would get over a stream, but they did not stop over a pond. I suppose that would be obviously important?

Mr. McKUSIAK. It's incorrect that they stopped over streams, they sprayed directly over three different semipermanent streams that I know of, and one permanent.

Congressman McCARTHY. Did you see that yourself?

Mr. McKUSIAK. I saw them spraying in this area over it, and the direction continues right down to the edge of the stream, it's quite visible.

Congressman McCARTHY. Will we be able to see that this afternoon?

Mr. McKUSIAK. I'm sure you will.

Congressman McCARTHY. I think it's very important.

Mr. McKUSIAK. One canyon in particular in 1968 when I was sprayed with my family on our property, and we did have illnesses and have had illnesses thereafter, continued since this time. This particular little canyon, when they flew up toward us—which has a permanent stream in it, and they flew right up the canyon to the pond, it's a stream that seeps out from the pond, and has never been dry.

Congressman McCARTHY. I wonder if you would, for the record, tell us about changes in livestock, and other animal life on your farm, which you would attribute to this spraying.

Mr. McKUSIAK. I really don't have a farm to correct the record, I have many different animals, my wife keeps ornamental fowl, she is an archeornithologist, and she works with archeological birds, and she keeps files of various types for comparative work, and also for our own enjoyment.

We have 10 or 12 milking goats that we have had for 16, or 17 years. We've kept a small population of them, and in the last 2 years we have had a number of our milk goats bear kids, they have from two to three offspring a year, each goat, and a number of these have borne deformed offspring. When I say deformed, I'm referring generally to their heads, their heads were born misshapen, and malformed in some cases their bodies, but generally their heads.

We have one goat which is already been covered by the news media, but we have one goat which wasn't as malformed as the others. We have kept it alive simply because people were denying such things happening. I would say most of the offspring that were born were either dead, or deformed, or both. Most of them who were born deformed were born dead. In other words, the animal miscarried deformed offspring.

Congressman McCARTHY. Did you ever ask Dr. Skinner to come out and look at these animals?

Mr. McKUSIAK. No, I don't believe I've ever discussed these animals with Dr. Skinner until just recently, but Dr. Skinner and I are good friends, and we have from time to time called him to ask how much dosage to give an animal if we were going to give them a shot. Some of our animals from time to time have suffered from pneumonia, or things of this type. For example, many of our fowl in birth have died. I'm referring specifically to geese, and ducks, and some chickens, and many of them have died, and we found by giving them a shot of com-biotic, it's a penicillin streptomycin, I believe, combination, by giving them a shot, usually we could save them. These fowl would come down with what seemed to be pneumonia. There are many other people in the canyon whose fowl done the same thing.

We found by giving them a shot we could save them. We called Dr. Skinner to find out what the correct dosage would be, and we generally didn't call back telling him it came out.

Congressman McCARTHY. Well, Mr. McKusiak, I know we could go on for some time, but we have to adjourn shortly, but we will be with you this afternoon.

Mr. McKUSIAK. I would like to make one other comment, if I could, for the record.

Congressman McCARTHY. Surely.

Mr. McKUSIAK. I was talking about 1968 when we were sprayed on our own property, and our own dogs following this spraying, we went home and washed, but our own dogs that were with us, two of them became ill immediately with what we considered to be pneumonia, at that time we didn't associate it really with the spray, we didn't think about it, and we gave the dogs—we tried to call Dr. Skinner and he was out of town, and we gave the dogs com-biotics for this, and I believe it was the next day we called Dr. Skinner, he was back, and my wife checked with him and she checked the dosage she had given them, and he said it was twice too much, and give them half as much again, and we did, and the dog survived. It would have died if we had not given him the medication.

Congressman McCARTHY. You still have the two dogs?

Mr. McKUSIAK. Neither are malformed or anything, one of them has never been quite well, it's never been well. It wheezes a lot.

One other thing, there are many families in the canyon and many families in Globe and Miami who have dogs that are bleeding from all body openings.

We have dogs of this type, and people who have had dogs die from this could put you in contact with.

Congressman McCARTHY. We would like to have that information.

Well, thank you, Mr. McKusick. We'll look forward to seeing you this afternoon.

This hearing will stand adjourned.

Congressman McCARTHY. The hearings will come to order.

I've just received the following letter from the White House which I will read into the record at this point. It's from the Science Adviser to the President of the United States, Dr. Lee A. DuBridge.

"The White House, February 10, 1970.

"Dear Mr. McCarthy: This will acknowledge your February 3rd letter concerning 2,4,5-T, the October 29th announcement that you referred to in your statement of the actions that were planned to be taken by the various units of the Federal Government in relation to the 2,4,5-T. It was not a directive to the agencies for the simple reason that statutory responsibility for these decisions rest in the separate agencies.

"I'm sure that by now you have heard from the Department of Agriculture. I appreciate your views on the desirability of an investigation of reports of the birth of malformed children in Vietnam. By copy of this letter I'm calling your views to Secretary Laird's attention since this area is primarily his responsibility.

"As to 2,4-D, this compound is being reviewed along with other compounds being singled out as requiring additional study in the Bionetics records which you referred to."

Signed, "Lee A. DuBridge, Science Adviser to the President."

I'd like to contrast this with a statement as it was issued on October 29, 1969, where DuBridge said that the Defense Department will restrict use of 2,4,5-T to the areas remote from population, that the Agriculture Department will cancel registration of 2,4-D for food crops effective January 1, 1970. The Department of Agriculture and Interior will stop using 2,4,5-T in their programs in populated areas, or where the residues from use could otherwise reach man. That the Department of Health, Education, and Welfare will complete action on a tolerance for 2,4,5-T, the residues on foods prior to January 1, 1970.

This is obviously a retreat from the position taken by the White House on October 29. As I read the statement at that time it was in the form of a directive that the departments will do such and such, now we find that the White House is backing off from this, and is saying that the statutory authority rests with the agencies.

It seems to me that the President of the United States has authority—the ultimate authority over these agencies, and I regret very much that the President's Science Adviser has seen fit to retreat from the decision of October 29, which I believe was the wise one. The use of this particular chemical should be banned pending tests.

On the plus side I'm delighted to be informed last night, and it's reported today in the press, that the distinguished Senator from Michigan, Phillip Hart has announced he will hold hearings on 2,4,5-T. He asked Secretary Hardin, Secretary of Agriculture, Robert Finch, Secretary of Health, Education, and Welfare, and DuBridge to testify on March 11. This is further evidence to me that the compound's effects require additional evaluation, and I expect that I will testify myself before this Senate Subcommittee when they have hearings. I will make that request.

I should also announce that a report of my investigation will be prepared in consultation with Dr. Galston, and will be issued at the earliest practical point.

Now, we would like to hear again from Mr. Pierovich of the Forest Service. Is he here?

Mr. PIEROVICH: Yes, sir.

Congressman McCARTHY: I would like to say for the record, which I just said on the radio station here, that I have been very favorably impressed by the cooperation of the Forest Service. I think that anybody who has any smattering of knowledge about this whole thing must realize that this is something

transcending individual agencies out in the field, that we are talking here about national policy, and what is done out in the field really is a result of decisions made at a much higher level, and to try to focus responsibility on a field unit I think is really to carry this too far. I've been most impressed with your cooperation, and that of your colleagues, Mr. Pierovich, and I want you to know that we appreciate it very much, and our report will so indicate.

I understand you would like to elaborate on the statements you made yesterday.

Mr. PIEROVICH. Thank you, Mr. Congressman, for your kind comments, and also for the way you've conducted this hearing. I think the Forest Service is pleased with the way the hearing has gone. There are some significant elements of Forest Service concern that I felt should be made a part of the record this morning, and I'll read essentially from that statement.

First of all, the Forest Service has used phenoxy herbicides, but not since the nationwide controversy broke last fall. In fact, the last use of herbicides on the Kellner Russell project was June 11, 1969, and to the best of my knowledge, the last use of any herbicide by the Southwestern National Forest was the August, 1969, on the Gila National Forest in New Mexico.

Second, it's apparent there are several persons in this area who believe there are unknown, or suspected characteristics of these herbicides which may have caused them damage, and this is of concern to us.

Third, it's apparent we must continue our efforts to ascertain the extent of drift levels of herbicide residues, and the definite relationships between herbicides over environmental factors and the responses of plants and animals in this area.

These studies are to be made public when they're completed.

Lastly, the extent of continued deferment of herbicide use in the Chaparral program is dependent upon the outcome of our studies and of the Department's investigation of these matters.

Congressman MCCARTHY: Thank you very much. I wonder if you could for the record, repeat what you told me yesterday relative to the drift of the herbicide over streams, and into adjacent private property, and what steps, should this be resumed, assuming that it can be shown to be safe, what steps would be needed to correct that?

Mr. PIEROVICH. At this point, this will be my own opinion, but I first mentioned to you yesterday that our instructions to the applicator pilot were to interrupt his spray application when he crosses streams, we had definite plans for the project here to call for application away from the open water, and main stream courses. I do believe there was some drift into this stream course as evidenced by some top kill on the Sycamores on the stream bottom. There has been drift from the project area onto private property which we have established so far as the visual effects are concerned, and from this I'm certain that we will be developing new guidelines to both assure that the herbicides that we might apply in the future are confined to the project area, and to assure the safety of the public.

One definite indicator in this is that it would be desirable to use a much more restrictive windspeed in application.

Does that answer your question, sir?

Congressman MCCARTHY: Yes, but what wind velocity do you think would be safe?

Mr. PIEROVICH: I wouldn't want to speculate at this time, but we do have a general rule of 5 miles per hour, and we know that herbicides were applied here to 10 miles per hour, and we see new development in the herbicide application field, the use of inverts has become more and more popular, and with some corrective work recently done in this area I feel this will help us a great deal.

Congressman MCCARTHY: Another point that I definitely sympathize with you about is difficulty you have of getting information. I think the fact that you weren't apprised of the Bionetics Research Laboratory finding on teratogenicity until late last year suggests a problem in communications here, and if you have any suggestions for new legislation I'd be grateful. Do you feel you get enough information from Washington on such subjects?

Mr. PIEROVICH. I feel that in all of our—the exchange of information is a very complex thing today. We do make ourselves available to conferences with

people in these fields. Our technicians in herbicide work attend meetings regularly on this matter. We are expected to keep ourselves informed. The literature has been quite full of the controversies on 2,4,5-T, and we have been aware of the developing controversies.

The most healthy thing that could happen in this area would be a definite summary of literature that our technicians could refer to. There are abstracts available now, but the combination of inputs from the universities and from the various departments of government in one abstract bulletin would be helpful to us.

Congressman McCARTHY. Do you have anything to add, Mr. Pierovich?

Mr. PIEROVICH. No, I don't, sir.

Congressman McCARTHY. Thank you very much, we appreciate it.

Mr. PIEROVICH. Thank you.

Congressman McCARTHY. Our next witness is Dr. Paul Martin from the University of Arizona.

Dr. Martin, I understand you are accompanied by Dr. Russell?

Dr. MARTIN. That's right.

Congressman McCARTHY. Would you like him to sit with you?

Dr. MARTIN. Yes.

Congressman McCARTHY. Dr. Russell, would you care to join Dr. Martin?

Dr. Martin, we appreciate your being here. I wonder if you would identify yourself and Dr. Russell for the record, your background and your particular interest in this?

Dr. MARTIN. I'm Paul S. Martin, University of Arizona, Department of Geology. I had training as a professional ecologist, and with me is Dr. Stephen Russell who is a zoologist in the biology department in the University of Arizona. His special interest is in birds.

Congressman McCARTHY. Thank you. Dr. Martin, I wonder before the record if you would tell us about your involvement with the spraying project, and any conclusions that you reached, based upon your analyses.

Dr. MARTIN. Well, I'm not involved in the spraying project, and I'm not a herbicide expert. I have no research experience with herbicides. I do have interest in the vegetation of Arizona. I've spent years studying its fossil pollen records, but the interest I had in Globe was in first seeing if indeed there was any effect on vegetation as a result of herbicide treatment that had been called to my attention, I have come up on four separate trips to visit the area that was sprayed, and see what little I could of the community.

Congressman McCARTHY. How long did you spend on these trips?

Dr. MARTIN. These were 1-day visits.

Congressman McCARTHY. How many did you make?

Dr. MARTIN. Four. As a result of seeing the area, and talking to some of the people in the area, I was curious to see if just what degree the community might have been affected by this. I wasn't prepared to believe that people, or animals could be affected by herbicide sprays because the little I heard indicated that those who work with herbicides stand underneath the spray plane and are occasionally drenched by the chemicals, and don't suffer ill effects.

So it seems incredible that people in this community could be complaining of such an effect, but they were.

Indeed as a result it seemed to me that it was important to listen to them and try to understand what they were saying, and try to come to terms with the only observers who witnessed an event that wasn't supposed to have happened.

It also seemed to me that some of the people involved in the work with herbicides were unprepared for this sort of experience, they weren't even listening to the complaints. So I presumed to do that.

Congressman McCARTHY. And what did you find in the course of your four trips?

Dr. MARTIN. There is one other person that's involved in what I'm going to say next, I don't know if she's here or not.

Within the last month a student from Massachusetts by the name of Miss Adelaide Frick and she was willing to go on a door-to-door basis, and interview people in the community apart from the ones that I talked to.

**Congressman McCARTHY.** Excuse me, is Miss Frick present?

**Dr. MARTIN.** I have the results, a summary of her door-to-door investigation in the area, the purpose was to see if there complaints coming from any other source other than the individuals that I talked to. The trips that I'd made up here and the design was to on a door-to-door basis talk to approximately 50 people in the canyons close to the sprayed area, and to another 50 over in Crestwood, which I believe is east of Globe at a further—at a point further remote from the area that was sprayed.

So what Miss Frick did was then conduct a door-to-door interview with people close to the sprayed area, and another group of 50 further away from it.

**Congressman McCARTHY.** What did she find, do you have the report? We would like to have that for the record.

**Dr. MARTIN.** I'd be glad to give you a copy.

**Congressman McCARTHY.** Would you care to summarize it?

**Dr. MARTIN.** I'll simply read about a paragraph from the report that summarized it, and of course, the individuals are not identified in this report, and the complete questionnaire is not represented here, simply the highlights of it.

There are three key questions, two that have to do with personal health, and one that has to do with livestock. It turned out that few people do have livestock in either—neither the spray area, or in Crestwood, but quite a number have pets. This is what she found.

Regarding pets, 13 cases in which animals were effected, and one must presume some relationship to spraying although in no individual case perhaps could this be directly proved.

This is the experiences of people living in this community who know the nature of the community, and then feel that something has happened that's a little bit out of the ordinary.

Thirteen cases in which animals acted, three kittens lost; two dogs lost; infertile eggs, one; rabbits not breeding, two; chickens not laying, one; burro lost, one; sick dogs, three reports.

Now, as far as people are concerned near the spray area, 23 of 56 indicated illness over the past 2 years which may be spray associated. Some people had absolutely nothing wrong with them, or were not concerned. They thought that those that were complaining were imagining it happened, an event that had no bearing in the real world, that it was in the minds of the people reporting.

Other reported, and we're quite convinced that their experiences were related to the events of last June, or earlier when herbicide spraying had happened.

Of the 23 reporting illness, 21 were reporting breathing difficulties. Many of these are attributed to the times of spraying. Some are attributed to smelter smoke, there's no avoiding the fact that this area that experiences a good deal of smelter smoke. Some of these people may be reporting an effect that is indeed caused by smoke, I don't know.

There were five reports of serious diarrhea, including one entire family. Four reports of chest pains, including one false-heart attack, one report of coughing of blood, one report of subnormal temperature. Two reports of numb pain in arms; two reports of hemorrhaging; two reports of irregular periods; one report of miscarriage; two others by hearsay.

Fifty-six people interviewed, 42 mentioned some damage to plants, although the purpose of this questionnaire was not to consider plant damage.

Now, in Crestwood at a great distance from the—

**Congressman McCARTHY.** Was the interviewer able to determine if such complaints were prevalent before the spraying began?

**Dr. MARTIN.** I don't know how one would do that. In fairness to the people in the Forest Service who have worked with this project, one simply can't conduct a scientific experiment at this point in time. All we can do is talk to the people who were the observers, or ones—or residents in the area, and while their memories are still hopefully fresh, recover some information, just having to take them at their word.

**Congressman McCARTHY.** Let me just clarify. Is the interviewer ascribing these conditions to the spraying based on the interviews with the people? Do

they say that these phenomena results were the results of the spraying, don't they know?

Dr. MARTIN. Yes, some of them would rather not say. The question was effect, "Have you experienced any sickness which might be related to herbicide spraying of this area."

It's a leading question in part. It's not a question that denies any ignorance of the fact that herbicide spraying had taken place in the area.

I am sure there are many faults of a questionnaire of this sort that a professional psychologist would recognize.

Congressman McCARTHY. Let me say as a point of information, we will shortly have put into the record a scientific data of the results on human beings of 2,4,5-T, which I think you will find bear a similarity to phenomena you've just described.

I wonder if you would go beyond Miss Frick's survey to give us benefit of your own observations of what you saw, and if you were able to reach any conclusions about the effects of the spraying on either humans, vegetation, or animals?

Dr. MARTIN. Well, the effects on vegetation impressed me as ones that have to be watched over a period of time. Again, this problem of who's to make the investigation, and how it's to be conducted are important. The incident is over and in the minds of some local people, hopefully will never occur again.

The problem is, what really happened? I was up on four separate trips, or separate days, I saw some things that I have not seen in Arizona vegetation before. Such as the presence on Century plants of flowering way out of season and immature new plants going on the old stocks of old ones without normal seed being set.

I understand that this particular species of Century plant is known to do that, and other botanists have seen such a feature.

The area that was sprayed, not all plants are dead in it. Some species like Manzanita are remarkably resistant up to this point.

The effectiveness of the treatment is doubtful. The areas of spray are dead. The effects of spray on the outside areas on different plants have to be watched over a period of time to fully appreciate the change in phenology, the changes of flowering time, the change of time when the leaves appear, and when they fall, the way the tradition of plants may be as far as overall growth is concerned, and if one wants to demonstrate the herbicide-caused effect on vegetation. It's also necessary to take into consideration all the other environmental variations that aren't under control either, such as rainfall and temperature.

Congressman McCARTHY. But, you did find evidences of drift outside the project area?

Dr. MARTIN. Yes.

Congressman McCARTHY. Did you find evidences of 2,4,5-T in any of the adjacent streams, or did you seek to find it?

Dr. MARTIN. No, I collected samples only from within the project area, soil samples and water samples.

Congressman McCARTHY. You found evidences of 2,4,5-T in the water you've collected within the project area?

Dr. MARTIN. The samples that I collected and submitted to a laboratory in California came back with a report of the presence of 2,4-D, and smaller amounts of 2,4,5-T.

Congressman McCARTHY. In the water?

Dr. MARTIN. There was a trace in the water, there was up to one part per million in the soil of 2,4-D.

Congressman McCARTHY. Is there anything that you or your colleague could add which would be pertinent to our inquiry?

Dr. MARTIN. I would make one recommendation, and then if Steve Russell has anything he would care to add.

The recommendation would simply be that hospital records, doctors' records, the veterinary records of those doctors and veterinarians in the Globe area be gone over very carefully by proper professional people.

Congressman McCARTHY. At that point I think we should put into the record a memo of conversation with Mr. Peter Riddleberger of my staff, and

Dr. Grantville Knight, M.D., 2001 Wilshire Boulevard, Suite 345, Santa Monica, Calif.

This conversation took place on February 6, 1970.

Dr. Knight informed Mr. Riddleberger that he has two patients under his care from Globe, Ariz. While his examination is not complete, he is of the opinion that their malady is associated with the recent spraying of Silvex containing 2,4,5-T by the U.S. Forest Service. Dr. Knight is of the opinion that an investigation is warranted, and offered to submit a statement of his findings upon completion of his examination subject to the approval of his patients.

Miss Frick is here now, and I wonder if she could sit next to Dr. Martin and Doctor, if you would be good enough to reread that portion alluded to?

Dr. MARTIN. This simply summarizes the interviews that Miss Frick conducted in the canyons that is Kellner Canyon, Russell, Sixshooter, and Icehouse. Fifty-six interviews in that particular area, and some people who had serious complaints to make were not considered in this interview.

What I found just in tabulating what her questionnaire revealed was that 23 of 56 individuals indicated illness over the past 2 years, which may be spray associated, 21 individuals reported breathing difficulties, many of these are attributed to the times of spraying, but not all. Some were attributed to smelter smoke.

There were five reports of serious diarrhea, including one entire family.

Miss FRICK. Yes.

Dr. MARTIN. Four reports of chest pain, including one false heart attack; one report of coughing of blood; one report of subnormal temperature.

Two reports of pains, or numbness in arms; three reports of uterine hemorrhaging; one report of a miscarriage.

There were two others that I thought were hearsay, but I wasn't sure had really occurred in family that you interviewed, and then finally all the questionnaires wasn't directed to plant damage, there were 42 people interviewed who mentioned at least some damage to their plants in that area.

Now, the Crestwood account shows much less effect, and this is what one might expect because of the distance further away from the area of spray.

Congressman MCCARTHY. Doctor Russell, is there anything that you would add to the record here that would be helpful?

Dr. RUSSELL. I don't think I would add to the record, but I'm in agreement with Dr. Martin's statement.

Congressman MCCARTHY. You are, you've studied the information he has available?

Dr. RUSSELL. I have seen much of the general information, but I've conducted no investigation of my own into it.

Congressman MCCARTHY. Thank you, Gentlemen, and Miss Frick, very much. I'd like to now recall Prof. Galston.

Doctor, as we discussed here I understand you have some scientific data on the effects on human beings of 2,4,5-T. I wonder if you would cite the source of this information, and the findings?

Dr. GALSTON. Mr. Congressman, I'm very happy to present this information because in the course of my wanderings around on this day I have found that certain individuals tend instinctively to disapprove any allegations of direct damage to human beings or animals.

Now, as I hoped I made clear yesterday, very small doses of 2,4,5-T can cause birth abnormalities in laboratory animals, and that is now actively under investigation, and we've discussed to see whether it might be due to this impurity called dioxin, or whether it was due in fact to the chemical.

But now, the question is, can we actually produce an effect on mature individuals, let us say male individuals, totally apart from pregnant females bearing embryos in utero, and I should say that there is a fairly sizable respectable scientific literature on this, and if one looks in a variety of sources, including the sort of encyclopedia of clinical toxicology by Gleason and Coughlin, and can find citations to many articles, and I have reference to a few here.

Now, 2,4-D can produce, if it's administered in very massive quantities, it can produce death in the small animals, and there are even a few cases

recorded of it<sup>114</sup> having produced very severe symptoms in man. The best, however, comes from 2,4,5-T, and I would like to read to you a brief account of an article published in 1959 by T. Flint entitled "Dermatitis and Kidney Damage Ascribed to Weed Killer 2,4,5-T."

Flint relates an episode involving two sisters, age 4 and 6 years, who played for several hours in a yard which had been sprayed heavily a short time before with the Ortho brand of 2,4,5-T, brush killer. This was used for the control of poison oak.

This spray contained 15.4 percent of the isopro ester of 2,4,5-T in an acetone base.

Now, I should mention parenthetically, I don't have the exact data at hand, but Kuron contains much more than that, I believe in excess of 60 percent of this same ester.

The next day both girls exhibited generalized erythema—reddening of the skin—and edematous swelling of the oral and vaginal mucous membranes.

The pulse rate and body temperature were not elevated, but both children were described as appearing slightly toxic. The limbs and eyelids were slightly swollen as the mucous membranes of the mouth were inflamed. On the 3d day there were signs of kidney damage. Albumen was noticed in the urine. There was no evidence of liver injury, the urinary abnormalities persisted for about 2 weeks, but 2 months later the urine specimens for both patients were normal.

Now, there are other reports in which 2,4-D, and 2,4,5-T are alleged to have caused toxic effects on the nervous system as measured by the electroencephalogram. That is after ingestion, there was a desynchronization of the electrical activities of the nervous system, I bring these points up only to reinforce the fact that no chemical is completely innocuous. Some individuals are more sensitive than others, and some may require a big dose, and some a small dose to have these abnormal effects produced, but I share with Dr. Martin the view that when people appear and say that they have been adversely affected by these chemicals, immediate and adequate attention should be given to the possibility that these reports will furnish yet additional data to supplement the rather large amount of scientific data already existing.

Congressman McCARTHY. Thank you, Dr. Galston. I wonder if you could give us your observations after your inspection of the sprayed area, and the area where it drifted.

Is there anything that you at this point care to have in the record?

Dr. GALSTON. Well, I'll say a few words. I want to make it perfectly clear that after 24 hours in Globe, Ariz., I don't want to pose as an expert either on the program, or the effects on vegetation, or on people, but as a biologist working in this area, there is some conclusions I think I can make which point out the need for still further investigation, and everything I say should be held in that light.

What did I see on my brief trip yesterday? Well, I would classify them in several categories.

Number 1, at the hellspot, overlooking the picnic area, I observed and smelled residues, there was no doubt that you could smell residual diesel oil which was primarily the carrier for the herbicide which had been splashed during the loading operation onto the helicopter.

Now, if you could smell it, there was a good deal around, and that would indicate that there are definitely residues in certain selected areas, how much there was I can't say, how much there might be in the soil, or in the water, I cannot say, but it seems to me that I could smell evidences at various points in my trip. So that there probably are residues here and there, and those could serve as a continuous supply of leaching, I suppose, into the waters of the area, one should not discount that possibility.

The second category was definite plant damage, and the plant damage was both the desired plant damage in the canyon, and undesired plant damage in the vicinity of homes, which was due to the drifting, I assume, the herbicide.

In the canyons we could see, and these were pointed out to me by some of our Forestry friends who were with me, the desired killing of such plants as

Manzanita and Oak, and the desired persistence of what they considered more desirable plants such as gerardia.

Now, I suppose a question could be raised as some of the local residents have been raising undesirable, and desirable, according to whose criteria, and by what judgmental values. Manzanita and Oak do live on these hillsides, they do transpire to water, and I suppose their killing is desirable in the contention of wanting to avoid the evaporation of water. Whether after you are all through with the operation and plant to grass, which is the stated objective of this clearing observation, you are going to save very much water, I'm not sure, and whether, in fact, the esthetics of the environment will be improved another stated objective of this operation is also I'd say open to question, I would think it would be a very useful operation for those groups charged with making policy to hold some public hearings at which citizens could come with their points of view. I think a lot of this fracas is due to poor interchange of information between official agencies, and the citizens. If there had been open hearings, and announcements, this is what we intend to do, this is why we are doing it, and this is how we are going to do it, and have objections recorded at the time, a lot of the acrimony that's built up here might have been avoided.

Now, so far as the damage of plants around homes, there is no doubt about it, it has occurred. I have seen it, and as a plant physiologist, I could testify that this is typical damage due to herbicide drift. I think that this points up a lesson when you discharge herbicides from the nozzles of spray on a helicopter, you are getting an assortment of droplet sizes, the big drops are going to fall quickly, the small drops are going to be carried for longer distances. I think until the technology is improved, the so-called invert sprays is one possibility here, and new types of booms for spraying are another, it seems to me that it's very unwise to spray in areas where homes are so intimately associated with the forest and woodland, that you are trying to control. You cannot pinpoint the spray, you cannot keep it out of the water, and you cannot prevent inadvertent spray damage to the nearby residences, and I would say that there are certainly many sprays in the country where the application of aerosol sprays is a highly beneficial practice.

From my cursory look here that I would say the intervening of house and the canyons in which spraying is desired, is so intricate that the slightest miscalculation, the slightest air movement, the slightest malfunctions of the spray equipment would lead to damage to the property, and I don't know how that could be worked out technically, and I would want assurance that those problems are looked into.

I think the people whose plants have been damaged ought to be compensated in some way because the damage has been considerable around some homes, and I think it's unfair to expect these people to bear the brunt of this kind of inadvertent drift operation.

Now, I did see damaged animals, and I talked with humans who alleged that they were adversely affected.

All I can say here is the damage is there, and spray operations did occur, but I know of absolutely no scientific evidence which would link the spray operation to the damage, and I think the people who showed me the damaged animals showed it to me in the spirit that this could be a consequence of spray operations, but they weren't sure, and certainly I'm not sure, but unlike some people I would not immediately offhand say this is ridiculous. It could be as I have shown from my previous reading from this scientific compendium, and I could document further a lot of the symptoms that people are reporting here have been reported for massive doses of 2,4-D. So we should not leave the possibility that this did occur, but a much more scientific information is required.

My overall view after one day of looking around is one of puzzlement. I wonder why it's desired to initiate this kind of an operation in this kind of an environment. The stated objective is to improve water runoff, and water runoff will benefit, I presume, the citizens of a nearby urban area, Phoenix, which is growing rapidly, and which has a lot of water requirements, and their water

requirements will grow as the years go by. We know this is an arid area the way, not being an Arizona resident, and not being a politician, I probably could say some things here which a lot of people were thinking, but have brought forth.

Truly, water is going to be wiling in this area for others. So far as I see unless nuclear technology makes it available on a massive scale, which I don't foresee, if you take water from this area to give to another area, you are, in fact, robbing Peter to pay Paul. If you are robbing water from one area you are going to partially change the kind of vegetation, perhaps you are going to denude some of the areas in order to increase the runoff, this involves a comparative set of rules. Whose object is going to be gored here, whose interests are paramount? Well, clearly cities are not going to be able to grow indefinitely, we are going to have to put some limit on them, we know, for example, that the city of Los Angeles got into a lot of trouble with smog because there are just too many people there. In the same way cities in the Southwest may have to limit their size ultimately based on the number of people they can support on the amount of water resources there are. Trying to take every amount of water out of the Country brings a possibility of a very serious question.

Now that President Nixon among others is calling for a campaign to repair the environment, it might be that we would want to look at this whole problem in the context of what we are doing to the entire State, and to the entire countryside.

Finally, I would like to merely renew my suggestions that the people who formulated this policy, who set up this whole spray program should identify themselves, and should request the contributions of the citizenry as an input to this whole program.

I think that policy should not be made without question. This is a democratic society in which citizens have responsibility to interest themselves in the making of policy, and—my faith in the American people, and in their desire to run their own country has been to a certain extent reinforced by seeing a group of aroused citizens here out to protect their rights.

Thank you very much.

Congressman McARTHUR. Thank you, Doctor Galston. I think the points you make are valid. One that I would just enlarge on a bit is that I am presently working on legislation to be established to support a National Growth Policy. I think growth has to be commensurate with the resources and of course, in this case, water is a critical resource.

I would conclude these hearings now with a couple of observations. I think it's important to know that 2,4,5-T was developed at the Army's chief Germ Warfare Research Center at Fort Detrick, Md. My experiences in investigating the Army's chemical and biological warfare programs, and policies, has encouraged me about some of the actions that have been taken, without taking into consideration some of the unforeseen consequences. For instance, when they wanted to dispose of waste from nerve gas production at the Rocky Mountain arsenal near Denver, they first dumped this material into ponds on the arsenal's property. They didn't expect that it would find its way out. They thought it would be just absorbed in the water on the pond. It wasn't, it was carried out into adjacent streams, and the neighboring countryside, and killed among other things livestock and 6 square miles of sugar beets.

They then dug a deep well and figured the best way to dispose of it was dumping it deep into the earth. That set off 1,500 earthquakes in the Denver area, some of them up to six on the Richter scale, and caused great alarm in the community. They finally had to pull out this material, and of course the earthquakes stopped.

Then, they thought they should ship it across the entire United States. They thought this would be safe. Scientists later said it would risk the lives of thousands of people, the plans also called for dumping this large quantity of nerve gas and other materials into the Atlantic Ocean. They thought this would be safe.

Scientists later said it could destroy all marine life in 600 cubic miles of the Atlantic Ocean, with a cataclysmic effect on ocean's production cycle.

Now, I cite these instances not in reproaching the Army, or the C.B.W. establishment, but I think that this particular program has a questionable record.

We find 2,4,5-T developed by the Army's Germ and Gas Warfare establishment, 25 years ago to this date. We do not know for sure whether it will produce birth defects in human beings, I find it unwise to say the least to use such a substance without being sure that it is safe. For some reason the burden of proof seems to be on me and my colleagues in the sense that the attitude is, "we'll keep using it until you can prove it unsafe." Well, I quarrel with the basic assumption, I think that it should be just the reverse, I don't think that any toxic substance whether herbicide, pesticide, drug, whatever, should be used, sold in the United States until it can be shown that it is not harmful to human beings, that it doesn't produce cancer, or birth defects, or genetic effects.

One would think that we have learned from the Thalidomide experience, but apparently we haven't.

I also find it incredible that the Dow Chemical Corp. could have succeeded in helping reverse an order from The White House.

Now, I read this section from the statement of October 29 wherein the President's science adviser said that certain agencies of Government, the Department of Defense, the Department of Interior, the Department of Agriculture would do certain things, will inaugurate a new policy. Now we have the letter received today from The White House addressed to me, advising me that The White House is backing off from this directive, and is saying that the statutory responsibility resides with the individual agencies.

I find it personally unconscionable that in light of the Bionetics findings, and the scientific data cited by Doctor Galston this morning about the proven effects of 2,4,5-T on females, that this substance would be continued to be used on wide scale in the United States, and for that matter in Vietnam where even larger quantities are used.

I welcome the U.S. Senate Subcommittee on Investigation into this. I will prepare a full report which will appear in the public documents that will be developed as a consequence of our trip will be made available to not only the Senate Commerce Committee, but appropriate other committees of the Congress, as well as to the study of the American Association for the Advancement of Science under the directorship of Professor Messelson of Harvard.

We finally conclude by thanking the officials who have been most helpful, and to the residents of Globe who have been most hospitable, and I would hope that this experience here might have effects far more reaching than the small area of Globe, Ariz., and that perhaps as a result at least in part of what we have discovered here, that we will stop using 2,4,5-T around the world until we can run a series of tests that show that it is not harmful to this generation, and to the next generation.

Thank you very much.

#### Appendix 6

ALBUQUERQUE, N. MEX., February 26, 1970.

HON. RICHARD D. MCCARTHY,  
House of Representatives,  
Washington, D.C.

DEAR MR. MCCARTHY: Thank you for your letter of February 16 and for the opportunity to furnish additional documents or statements for the record of your hearing in Globe.

#### FOR THE RECORD REGARDING WINDS

In my testimony I promised to furnish you with additional data on wind-speeds during the 1969 spray project. While windspeed was measured by the Project Air Officer who used a pocket anemometer, no record of observations was made. He did, however, maintain a record of application flight times

which shows when the work was shut down due to winds exceeding 10 miles per hour. The following table summarizes these important times from record:

Date	Time	Remarks
June 8, 1969.....	1505	Shutdown (wind exceeds 10 m.p.h.).
June 8, 1969.....	1703	Resumes operations (wind below maximum).
June 8, 1969.....	1935	End operation for day.
June 9, 1969.....	1818	Shutdown (wind exceeds 10 m.p.h.).
June 9, 1969.....		End operation for day.
June 10, 1969.....	1115	Do.
June 11, 1969.....	1250	Do.

Because allegations of "gale winds" during application have been made of interest to compare the above shut-down times with winds recorded at Globe Fire Weather Station. The Globe Station records are for observations made only once daily at 1300 hours, but do not indicate the presence of "winds" on any day of the project. These 1300 hours observations are as follows:

Date	Direction	Speed (m.p.h.)
June 8.....	SW	
June 9.....	SW	
June 10.....	W	
June 11.....	SW	

As can be seen from the two tables, the only day on which application extended beyond 1300 hours was June 8, when the 1300 hours observation was only 5 miles per hour. The June 11 shut-down time of 1250 hours would tend to infer that winds did possibly exceed 10 miles per hour when compared with the 1300 hours observation of 16 miles per hour. Ranger Moehn has stated that winds did not exceed 10 miles per hour in the area of the spray application, and this is quite possible since spray work was high up in Russell Gulch in the lee of sheltering mountains to the Southwest, on that date.

#### OTHER ITEMS FOR THE RECORD

Additional copies of the Forest Service Interim Position Statement and the map showing the limit of infrared detection of dead and distressed vegetation (as of October 1969) are enclosed for the record.

As I recall, Professor Galston asked for additional information on the 2-R research studies related to water yield. Since the Interim Position Statement digests these, I suggest that the Statement will serve for the record, but would be glad to arrange for you or for Dr. Galston to receive a copy of the rough draft of the manuscript referenced in the Statement.

Since the herbicide container converted to a trash barrel, and found in Keller Canyon during your field tour, became a matter of importance to the press, the following additional information may serve as a useful insertion in the record: (1) The Dow Chemical Company label does not specify that the container be destroyed (copy of specimen label enclosed); (2) As a matter of good practice, we prefer that all pesticide containers not be reused, and when it was found that trash barrels were being made of the containers by the Globe District, the Regional Forester directed by memorandum on January 1969 that all Southwestern Region Ranger Districts discontinue such uses; (3) Ranger Moehn, in response to the Regional Forester's direction, had all such trash barrels picked up earlier in the week of your visit; (4) presence of the container in the creek at the Keller recreation area cannot be explained by District personnel who were in the area and had not seen it prior to your field tour; (5) the container had been washed with water and detergent prior to painting for use as a trash barrel.

Also on your field tour, there seemed to be some misunderstanding regarding application of herbicide to the live stream in Kellner Canyon. While the stream was flowing when you were in the area, it was not a live stream at the time visited at the time of application. We do not deny that some herbicide may have drifted to live streams, as evidenced by some tip damage to trees in the Kellner Recreation Area where there was a live stream, but that drift actually reached the water has not been established.

While the Interdepartmental Panel of Scientists headed by Dr. Fred H. Tschirley arrived following your hearing, their findings are of sufficient importance to the matter under consideration, that we desire to have the enclosed press release issued by them inserted in the record.

It was a pleasure working with you and Mr. Riddleberger during your visit. If the Forest Service can be of any further assistance, please let us know. We will appreciate receiving three copies of the hearing record when available.

Sincerely,

JOHN M. PIEROVICH,  
*Assistant Regional Forester.*

FOREST SERVICE INTERIM POSITION: KELLNER CANYON-  
 RUSSELL GULCH HERBICIDE SPRAY PROJECT AND THE SOUTHWESTERN  
 REGION CHAPARRAL PROGRAM, February 9, 1970

INTRODUCTION

Background on Kellner Canyon-Russell Gulch Project

The Kellner Canyon-Russell Gulch Project is a part of the Chaparral Management Program of the Tonto National Forest. The primary objective of this project is to improve water yield, but other program objectives and resulting benefits are intended to be met as well. Improved water yield and other Chaparral Program objectives are discussed below.

This project was initiated in 1965 following extensive local discussion and a press release which appeared in the local paper. Rather than the usual practice of applying prescribed fire as the initial treatment, herbicides were used. This was because of the known tendency for streams in this area to produce flash floods; herbicide treatment was considered to be unlikely to contribute to flooding, whereas large areas treated by fire could.

Chemicals used in this project are listed by year of use in Table 1 which is appended. These are all Federally Registered Compounds and were applied in keeping with the laws and label instructions governing their safe use.

Following the 1969 Application of Herbicide, Tonto Forest Supervisor Robert Courtney received a complaint in the form of a petition bearing 154 signatures of people in and near Globe, Arizona. Following the initial complaint, Courtney requested a team of qualified individuals to visit the area for a general assessment of alleged herbicide damage. This team reported some limited damage to vegetation on certain private properties.

Chaparral Management Objectives

Objectives of managing chaparral on the Southwestern National Forest are to:

1. Improve water quality and yield through reductions of the potential for sedimentation following wildfire and through reductions in evapo-transpiration losses where modification of existing vegetation is proper.
2. To enhance the scenic value of the Chaparral zone through development of varied patterns resembling the natural variations sometimes found in unprotected chaparral; these patterns range from savannah-like grass and forb areas to newly regrown chaparral, to relic stands of mature chaparral.

3. To improve wildlife habitat through creation of additional edge effect and through maintenance of vigor and new growth in desirable species.
4. To reduce the high costs of protecting chaparral from wildfires through the establishment of breaks in heavy fuel continuity, making it more possible to avert fires of conflagration proportions.
5. To increase forage production for wildlife and livestock through the release of native grasses and the establishment of new grass stands.
6. To improve access for both the observer of wildlife and the hunter through a system of near-primitive roads to strategic fire control locations and through the openings that will result in treated areas.

It is intended that each of the above objectives will be met through Multiple Use Coordination Procedures. These require that regardless of the primary purpose of any project, proper consideration be given to other forest uses and values. Because of the intense interest in improving Southwestern water quality and yield, both Federal watershed management and cooperator funds have been made available for this work as a primary purpose. Each of the objectives of chaparral management is fairly well understood by the interested public except for this one of improvement in water yield. Even some experts have, until recently, discounted the potential for augmenting water supplies through alteration of shrub cover in the chaparral type.

Much of the research leading to improved understanding of the potential for additional water has been done on the 3-Bar Experimental Watersheds near Roosevelt Dam on the Tonto National Forest. Work there was begun in 1956. Two reports from this work are of particular interest.

Pase, C.P., and P.A. Ingebo, 1965, "Burned chaparral to grass: early effects on water and sediment yields from two granitic soil watersheds in Arizona," Proceedings Ninth Annual Arizona Watershed Symposium, 4 pp illus.

Hibbert, Alden R., Unpublished 1970 Manuscript on file with Rocky Mountain Forest and Range Experiment Station: "Increases in streamflow vary with rainfall after converting brush to grass."

The latter report is cited because it contains data not previously available which are regarded as more reliable (due to additional years of streamflow measurement) and which indicate greater promise of improved water yields than previously expected. Increases due to watershed treatment have varied from 1.5 area inches to 14.0 area inches. The two test watersheds averaged an increase in water yield, for the period 1959 through 1969, of from 4 to 6 area inches.

Progress and Direction of Studies--The Kellner Canyon-Russell Gulch ProjectTask Forces No. 1 and No. 2 (Completed Work)

The first two teams to examine the area were concerned with visually detectable effects of the 1969 herbicide application. Due to the similarity of some insect and disease symptoms to symptoms of herbicide effects, the second team included specialists in entomology and plant pathology. It was on the basis of this team's findings that many plants alleged to be damaged from herbicide drift were determined to be affected by other causes.

It should be noted that while all complainants have been advised of Forest Service claim-for-damage procedures, only one formal claim has been filed. This claim was not for properties identified as damaged in the Task Force No. 2 Report, and has thus been disallowed.

Infrared Photography and Interpretation for Distressed Vegetation (Work In Progress)

While the second Task Force reported that some visually detectable herbicide drift had occurred from the 1969 spray project, extending approximately one-fourth mile north of the project, their assessment did not include previous years' effects, nor was it concerned with delineation of the sprayed area as a whole.

In order to more accurately define the limits of herbicide effect on plants from all years of spraying, aerial infrared photography has been employed. Interpretation of these aerial photographs has made possible a preliminary delineation of the exterior boundary of distressed and dead vegetation. Both the visually detected drift line reported by Task Force No. 2 and the External Limit of Infrared-detected distressed and dead vegetation are shown on the appended PRELIMINARY map. It is important to note that internal exclusions have not been delineated and that field verifications are not yet completed for the infrared interpretation.

Environmental Effects (Work in Progress)

Work is underway in this study to assess the total effect of the Kellner Canyon-Russell Gulch Project on the environment. Some of the key considerations included in this study are listed below.

1. Possible further evidence of drift of herbicide sprays through such herbicide residues as are detected in soil samples north of the project area. Initial soil sampling was within the project and on two transects toward the

northeast corner of the project. This corner was selected as the best to test the hypothesis that soil residues from drift might be found, since prevailing winds are from the Southwest.

Initial laboratory analysis reports have indicated low concentrations of Silvex and 2, 4-D at some locations (maximum detected concentration off the project to date is 0.16 p.p.m. Silvex). Especially at these low levels of concentration, it is possible that other sources of contamination may induce "background" which could lead to erroneous conclusions. For this reason, we are proceeding to cross-check analysis procedures while, at the same time, widespread sampling north of the project is scheduled.

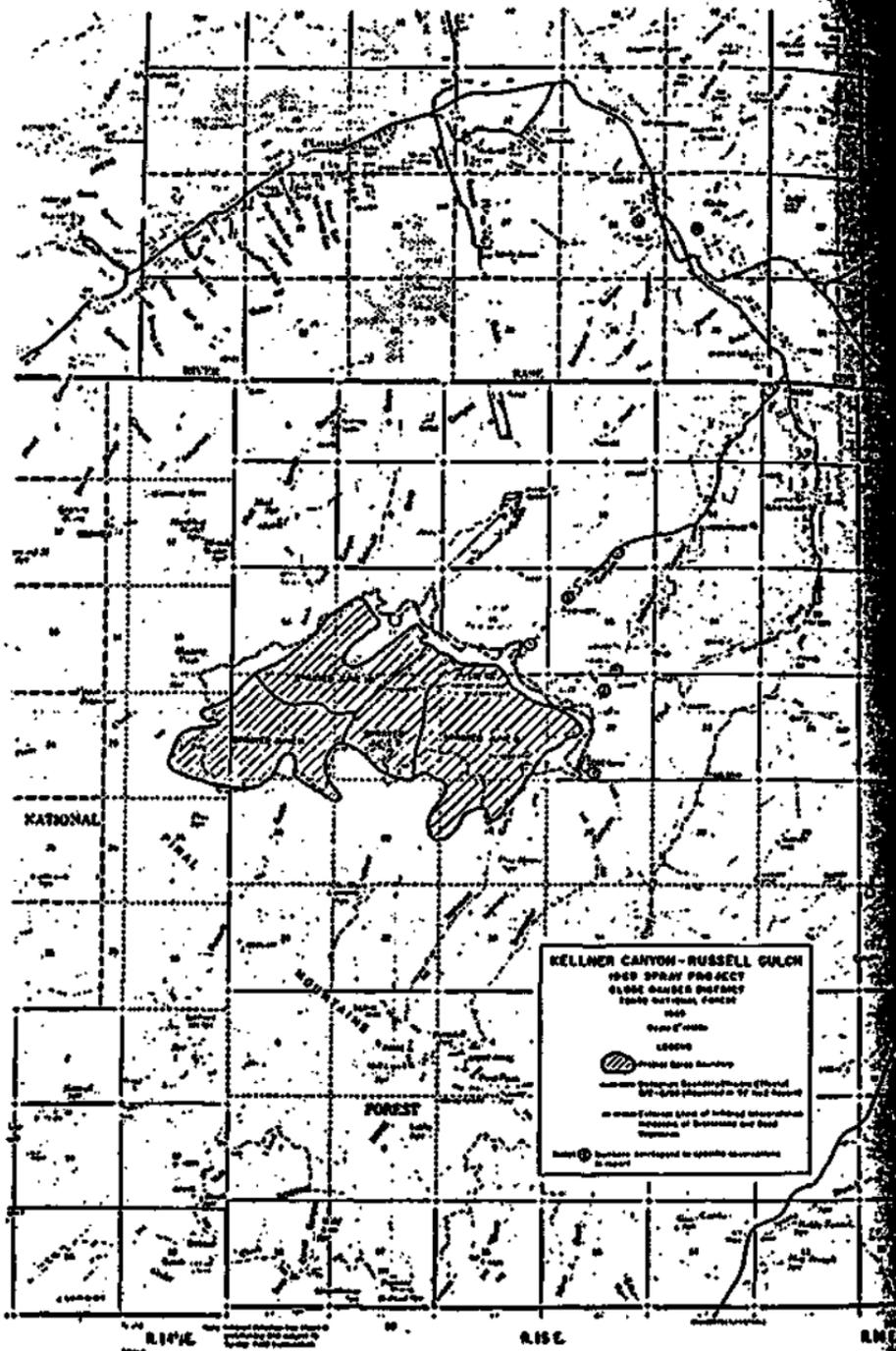
It would be premature to reach any conclusion regarding drift at this time.

2. Herbicide levels in water samples. Water sampling and analyses have been underway for some time. Project methods called for interruption of application at all stream channel crossings, and as far as we have been able to determine, no herbicide was applied directly to water. Some soil-leaching and runoff is to be expected. All samples we have taken, or taken by private individuals and brought to our attention, are less than the Federal water quality criterion of 0.1 p.p.m. 1/
3. Effect of Treatment on Esthetics. While it is evident the dead vegetation over this area is not pleasing, our concern here is with the next needed steps to actually provide enhancement of the scenic resource. It is sometimes necessary to tolerate temporary degradation of the appearance of an area as a cost of ultimate improvement. This study is intended to better define tolerable limits, explore alternatives, and recommend treatments to completion. Concurrently, we are assessing the past, present, and projected fire hazard in order to build conflagration control concepts into the landscape design.
4. Effects on Animals and Plants. Initial observations by wildlife experts have shown no marked effect upon wildlife.

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1/ Surface water criteria for public water supplies table appearing in: Water Quality Criteria issued as a report to the Secretary of Interior, April 1, 1968, and published by the Federal Water Pollution Control Administration.

PAGES 160 AND 161 MISSING FROM LIBRARY COPY



PRESS RELEASE - February 20, 1970

Government Interdepartmental Panel of Scientists

The panel is carefully examining the evidence collected during its visit. The study will continue and will include analyses of the numerous samples of blood, soil, water, fruit and plants for the herbicides, a possible contaminant (dioxin), as well as various agents producing disease in man, animals and plants. However, to date, we can summarize a few of our findings as follows:

1. The application of herbicides in the Pinal Mountains near Globe, Arizona was made by the Tonto National Forest starting in 1965. The most recent application of the herbicide was made by helicopter on June 8, 9, 10 and 11, 1969.
2. The materials used in the treatments in 1965, 1966, 1968 and 1969 included 2,4-D, 2,4,5-T, and silvex. These chemicals came from different sources. In 1969, 30 gallons of 2,4,5-T produced by the Hercules Chemical Company and 935 gallons of silvex produced by the Dow Chemical Company were used. The silvex is reported by Dow Chemical Company to contain less than 1 ppm of the dioxin. Analyses will be made of silvex and the other herbicides for dioxin and the active herbicide ingredients.

3. There are reports of the aircraft flying over private properties but not spraying; and other reports of the herbicide being applied just outside the project area. There is clear evidence of drift of the herbicides on a number of plants on some of the nearby properties.

4. Human illnesses have been reported by several residents in the Globe region. Many of the residents with complaints were interviewed by a medical member of the panel. These are complaints that commonly occur in the normal population; the eye irritation in one individual may be related to the spraying. Nine doctors serving the area of Globe were interviewed and there was general agreement that there had been no significant increase in human illness related to the spraying. However, blood samples were obtained and additional studies are planned to verify or rule out this possibility.

5. Reports from the wildlife specialists indicate no significant effects on birds, deer, and other wildlife. There are reports of reductions of birds on a few properties but there are other reports that bird and other wildlife populations in and near the project area are normal.

6. Information obtained from owners of livestock and observations of animals did not indicate any illnesses that do not commonly occur in other regions. It is doubtful that the spraying of the herbicides or dioxin caused the afflictions in the goat and duck because the goat was born before the treatment and the duck was hatched about 4 miles away from the treated area.

7. There was evidence of woody plant mortality from root rot, and also visible damage to certain yard trees from several kinds of insects and woodpeckers or sapsuckers. Other plant injuries were observed that appeared to be caused by low soil moisture, air pollution and unusual soil properties.

8. The phenoxy herbicides following normal use do not usually persist for more than 8 months in soil and water. Additional analyses are in progress to determine the presence or absence of herbicides.

Senator HARR. We are adjourned to resume on the 15th of this month in this room.

(Whereupon, at 5:15 p.m., the Subcommittee was adjourned, to resume on April 15, 1970.)