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Repealed Darrow
DEPARTMENT OF THE ARMY
FORT DETRICK
FREDERICK, MARYLAND 21701

10 March 1971
10 March 1971

IN REPLY REFER TO:
AMKFD-PSL-PH

SUBJECT: Minutes - Meeting of Vegetation Control Subcommittee of the
JTCC/CB, 2-3 March 1971

TO: SEE DISTRIBUTION

The attached Minutes and Meeting Agenda of Vegetation Control Subcommittee of the JTCC/CB, 2-3 March 1971 are forwarded for approval and retention. Any comments should be addressed to the Secretary.

- 5 Incl
1. Agenda
2. Minutes
*3. Trip Rpt of AAAS Mtg
*4. AAAS Panel Session
*5. Trip Rpt of CINCPAC Mtg

Robert A. Darrow ✓
~~ROBERT A. DARROW~~
Subcommittee Secretary
JTCC/CB Subcommittee on Vegetation
Control

FD-PSL-PH

10 March 1971

SUBJECT: Minutes - Meeting of Vegetation Control Subcommittee of the
JTCG/CB, 2-3 March 1971

DISTRIBUTION:

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Mr. W. Vandeventer (SAOQT), San Antonio Air Materiel Area, Kelly AFB,
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Mr. Eldon V. Orton (MONTMB), Ogden Air Materiel Area, Hill AFB, Utah 84401

Dr. C. E. Minarik (AMXFD-PSL), Plant Sciences Laboratories, Fort Detrick,
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✓ Mr. M. G. Solomon (AFATL/DLGI), Armament Development & Test Center,
Eglin AFB, Florida 32542

Mr. C. Heineman, Naval Air Systems Command, CODE: AIR-53222C, Washington,
D.C. 20360

Dr. Robert A. Darrow (AMXFD-PSL-PH), Plant Physiology Division, Fort
Detrick, Maryland 21701

Associate Members

Dr. W. F. Warren, Scientific Advisory Group, CINCPAC (J3A1), FPO 96610

LTC James Turner, Cml Opns Officer (J3-09), Headquarters MACV, APO
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COL H. C. Kinne, Jr., NBC Branch, J-5, Joint Staff of JCS, Washington, D.C.
20310

LTC R. T. Seaman, DCSOPS-SW Division, Hq USARPAC, APO San Francisco 96558

Mr. Werner Beyth, USA, MUCOM-RE-RT, Dover, New Jersey 07801

CF:

Mr. M. G. Ringenberg (SMJEA-CC), Edgewood Arsenal, Maryland 21010

Mr. M. L. Carter, USAF Logistics Command/MCNW, Wright-Patterson AFB,
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Mr. Harry Sweet, (AFATL/DLGI), Eglin AFB, Florida 32542

Mr. Albert Waschler, USA, MUCOM, AMSMU-RE-CN, Dover, New Jersey 07801

Mr. A. E. Bayvard, Ass't Dir (Environmental & Life Sciences), Ofc Dep Dir
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DOD JOINT TECHNICAL COORDINATING
GROUP, CHEMICAL/BIOLOGICAL

Quarterly Meeting
of
Subcommittee for Vegetation Control

2-3 March 1971

AGENDA

Tuesday, 2 March 1971

0900 - Meeting Convenes. Chairman, Mr. M. G. Solomon (Eglin AFB)

Review and approval of minutes of last meeting.

0920 - Subcommittee Reports.

U. S. Navy - Mr. Heineman
USAF/AFLC - Mr. Vandeventer
USAF/AFSC - Mr. Orton
USAF/AFSC - Mr. Solomon

1130 - Lunch.

1300 - Subcommittee Reports (Cont'd)

U. S. Army/Fort Detrick - Dr. Minarik

1400 - Technical and Operational Reports by Associate Members.

DOD/JCS: Herbicide Policies and Programs

Pacific Command: Status of Vegetation Control Program in SEA

1600 - Adjourn.

Wednesday, 3 March 1971

0830 - Administrative Announcements.

0845 - Discussion.

Herbicide ORANGE Disposal

Restriction on Use of Vegetation Control Agents in SEA and
CONUS

Research and Development Projects

1130 - Lunch.

(cont.)

1300 - Discussion.

Status of AAAS and National Academy of Science Surveys
of Defoliation in SEA

SEA Operations

Recommendations

1500 - Adjournment.

ing Papers for Limited Distribution and Do Not Represent Coordinated
Staff Positions

Minutes of Quarterly Meeting
Vegetation Control Subcommittee
(formerly Defoliants/Anticrop Systems Subcommittee)

Eglin AFB, Florida
2-3 March 1971

1. Meeting was called to order at 0845 by Marshall Solomon, Chairman.

Participants

Members

Marshall G. Solomon, Eglin AFB,--Chairman
Robert A. Darrow, Fort Detrick, Secretary
Charles E. Minarik, Fort Detrick
Carl R. Heineman, Naval Air Systems Command

Associate Members

Werner W. Beyth, USA, MUCOM
COL Charles H. Sunder, OJCS J-4
LTC Richard T. Seaman, CINCPAC

Visitors

COL John E. Hicks, DEN-AFATL, Eglin AFB
MAJ Reed J. Olsen, DLNA-AFATL, Eglin AFB
CPT John H. Hunter, DLNA-AFATL, Eglin AFB
CPT Benny D. Pate, DLNA-AFATL, Eglin AFB
Don D. Harrison, DLNA-AFATL, Eglin AFB
Billy C. Wolverton, DLNA-AFATL, Eglin AFB

2. Minutes of the previous meeting (8-9 Dec 1970) were approved with correction of the statement concerning the proposed transfer of CB defoliation projects from Air Force to Army.

3. Reports by Committee Members:

a. Carl R. Heineman, Naval Air Systems Command

No activity in vegetation control was reported for Naval Air Systems Command. Navy has an interest in the disposal procedures which may be developed for stockpiles of herbicides.

It was reported that Navy riverine craft in RVN have been turned over to GVN. Chairman Solomon requested information on test results in RVN of Operation Douche.

b. Wayne Vandeventer, USAF/APLC (report read by Marshall Solomon, Chairman in absence of Mr. Vandeventer)

(1) Disposal of ORANGE

No official word has been received on the destruction or continued use of this material. A letter was sent through channels to Headquarters U. S. Air Force 19 Feb 71 outlining the burning method, costs, location, time required, etc., but it was all based on theory in relation to incineration equipment being developed for Rocky Mountain Arsenal. Incineration of ORANGE at Gulfport, Mississippi, Johnston Island or other locations would involve air pollution clearances and other safeguards.

(2) Use of Herbicides in SEA

No supply support is now being given to SEA activities. Apparently use of WHITE and BLUE has been reduced to a minimum or these herbicides are no longer being used.

(3) Contractor Termination Inventory

Some of the normal butyl ester 2,4-D on hand at the termination of ORANGE procurement contracts is being stored at Kelly AFB, Texas. SAAMA has received a request from Army for enough of this material to control weeds on 45,000 acres at Fort Riley, Kansas. No word has been received on final arrangements for use of the 2,4-D.

* (4) Contractor Survey

A letter was sent to DSA recently, again asking that an industry-wide survey be made to determine if industry can use, buy, or reprocess our excess ORANGE.

(5) Participation in 23 Feb 71 meeting of Parent Committee of Joint Technical Coordinating Group for Chemical-Biological at Eglin AFB

Mr. Vandeventer, as 1970 chairman of Defoliation/Anticrop Systems Subcommittee attended this meeting to report on subcommittee activities for year 1970. Other subcommittees reporting were: CB Defense, Chemical Agent/Weapon Systems, Marking, Tracking and Detection, and CB Safety.

Review and discussion were given of the 1970 annual report of the Defoliant/Anticrop Systems Subcommittee submitted in January 1971. Considerable discussion resulted on the subject of ORANGE disposal and the agency or group responsible for disposal of the material. Assignment

of this responsibility will apparently be made at the Secretary of Defense level. Army representatives pointed out that there was a communication gap at the JCS level because no request had been made to Army concerning possible use of the Johnston Island or Rocky Mountain Arsenal facilities for incineration of ORANGE.

The JTCG/CB Committee was impressed with the information contained in the 1970 minutes of our subcommittee and requested that these minutes be compiled into a single bound document for reference use.

c. Marshall G. Solomon, USAF/AFSC

(1) Modular Internal Spray System, FWU-5/A

The bonding technique for attaching the externally mounted spray booms to the underside of the aircraft wings was not approved for flying by the Flight Dynamics Laboratory, Wright-Patterson Air Force Base (WPAFB), Ohio. As a result of this decision, flight compatibility testing at Eglin will be delayed approximately 6 weeks, to 12 April 1971, awaiting completion of WPAFB testing. The bonding technique will preclude the necessity of a permanent modification to the aircraft and will allow any one of several cargo aircraft to be utilized for spraying operations instead of being tied to a single one like the Ranch Hand system. Straight pull tests conducted by the contractor on two mounting plates bonded together exceeded 10,000 pounds pull before deformation of the plates occurred. If the WPAFB tests are satisfactory and the adhesive is flight certified, the technique will have a multitude of applications in Air Force RDT&E.

Since Eglin AFB no longer has the capability of assessing the effectiveness of aerosols, due to the closing of the CB Test Grid and Assessment Laboratory, Deseret Test Center has been requested to flight test the Modular Spray System some time in CY-72, or earlier if possible. The FWU-5/A contract is scheduled to be completed by June 1971, but it is doubtful if any testing could be accomplished at Dugway before September or October 1971. This delay will contribute toward a contract cost overrun.

The FWU-5/A system is being developed to provide the USAF with a civil action capability to aeri ally disseminate herbicides, insecticides, or fertilizers on a world-wide basis. Because the system will be compatible with a variety of cargo aircraft, including foreign types, the USAF will be able to provide assistance to the country requiring aid without the necessity of committing American aircraft and personnel to perform the task. By knowing the type of cargo aircraft available in a foreign country, American personnel can provide the appropriate FWU-5/A system(s), the proper liquids for spraying, assist in aircraft modification and training of the foreign crews in spray operations, and then depart the country, allowing the trained crews to accomplish their own spray missions.

This procedure will obviate the use of U. S. military aircraft and prevent embarrassment to the United States and the country receiving aid.

(2) High Speed Defoliant/Insecticide Spray Tank, PAU-8/A

Flight compatibility testing of the new tail fins for the PAU-8/A spray tank was successfully completed in February 1971. Aerosol testing will have to be accomplished at Dugway by DTC. The program is presently in limbo, awaiting revalidation by TAC of the need for a high speed defoliation capability. 7th Air Force indicated there is no longer a requirement for this capability and recommended cancellation of the program. No additional work will be accomplished on the PAU-8/A until TAC resolves the difficulty.

d. Dr. C. E. Minarik, USA, Fort Detrick.

(1) Status of Vegetation Control Program at Fort Detrick

A waiver has been granted through FY 1972 for the proposed move of Vegetation Control Program from Fort Detrick to Edgewood Arsenal. The administrative status of the program during FY 1972 is still undetermined. U. S. Department of Agriculture will take over funding and administrative responsibility for the Plant Pathology Division by the close of FY 1971. Permit use of building 1301 at Fort Detrick will be granted to the Department of Agriculture on or shortly after 1 April 1971. This building currently houses the Plant Physiology Division (Vegetation Control Program) and the Plant Pathology Division.

(2) AAAS Meeting at Chicago 28-29 December 1970 with report of the AAAS Herbicide Assessment Commission

Detailed reports of this meeting are given in Inclosure 3 and taped transcriptions of the panel session on "Implications of Continued Military Use of Herbicides in Southeast Asia" (Inclosure 4).

(3) National Academy of Sciences Ecological Survey

Mr. A. E. Hayward, DDR&E, is project officer for DOD on contract with National Academy of Sciences to conduct an ecological survey of defoliation program in RVN. Thomas R. Dashiell and Dr. C. E. Minarik are assistant project officers on the DOD committee assisting NAS.

Dr. Anton H. Lang, Director MSU/AEC Plant Research Laboratory at Michigan State University, has been named chairman of the NAS committee on the ecological survey. The survey will be conducted under a contract with DOD involving a 6-month period for orientation and review of available data, 6 months in-country survey and 6 months for preparation of final report. An interim report will be submitted by 1 January 1972 as specified under the Defense Appropriation Act. Funds provided for the

contract include \$50,000 to initiate the survey and \$750,000 for the survey and report to be conducted in FY 1972.

Preparations and actions to be taken by DOD personnel in support of the National Academy of Science ecological survey are given in Inclosure 5 as outlined in a meeting at CINCPAC, 8-10 February 1971.

e. Dr. R. A. Darrow, USA, Fort Detrick

Current and prospective research in vegetation control at Fort Detrick includes the following: (i) Evaluation of pinolene as an additive to herbicides such as ORANGE and 2,4-D ester and 2,4-D amine in attempts to increase herbicide efficiency by reduction in rate of application and increase period of foliar absorption; (ii) evaluation of Ethrel, an ethylene-releasing compound, in combination with herbicides in the search for a nonherbicidal defoliant; (iii) field and greenhouse evaluation of growth retardants and soil-applied herbicides with emphasis on control of grasses in perimeter areas.

Two recent publications on herbicides have been released by Fort Detrick:

Technical Memorandum 212. The lateral and vertical movement of four herbicides applied to a grassland soil. October 1970. AD 876 554

Technical Report 114. Field evaluation of desiccants and herbicide mixtures as rapid defoliants. January 1971. AD 880 685

4. Reports by Associate Members:

a. DOD/JCS Herbicide Policies and Programs reported by COL Charles Sunder, OJCS J-4

Recent statements of policy concerning the defoliation program in RVN are given in the following two statements:

White House Statement issued on Saturday, 26 December 1970

"In response to the President's direction to reduce the use of herbicides in Vietnam, the Secretary of Defense has reported the following actions to the President:

"--Steps are being taken to assure that there will be strict conformance in Vietnam with policies governing the use of herbicides in the United States.

"--Ambassador Bunker and General Abrams are initiating a program for an orderly, yet rapid phase-out of the herbicide operations.

"--During the phase-out, the use of herbicides in Vietnam will be restricted to the perimeter of fire bases, in U. S. installations, or remote unpopulated areas.

"--The ban on herbicide known as "ORANGE" remains in effect."

29 December 1970 statement of Jerry W. Friedheim, Acting Assistant Secretary of Defense for Public Affairs:

"Secretary of Defense Melvin R. Laird has, as we have previously reported, taken steps to insure that herbicide usage in South Vietnam will conform to the policies governing usage in the United States. As a result, the stresses and risks involved in South Vietnam will be no greater than those sustained by the United States population and the United States environment in normal peacetime activities.

"Deputy Secretary David Packard last spring restricted all use of defoliant ORANGE, and that ban remains in effect. In addition, at that time use of other defoliants (BLUE and WHITE) was strictly limited to areas remote from population.

"General Abrams is now initiating in South Vietnam an orderly phase-out of the herbicide operations to be completed by next spring.

"It is important to note that estimated herbicide coverage for 1970 through September is 75 percent less than that for the same period in 1969."

On 20 February 1971, Ambassador Bunker and General Abrams publicly announced the end of the use of chemicals to destroy crops in RVN. Limited herbicide operations would continue in remote jungle areas away from heavily populated centers but would be limited to spraying from helicopters and ground machines, in a manner currently authorized within the United States within the guidelines set forth by the U. S. Department of Agriculture.

b. CINCPAC-MACV reported by LTC Richard T. Seaman, CINCPAC

LTC Robert F. Franz has terminated assignment as MACV Chemical Operations Officer (J3-09) as of 28 February 1971. LTC James Turner is his replacement.

The discussions at CINCPAC on 8-10 February 1971 by the DOD committee appointed by Mr. A. E. Hayward, DDR&E, on the National Academy of Science ecological survey and on disposal of herbicides as summarized by Dr. C. E. Minarik are given in Inclosure 5.

... Disposal of Herbicide ORANGE - Discussions led by COL Sunder brought out the following points:

a. The term disposal should be interpreted to include: legitimate use, destruction or removal from storage requirement.

* b. In a recent meeting of the Armed Forces Pesticide Control Board at which Dr. Fred H. Tschirley, U. S. Department of Agriculture, was present, it was emphasized that possible marketing and uses in and out of government of herbicides containing 2,4,5-T are dependent on variation in dioxin content. Use of surplus herbicides would be contingent on validation of source of manufacture and dioxin content.

c. Options for disposal of ORANGE in RVN include:

- Marketing in country
- Destruction at present locations of stockpiles
- Develop uses for herbicide
- Move offshore for temporary storage
- Move stockpile back to CONUS for subsequent disposal

d. Current restrictions on the use of 2,4,5-T may be modified or influenced by:

* Report prepared by the President's Science Advisory Committee indicating that the present curtailment in use was a hasty decision and that the chemical is not as hazardous as publicized.

Study to be completed 1 May 1971 by National Academy of Sciences addressing the validity of the restriction on use of 2,4,5-T. Questionnaires are being sent to farmers and users to assess the experience and safety of this herbicide.

Suit filed by the District of Columbia Court of Appeals against the Environmental Protection Agency to provide information by 6 May 1971 whether or not 2,4,5-T is an "imminent hazard."

LTC Seaman indicated that plans for disposal of Ranch Hand assets including the stockpile of ORANGE in RVN had been prepared by MACV on 1 March 1971 for submission through channels.

6. Report on Ecological Studies of Test Area C-52A, Eglin AFB, Florida

a. CPT John Hunter discussed vegetational changes and ecological studies of the 2 square mile test area which had been sprayed with the following amounts of herbicides over the period 1962-70:

ORANGE	20,626 gallons
PURPLE	16,164
WHITE	4,172
BLUE	4,395

Over the period, four grid locations have been used with the final 1 square mile grid established in 1968. The most extensive testing was done in 1963-64 with PURPLE and ORANGE. WHITE was first applied in 1967 and BLUE in 1968. During 1970 only BLUE and WHITE were applied.

Vegetation samples taken at distances of 0.15 mile to 2.0 miles from the edge of the test grid in 1965 showed three plants to increase significantly with proximity to the sprayed area: poverty weed, golden-rod, and mustard--all associated with a decrease in density of the turkey oak canopy.

Growth ring studies on sand pines adjacent to the test grid showed no significant differences associated with the periods in which spraying occurred. Yucca plants on sprayed areas showed no visible differences in top growth from control plants but had greater development of adventitious roots.

Soil microorganism studies were made of soils with high and low herbicide residues and wet and dry conditions. Algae, bacteria and actinomycetes showed no significant differences in total numbers due to residue level. Fungi showed lower total counts on high residue soils.

Fish population surveys made before and after applications of BLUE showed no effect on fish except for a decline in sailfin shiners. Arsenic levels in streams were at 0.05 ppm throughout the period. Oysters showed no increase in arsenic content.

Arsenic analysis of 16 soil samples from the grid showed only four samples with greater than 1 ppm, no samples had more than 2 ppm arsenic.

Soils at 48 locations sampled to depths of 3 feet were analyzed for ORANGE by bioassay. Only four samples contained more than 4 ppm ORANGE. Dioxin analysis by the Beltsville laboratory of U. S. Department of Agriculture of eight soil cores sampled at 6-inch increments to a depth of 3 feet showed no dioxin present in any sample. Sensitivity of the analytical procedure was 1 ppb dioxin.

b. CPT Benny Pate reviewed results of surveys and animal population studies on the grid test area as related to herbicide residues. Most mammals were found near the permanent water in the center of the grid area.

Six litters of cotton mice (Peromyscus gossypinus) bred from animals captured on the test grid in 1970 showed no abnormal offspring.

Population density studies of beach mice and harvest mice showed counts ranging from 12 animals/hectare on high density/low herbicide residue sites, 8/hectare on high density/high residue sites, 3/hectare

on burned areas with low residue to 0/hectare on areas barren of vegetation. Control samples off the grid contained 6 animals/hectare.

c. Don Harrison reported on greenhouse tests of plant species establishment on soils with high herbicide residues, using tomato, corn, and Bahia grass. Tomato plants exhibited some damage but corn and Bahia grass showed no herbicidal response when grown on soils with maximum herbicide residue obtained in 1970 from the grid area.

Bioassay tests were made with cucumber seeds on soils treated with ORANGE, BLUE and WHITE to which activated charcoal had been added at rates of 1000 to 8000 lb/acre. BLUE was not adsorbed by charcoal. WHITE was adsorbed or inactivated better than ORANGE when herbicide applications of 1, 2, 4, and 8 gal/acre were made to soils.

7. The next subcommittee meeting will be held at Fort Detrick, Frederick, Maryland on 8-9 June 1971. Notification of attendance should be made with Dr. C. E. Minařík, Autovon 231-1350/2202.

Robert A. Darrow

ROBERT A. DARROW
Subcommittee Secretary
JTCC/CB (Joint Technical Coordinating
Group/Chemical Biological)
Subcommittee on Vegetation Control

7 January 1971

TRIP REPORT OF C. E. MINARIK TO AAAS
MEETINGS IN CHICAGO 29 DECEMBER 1970

On Monday evening a meeting on Chemical Warfare in Vietnam was sponsored by the Committee for Environmental Information. The majority of the attendees were student hippies although some responsible establishment types were also present. The formal portion of the program consisted of a movie made by Prof. Bert Pfeiffer of the University of Montana and a showing of slides by Prof. Arthur Westing of Windam College. Prof. Pfeiffer's movie was amateurish but his accompanying narration was very emotional and provocative. His concluding remark which was loudly applauded by the audience was "We've got to get that blankety blank Nixon out of Vietnam."

Professor Westing, who was the Director of the AAAS Herbicide Commission in Vietnam, showed slides of Vietnam-defoliation scenes. At the conclusion of his presentation the crowd attempted to discuss the moral and legalistic aspects of our being in Vietnam and what they must do as activists to get us out of Vietnam. On one occasion when Westing mentioned that his Marine major escort was killed the following week at a location that Westing pictured, the audience applauded. When the statement was made that defoliation prevents ambushes by the enemy a member of the audience suggested that we re-evaluate that term. He stated that we--the Americans--are the enemy and not the NLF.

Following the meeting I had a long session with the two speakers, an officer of the Committee for Environmental Information and the editor of their journal, "Environment". Incidentally, the hat was passed after the formal meeting and approximately \$175 was collected.

The Tuesday morning session was opened by Dr. Bentley Glass, retiring president of the AAAS, who reviewed the history of the herbicides in Vietnam within the AAAS.

Next, the Chairman of the session, Dr. Kenneth Thimann, introduced the speakers. It appears that all members of the Commission have had or have some connection with Harvard. Dr. Thimann taught at Harvard for many years. Dr. Meselson is currently on the staff. Dr. Constable did his undergraduate work there and also received his MD from Harvard. He is currently on the staff of Harvard associated hospital. Dr. Westing was a Harvard undergraduate and received his PhD at Yale.

Meselson described their activities in Vietnam and the support that they had received while overseas. He stressed the crop destruction mission at Song Re in much the same manner as in his letter to Ambassadorunker and to Gen. Abrams. He stressed the effects of defoliation on the lumber industry and on the mangrove forests. He suggested that defoliation is causing coastal erosion. Destruction of mangrove forests is affecting fish populations, although Tschirley reported the opposite. He attributed

increased fish catches to greater use of motorized fishing vessels and fishing at greater distances from shores.

Dr. John Constable reviewed their medical survey and stated that rather than make a survey of the entire country, they would make an intensive survey of one province. He reviewed LTC Cutting's data which showed, if anything, a decrease in birth defects and still births. By eliminating the data from the city of Saigon, Constable showed an opposite trend. His own data also showed a possible 5% increase in still births. He was good enough to state that the data were not conclusive.

Dr. Westing dwelt on the effects on forestry. Taking Barry Flann's data, which are not too harmful to the defoliation program, Westing showed that we are destroying 37% of the RVN's lumber needs per year. The fact that they can cut all of their needs from the dead trees and not have to touch a living tree for several years was not mentioned. Westing also discussed the mangrove forests.

The ensuing discussions were quite brief because the formal presentations took up practically all of the allotted time.

The formal AAS Commission report will not be available for several months.

Phillip Boffey of SCIENCE staff asked if I would care to give him my comments on the Commission report. Time and other considerations did not permit me to comment.

Dr. Dael Wolfe, formerly of the staff of SCIENCE, also asked my views. I stated that Meselson presented a one-sided picture and that the other side needed to be heard.

At the afternoon session which I attempted to tape, Dr. Scoville opened the session with an announcement from the White House that defoliation operations would be terminated by next spring and that until then herbicides would be used only in isolated areas under VC control.

Meselson continued his discussion and mentioned such comments from the "highest military authority in Vietnam" that defoliation was a miserable failure, etc. He discussed linear and block defoliation and anticrop operations. In the linear defoliation--along LOC's--he stated that decrease in ambushes frequently were dug to other types of military activity. Where block defoliation reduced need for large military forces, he attributed this to unrealistic planning.

Prof. Bunn discussed the legal aspects of anticrop warfare and quoted from the Hague Convention and subsequent pronouncements on the scorched earth policy. He repeatedly stated that to destroy the crops and agricultural land of civilians was contrary to international law. In subsequent discussions on this subject EG Stone was practically tried as a war criminal.

Gen. Stone gave an excellent paper on the use of herbicides in Vietnam. It was very similar to the paper that I prepared for the AIBS meetings last August.

Gen. Stone also attacked Meselson's report on the Song Re crop destruction mission. These comments had been prepared by LTC Bob Franz, MACV Chemical Officer.

Gen. Stone did an outstanding job in answering the critics and refuting Meselson.

Dr. Tachirley did an excellent job in reviewing the dioxin problem and stating that there is no hazard in using 2,4,5-T according to present approved procedures. From the practical standpoint one could not possibly get a hazardous dose of dioxin from using 2,4,5-T at the rates used in the United States.

Samuel Popkin, a sociologist, reviewed effects of herbicides on the life in villages. Although there is no intent to destroy crops of friendly natives, the crops are in fact inadvertently destroyed on occasion. The peasants find it difficult to understand that these operations are not directed against them.

One member of the audience inquired about the Globe, Arizona case where herbicides were supposed to have caused birth defects in a duck and a goat. Dr. Tachirley set the record straight--this was a hoax. The questioner asked why no publicity was given to the discovery that this was a hoax when so much publicity was given to the original inaccurate claims.

Congressman McCarthy made some very brief comments of no consequence. However, he did state that when he visited Fort Detrick several months ago he asked the question, "How could Fort Detrick recommend use of 2,4,5-T in Vietnam without having first run teratological studies?" He said he did not receive a "satisfactory" answer.

The Bionetics report on 2,4,5-T also came up for discussion. Dr. Thimann stated that withholding the data for several months was justified because the experiments were poorly planned and the significance of the data were not readily apparent. He criticized the use of the Sprague-Dawley strain of mice that normally produce 30% birth anomalies. He also stated that if used properly 2,4,5-T would not be a practical hazard to man or wild life because of the low content of dioxin to which they would be exposed. He stressed that ink, gasoline, paint and other liquids, if drunk instead of being used as they were intended might be harmful but if used as intended they were harmless.

In general, the afternoon session was attended by only about 80 people, about 20% of whom were the press. Only approximately 10 attendees were hippies--one of whom tried to read a People to People peace treaty between North Vietnam and the U.S.--by-passing the respective governments.

During the luncheon break I was permitted to see a propaganda movie brought back from Paris by Prof. Pfeiffer. Since the film was 35 mm, Pfeiffer had difficulty in finding a place to show it. It was finally shown to me in the CBS studio. I made three comments on it. (1) The defoliation scene looked more like H.E. damage than chemical defoliation. (2) Responses of plants shown may have been herbicide responses since that was what herbicides were developed to do. (3) Human and animal responses shown could not be attributable to herbicides since they do not cause such symptoms at the rates used in Vietnam. Our herbicides are non-toxic to man and animals.

In general, the facts presented at the formal sessions were not too different from what we know and accept. The conclusions drawn from them differ diametrically from our own. This is due to the bias of some of the speakers.

An attempt was made to tape the afternoon session. When the tapes have been transcribed, the reports will be distributed.

C. E. MERRICK
Director, Plant Sciences Laboratories

Dr. Herbert Scoville, Jr., Chairman

Dr. Scoville started the session by reading a White House announcement that vegetation control operations were to be terminated by next spring and that the only authorized use until that time would remain vegetation control around base camps and in remote sparsely populated areas.

Before the tape recorder could be set up the first two points of his introduction were lost.

3. What is the effect on the people of Vietnam who we are trying to whose minds we are trying to win and who we are trying to get over to our side and

4. What are the international legal aspects and consequences of the use of herbicides in Vietnam. We have the Geneva Protocol coming up for ratification shortly and this is a very important question. What does the, what is the effect of our use of herbicides in Vietnam on the proliferation of this type of warfare in other areas and also to escalation to this type of chemical warfare to lethal and more dangerous agents. Finally, looking at all these together, what are the overall consequences of the U. S. having carried out this type of action over the years on such an extensive scale and with that preamble I think I will shut up. I have probably talked longer than a chairman is really entitled to talk but since I am the chairman no one could stop me. I think I would like to ask Fred Tschirley if he would like to lead off.

AAAS Panel Session

PM 29 December 1970

"Implications of Continued Military Use of Herbicides in Southeast Asia"

Dr. Herbert Scoville, Jr., Chairman

Participants

Fred H. Tschirley, Agricultural Research Service, U. S. Department
of Agriculture

General William Stone, USA Retired, formerly CG, ACSFOR

Samuel Popkin, Department of Government, Harvard University

George Bunn, Professor of Law, University of Wisconsin

Honorable Richard D. McCarthy, U. S. House of Representatives

Matthew Meselson, Department of Biology, Harvard University

Fred H. Tschirley

Two years ago at the AAAS meetings in Dallas I spoke to a group that was assembled on my impressions of the ecological consequences of the use of herbicides in Vietnam and those discussions were restricted to the defoliation program and had nothing whatsoever to do with the crop destruction program. Because I have already presented my views on what I think the ecological effects will be and since there has been an entire, almost an entire morning devoted to this subject, there is hardly any advantage to be obtained from my going through that again, so what I would like to do as an alternative is to discuss with you for a few brief moments what we now know about a contaminant that occurs in 2,4,5-T. The work that I will be presenting has not yet been published so I think it will be new to most of you who are in this room.

The problem with the contaminant in 2,4,5-T, insofar as general public knowledge is concerned, arose on October the 29th last year when a press release from the office of Science and Technology informed the public that 2,4,5-T that was used in a study by Bionetics Laboratories resulted in fetal abnormalities in experimental test animals. Very shortly thereafter a question was raised as to whether this result was a consequence of the 2,4,5-T itself or whether it was a consequence of a contaminant which was known to occur in 2,4,5-T. A subsequent analysis of the sample that was used by the Bionetics Research Laboratories revealed that it did, indeed, contain this toxic contaminant at a level of 27 ± 8 ppm. The specific contaminant of which I speak is the 2,3,7,8-tetrachloro-dibenzo-para-dioxin, commonly referred to as dioxin.

You must understand that there is a family of these chlorinated dioxin compounds, but it is the tetrachloro substitution which is the most toxic and is believed to have the most severe adverse effects.

After it was learned that the sample used by Bionetics did contain a high level of the tetrachloro dioxin, representative scientists of the Dow Chemical Company and of the Food and Drug Administration met together to establish some protocols for further testing with 2,4,5-T to try and establish whether or not it was the 2,4,5-T itself or the dioxin which had actually caused these fetal abnormalities. Essentially, without going into a great detail, what was found was that a production grade 2,4,5-T in the Dow studies at rates ranging up to 24 mg/kg were not teratogenic in rats. The Dow Chemical Company also tested the tetrachloro dioxin on rats and found there was no effect at a level of 0.03 mg/kg but some effects did become apparent at a level of .125 mg/kg. So from their studies it was established that the dioxin was, indeed, a teratogen, and a potent teratogen, but that the production grade 2,4,5-T was not teratogenic in rats at least in rates up to 24 mg/kilo.

Tschirley - continued

The National Institute of Environmental Health Sciences also conducted studies and in their studies on rats they came to essentially the same conclusion as Dow did from their studies but in further studies on mice the NIEHS studies showed that at rates of 100 mg/kg the production grade 2,4,5-T did result in terata. I should say at this point that the NIEHS studies on mice were all conducted by subcutaneous injection of the 2,4,5-T and the carrier was dimethylsulfoxide.

It's of interest, too, that there are a couple of reports in the literature which demonstrate that DMSO, dimethylsulfoxide, itself, can be a teratogen although admittedly at higher rates than were used when the DMSO was used as a carrier in the NIEHS studies. So this brought us up to the situation in which studies had shown that terata were not caused in rats but they were caused in high dosages in mice. Additional work, of course, needed to be done.

I would like to relate to you now some of the specific work that the Department of Agriculture has conducted to shed more light on this total dioxin problem. For those of you who are not yet aware, the tetrachloro dioxin is not a nice compound. It is an extremely toxic one. The LD₅₀ on guinea pigs, which so far as we know is the most susceptible test animal, is .0006 mg/kilo, so it is an extremely toxic material. One of the things that we wanted to know soon was the relative level of this dioxin in various classes of pesticidal compounds. So, together with FDA we decided on a list of 18 different compounds which should be analyzed to determine their dioxin content and what we are concerned with here is the tetrachloro dioxin.

On the basis of this survey with the phenoxy materials, out of a total of 79 compounds, 53 of them had less than .10 ppm of the tetrachloro dioxin; 5 out of 79 were in the range from .1 to 1 part per million; 9 were in the range of 1-10 parts per million and 12 were in the range of more than 10 parts per million. We also tested a number of chlorophenols and found that there the tetrachloro dioxin occurred in 14 of those compounds but always at a rate lower than .10 ppm; .1 ppm there was the limit of detection.

In other materials which we suspected might contain the dioxin as a contaminant, we found none. So we did, in summary, in capsule summary, we did find the dioxin in phenoxy compounds; we are not sure whether we found it in chlorophenols or not because we were at the limit of detection but if it was there it was less than .1 ppm. I might mention at this point that despite the fact that 12 of the 79 samples contained greater than 10 ppm of the dioxin, that these samples belonged to one chemical company which has since gone out of production of 2,4,5-T and our information to date suggests that the 2,4,5-T that is now on the market contains one-half or less parts per million of the dioxin.

Tschirley - continued

We were interested immediately, also, in how persistent this compound is in the environment. Naturally, not enough time has elapsed so that we can get a clear handle on this but as soon as we were fortunate enough to have Dow Chemical Company supply us with labelled material we did institute some studies on the persistence of this material in soils. We now have 160 days data and these data suggest that at the end of 160 days we can account for about 95% of the dioxin that was put into the soils. Two different soils were used, one a Lakeland sand which has a very low microbiological activity; the other one a Hagerstown silty loam which has quite a high microbiological activity. In both cases, however, we could recover about 95% of the material that had been originally applied. So, it would appear at this point that in the soil the tetrachloro dioxin is quite a stable compound.

We were also concerned about whether or not plants will absorb the tetrachloro dioxin from the soils, and if so, at what concentrations. We used soybeans and oats as test plants in laboratory studies and found that of the amount that was present in the soil, a maximum of .16% was picked up by the plants. The maximum concentration in those plants peaked at 10-15 days and declined thereafter. We don't know the reason for this decline--whether it moved to the surface and was volatilized or whether it was metabolized. We simply don't have that answer yet but it is a question that we are working on.

It is also important to emphasize that in these plant uptake studies it was necessary to apply a very high level of dioxin. By calculating on the basis of the uptake of other similar organic compounds and the specific activity of the radioactive materials that we had at hand, we had to apply 40,000 times as much of the tetrachloro dioxin as the soil would receive by a normal agricultural application. By a normal agricultural application I am talking here about 2 pounds per acre. So we had to apply extremely high quantities simply in order to be able to detect this material in the plants.

It's also interesting that even though it was possible to detect the small amount of material in the foliar portions of the plants, we carried these plants through to maturity but in no case were we able to detect the dioxin in the seed, either in the bean of the soybean nor in the grain of the oats.

We were also interested in whether or not the compound, tetrachloro dioxin could be photodegraded. In laboratory studies under a lamp with an emission of 310 nanometers we found that the half-life of the tetrachloro dioxin was about 3½ hours. This was in a methanol solution. So, it is photodegraded quite rapidly under those situations.

We also put some of the tetrachloro dioxin into methanol, sealed it in ampoules and exposed it to sunlight. Here again the photodegradation occurred quite rapidly.

Tschirley - continued

We don't have real good information on just what the situation is in water. We are reasonably confident that the photodegradation in water is not as rapid as it is when in methanol solution so we are still in the process of attempting to determine in a fairly precise manner at least how quickly one might expect photodegradation to account for or to degrade some of the material that would be introduced into the environment under natural circumstances.

In the laboratory studies we have shown that the tetrachloro dioxin is degraded to the trichloro and this has been proven by mass spectrometry studies and we assume that there is further dechlorination down to the di- and the monodioxins. It is only the trichloro dioxin which has been definitely established at this point.

We were also interested in the movement of the tetrachloro dioxin in the soil. Again in laboratory studies using three different soils we were able to establish that the compound is essentially immobile. This was true even in a soil such as Lakeland sand which is about 95% sand. This is quite surprising and I am not sure whether I am completely ready to believe this as yet or not because one would think that simply by mass flow of a large amount of water that some of the dioxin would carry with it. However, the laboratory studies don't suggest this. But it is indicative certainly that in your heavier soils the movement of this compound is going to be restricted to the surface layer of soils. This is important I think, because if it is restricted to the surface layers of soil then it will be less readily picked up by plants. On the other hand, of course, it is the surface soil which is subject to erosion and thereby this material might be moving into the water courses.

From the work that we have done, we don't, let me say I, I don't feel at this time that the possibility of ingestion of an adequate amount of dioxin to cause damage is a very real possibility and I say this for a number of reasons. One of these is that the current production of 2,4,5-T, insofar as we are aware, and I think we have got a good handle on this, the current production of 2,4,5-T contains one-half or less ppm of the tetrachloro dioxin. We know that photodegradation occurs; it is faster in methanol than it is in water but this could very well account for some degradation in the environment. We know that plants will pick up the material, but only a very small amount of it, less than .2 or 1% of the tetrachloro dioxin present in soil was absorbed by plants and it did not accumulate in the plants. It built up to a peak and then that peak fell off. Again, we don't know just exactly at this point what happened to that--whether it volatilized or whether it was metabolized. It's important, extremely important, I think, to know that the dioxin did not occur in the seeds of the crops that were grown to maturity. And lastly, I base the conclusion that the possibility of hazard from the dioxin is a remote one is that terata have occurred in test animals only when those test animals were subject to massive doses. There is a remaining question that must be

Tschirley - continued

answered and that is the possibility of the accumulation of the dioxin in fatty tissues. Its chemistry would suggest that this is a possibility that would happen. On the other hand, there is no proof either one way or the other that it does not accumulate. The evidence that we have at hand now is entirely circumstantial, secondary and one can argue either way. The pure and simple fact of the matter is that at this point we don't know so we do have to find out whether or not the tetrachloro dioxin does accumulate in fatty tissues. If it does, there are, of course, problems. If it does not, then this is the other side of the coin.

I think I will stop now. Thank you for your attention.

Chairman: Thank you very much. We can have questions at the end.
General Stone.

General William Stone

With Dr. Scoville's permission, I am going to really give what amounts to two short talks. First of all, approximately 10 minutes that I prepared of a rather formal talk on directly what are the military uses and utility of herbicides in Vietnam and I would also like to give about 10 minutes talking specifically to some of the points that were raised by Dr. Neselson and his group this morning, not contesting the validity of what was said this morning but adding points to them which, from my point of view, do change the conclusions that one should draw from what we heard this morning.

However, in keeping with Dr. Scoville's plan for this discussion, I will discuss first of all the military utility of herbicides in Vietnam as they have been employed for defoliation and for crop destruction.

In Vietnam because of this dense vegetation and jungle-like terrain it is difficult to observe the enemy and this certainly is a capability which is essential to any military campaign. Herbicides offered a method of overcoming this most important obstacle by defoliating vegetation. In addition to selective crop destruction we have been able to hurt the enemy's ability to live off the people and the land. Defoliation of the thick undergrowth along highways and canals has been credited with saving many lives while reducing the opportunity for as well as the effectiveness of ambushes. Similarly, the defoliation of protective zones around our base camps has significantly reduced the incidence and success of surprise attacks. The defoliation of enemy supply trails and infiltration routes as well as his base camp areas has enabled us to observe his activities and alert us to his movements.

Crop destruction, although a relatively small part of the total effort, approximately 10% as we heard this morning, has been an important adjunct to the total herbicide program. There are many reports from VC and NVA defectors of the impact of food shortages from crop destruction in remote mountain areas. In many instances the enemy has had to divert a major portion of his manpower to the transportation and growing of food for their own use. Crop destruction is now confined to areas where there is no known native population not under the direct control of VC or NVA. In any large-scale operation involving many variables and particularly in a war which is constantly changing such as we have here, it is extremely difficult to obtain quantitative data which then can be used in a clear cause and effect type analysis as we would like to determine a benefits versus cost analysis.

As a scientific body the AAAS would certainly like to see good base line or control data as well as an up-to-date analysis of pros and cons. It does not exist up to this point in time. We, too, in the military would

Stone - continued.

like to see this analysis and data. But it is clear, however, that especially to the military man on the ground, and there is general unanimity on this, although not 100%, that the use of herbicides in Vietnam has in many instances saved lives. Although, again, we have no specific number to offer. Commanders at all levels attest to their effectiveness when properly used, while recognizing that their use has been controversial in terms of ecological effects and more recently the possibility of there being teratogenic effects as well. It was because of this latter possibility that the Deputy Secretary of Defense last spring, April, suspended the use of ORANGE pending obtaining additional data which would clear the agent. This has not yet been possible. In 1968 the American Embassy in Saigon sponsored a detailed review of the herbicide program with particular emphasis on the economic and socio-political aspects. The review found that the defoliation program work was worthwhile, stated that the military value outweighed the known adverse effects as of that point in time. However, as a result of the review, improved controls were instituted to minimize the accidental spraying of rubber trees and other crops which had occurred as we again heard this morning. These improved controls reduced South Vietnamese civilian complaints of damage to friendly crops from some 30 a month in 1967 to 3 a month by early 1969.

By way of comparison, it is interesting to note that in 1965 there were 259 cases of herbicide drift damage to crops in North Carolina alone. Investigation of herbicide claims in Vietnam reveals that many farmers have submitted a claim whenever they saw a spray aircraft in the area. Frequently these aircraft were spraying insecticides and the alleged damage was caused by insects, plant disease, or some other cause. For example the very wide spread use of malathion as again we heard this morning.

The most recent study that I have seen on the military effectiveness of defoliation operations was conducted in the late 1968 by MACV and produced evidence from both intelligence sources and after-action reports as to the effectiveness of herbicides. I would like to cite a few examples that are in this report that have also come up subsequently.

First of all, the banks along the two rivers in the An Xuyen Province were defoliated. In the year prior to the spraying there had been 5 attacks of river boats, but none in the year following. VC tactics changed from attack of boats and military and civilian facilities to harassment accompanied by a decrease in the intensity of the action. We believe that defoliation was a significant factor although we certainly cannot say the only factor in this changing tactic.

Second, along the major highway in the Kien Hoa province an area of 14 kilometers long was defoliated. In the year prior to the defoliation there has been 145 VC-initiated actions. In the 12 months following defoliation there were only 46. After defoliation there was also an abrupt shift in VC targeting away from civilian objectives.

Stone - continued

Third, defoliation does aid visual reconnaissance. Air Force forward air controllers and Army aerial observers as well have discovered VC base camps and major supply routes in defoliated areas that have previously been undetected.

Fourth, helicopter defoliation operations were conducted in mid-1968 against suspected infiltration routes and mortar and rocket sites in the vicinity of Pleiku City. As a result, aerial observation was possible and Pleiku did not experience any mortar or rocket attacks for over a year subsequently.

Fifth, a portion of national highway No. 4 in the Phong Dinh Province was defoliated in June 1968 after a series of attacks against GVN convoys and troop movements. The area consisted primarily of coconut palms and banana trees that had been abandoned for several years with vegetation so dense that the convoy security elements were unable to see into the underbrush. It required three companies of regional and popular forces and an armored cavalry troop to secure the target prior to the helicopter spraying. After defoliation and for the remainder of the year, convoys used the highway two or three times a week without harassment or attack and only one platoon of popular forces was required to provide local security both to the nearby hamlet as well as to the highway.

Sixth, the defoliation along the main shipping channel through the Rung Sat, which we saw several slides of in Dr. Meselson's presentation, between the ocean and Saigon helped to deny protective cover to the enemy for the ambush of the slow moving merchant ships and the U. S. Navy vessels which were so essential to our operation. Use of defoliants has unquestionably created some problems with the South Vietnamese civilian as we have heard this morning and we will hear more this afternoon. This is as well as political problems here at home and until very recently very clearly in the military view, and in the view of the U. S. Embassy, the benefits have outweighed the potentially adverse effects. Not only have herbicides assisted the military effort but they have been one of several factors benefiting the local economy in many areas by opening roads and canals which had been under enemy control. Many farmers are now able to take their products to market without paying a tax to the VC or worrying about ambushes. probably the fact that we have conducted defoliation has been one of the factors which has enabled this to come about.

In many sections the defoliated areas along roads have been cleared and used for farming. Rather than hindering the small farmer in their attempts to improve their lot in some areas defoliation, in conjunction with road clearing and road building operations, has opened up new markets and new opportunities.

Stone - continued

If you will recall, the Secretary of Defense before the act was passed supported the recent legislation requiring the Department of Defense to contract with the National Academy of Sciences for survey of the ecological effects of our own use of herbicides. I am sure that as arrangements are completed with the National Academy, and they are underway now between the National Academy and the Department of Defense, that the services at all levels will fully support this study.

To date, we in the military believe that our use of herbicides has not created any permanent ecological damage of any significance in Vietnam. I personally still believe this to be the case but recognize that it is clearly a debatable point. I do hold, however, that two points are clear and must be accepted. Herbicides have been militarily useful and have also saved many lives. For example, during the period 17 March to 1 April 1969 Professors Pfeiffer and Orians of the Society for Social Responsibility in Sciences visited Vietnam to survey the damage caused by the herbicide program. They did find some ecological changes and they are generally opposed to the program but in a press interview in New York upon their return, Professor Pfeiffer observed it was completely unrealistic to expect military commanders to abstain from defoliation operations. There is no question about it he said, they do save American lives. On a 65 mile journey while on the boat from Saigon to the sea he said we scarcely saw a living plant. He added, however, that had the vegetation not been destroyed, he and his companion probably would not have returned alive.

This concludes the formal part of my talk which is in the handout and I would like now, with Dr. Scoville's and Dr. Meselson's permission, to address several points that were raised by Dr. Meselson and his supporters in the study which was recently completed.

First of all there is the question of what was the population density in this particular target which is the one that he had the number of pictures of. As the maps did show and was certainly true, a large number of dwellings, small hutches or huts, as they are called, in this area. The map which he saw was dated 1965, was revised as of 1965, was based on considerably older French data. There was no question at one point in time these huts had been occupied. The beliefs of the 203 Committee which includes personnel from the State Department, CORDS, USAID, as well as the military at the time this target was approved, was that this target did in fact contain 8 or less persons per kilometer which is the

The remainder of General Stone's talk was not taped but the following notes were taken:

1. The population was reported by CORDS (?) to be 8 persons/km² or less; not the 5-6000 reported by Meselson.
2. The huts were unoccupied. This is V.C. territory.
3. The old rice fields were put back into cultivation - obviously by the V.C.
4. The bomb craters were made by B-52's and not by fighter aircraft during fire suppression mission.
5. A COSVN directive admonishes the enemy not to fire on aircraft, except defoliation aircraft. This proves that defoliation has been hurting the V.C.
6. If the inhabitants are superstitious and moved because they thought evil spirits destroyed their crops in the August 1970 spraying, as Meselson reported, why did they not move in April when the same area had been sprayed? That target has been sprayed repeatedly for the last several years.

Samuel Popkin had been in Vietnam for some time making a study of the villages of that country and the sociological changes brought about by the war. When Dr. Meselson learned that Popkin was conducting interviews with natives he asked Popkin to get information on the effects of herbicides from the farmers.

The first part of Popkin's talk was not taped.