UNCLASSIFIED

1601

COMMANDER IN CHIEF PACIFIC
SCIENTIFIC ADVISORY GROUP
FPO SAN FRANCISCO, CALIFORNIA 96610

SCIENTIFIC ADVISORY GROUP
WORKING PAPER NO. 10-68

A REVIEW OF THE HERBICIDE PROGRAM IN SOUTH VIETNAM (U)

William F. Warren

Approved by
ROY F. LINSENMEYER
Chief, Scientific Advisory Group

August 1968

This working paper presents the findings of CINCPAC Scientific Advisors. It does not necessarily represent the views or policies of the Commander in Chief Pacific, nor should it be interpreted as an official finding.

COMMANDER IN CHIEF PACIFIC
SCIENTIFIC ADVISORY GROUP
FPO SAN FRANCISCO, CALIFORNIA 96610

SCIENTIFIC ADVISORY GROUP
WORKING PAPER NO. 10-68

A REVIEW OF THE HERBICIDE PROGRAM IN SOUTH VIETNAM (U)

by

William F. Warren

Approved by

ROY F. LINSENMEYER
Chief, Scientific Advisory Group

August 1968

TABLE OF CONTENTS

1601

[redacted] UNCLASSIFIED [redacted]

1601

[redacted]

[redacted]

[redacted]

APPENDIXES

1601

[redacted]

A REVIEW OF THE HERBICIDE PROGRAM IN SOUTH VIETNAM

SECTION I

I GENERAL

A. Data sources for this paper were assembled to support requirement for study of the overall herbicide program in South Vietnam.

B. The information which follows has for the most part been extracted from the references with only minor editorial changes. Refs (a) and (g) have been the source of most of the material in Section II, Background. Section III, Test and Evaluation, has been drawn from refs (b), (c), (d), (e) and (h) while Section IV, Current Operations has been taken mainly from the CHECO report, ref (a). Ref (f) has been used for the first part of Section VII, Results of Herbicide Operations and ref (a) for the remainder of this section.

C. Section VI on Psychological Effects was written by J. T. Ryan of the Social Science Research Team, Scientific Advisory Group, as a separate report and has been included here in abbreviated form because of its pertinency to the subject of this report.

D. Appendix A was drawn from operational reports and intelligence reports available at HQ CINCPAC, while Appendix B was drawn from all of the references, (a) through (d).

E. Appendix C was drawn from two sources: the first section on local VC propaganda was drawn from ref (a), while the second section on world wide communist propaganda was taken from reference (d).

SECTION II
BACKGROUND

A. EARLY HISTORY OF HERBICIDES USED IN MODERN WARFARE

1. The first adaptation of herbicides to modern warfare was marked by British use (Malaya, 1948) of helicopters to dispense chemicals for controlled crop destruction. These missions were, by contemporary standards, relatively safe for friendly helicopters since the Chinese guerrillas in Malaya were ill-equipped to resist this type of air operation and most of the areas covered had been previously secured by ground forces.

2. The first consideration of herbicide operations in the RVN came in July 1961 when CHMAAGV suggested they might be used to improve visibility along communication routes, and to deny the enemy his source of food. As the result of this suggestion, the Combat Development Test Center began research on the practicability of crop destruction and defoliation operations in the RVN with the first test conducted in August 1961, along Route 13 in Chon Thanh province.

3. On 6 December 1961, six C-123s and 69 personnel set up temporary operations at Clark AFB, Philippines. On 7 January 1962, three aircraft were moved to Tan Son Nhut, RVN. The project was named RANCH HAND and was tasked with testing the soundness of the defoliation concept as well as to determine optimum chemical concentrations and methods of delivery.

4. RANCH HAND aircraft flew their first experimental mission on 12 January 1962 on a target along Route 15, northwest of Saigon. In addition to RANCH HAND aircraft, the VNAF used one C-47 aircraft and several H-34 helicopters to test the herbicide concept. Other tests were conducted in the Ca Mau Peninsula region. The initial test continued until 20 March 1962, when they were terminated to await evaluation of the chemical effects on the foliage. An Army brigadier general arrived in Vietnam in April 1962 with a team of herbicide experts from Army Chemical Corps to "determine the feasibility of the use of chemicals applied as spray by aircraft or ground equipment against tropical vegetation in selected target areas in South Vietnam." The team was primarily concerned with the ability of the spray "to improve roadside and jungle visibility as an aid in aerial and ground surveillance of routes of enemy movement and supply, to reduce ambush opportunities for the enemy, and to aid in exposing enemy jungle areas." The team evaluated 21 targets in 11 areas and concluded that, when evaluated from the air, herbicides were 70% effective, and from the ground, 60% effective in improving [redacted]

1601

[redacted]

horizontal and vertical visibility. Heavier concentrations of herbicides, and spray equipment improvements were also recommended.

5. During the period January-March 1962, many training missions were also flown. It was on one such low-level mission, in February, 1962, that a RANCH HAND aircraft crashed, destroying the aircraft and killing the three crew members. The cause of this crash has never been determined. A replacement aircraft was immediately flown from Clark AFB to keep RANCH HAND's strength at three aircraft. In March 1962, the remaining two aircraft were flown from Clark to Vietnam. During the evaluation period, three of the five RANCH HAND aircraft had the spray equipment removed and were used for logistics missions as part of Project MULE TRAIN, also operating out of Tan Son Nhut. On one of these missions, the second RANCH HAND C-123 was totally destroyed while attempting a short field takeoff. The crew, however, was saved.

6. After the evaluation was completed in May 1962, two RANCH HAND aircraft were flown back to the U.S., leaving two in Vietnam to be used for Herbicide operations. One of the two departing aircraft returned to Langley AFB, Virginia, via the Pacific route; the other was sent, by request of the State Department, to help with a widespread locust crop destruction problem in Iran and Afghanistan. After completing this mission, the crew proceeded to Langley via the Atlantic Ocean.

7. Based on the recommendation of the evaluating team, the two remaining C-123s were modified to increase the flow rate to 1 1/2 gallons per acre. Following these modifications, in August 1962, requests were approved for defoliation of six areas along canals in the Ca Mau Peninsula. These operations were conducted between 3 September 1962 and 11 October 1962. One additional C-123 was recalled to Vietnam to aid in these missions, which were personally observed by the Commanding General of the U.S. Army Chemical Corps. These tests were successful and resulted in approximately 90-95 percent increased visibility along the canals.

8. In December 1962, targets were sprayed along roads located in the mountains near the city of Qui Nhon. After these missions were completed, defoliation activities were halted until the advent of the rainy season the following June since the chemicals are most effective during the wet season when the vegetation is growing. During the period January-May 1963, RANCH HAND aircraft were used to fly logistics, navigational aid testing, and radar target missions.

9. In June and July 1963, projects included defoliation of a canal in the Ca Mau Peninsula and along the powerline from Dalat to Saigon. VNAF H-34

1601

[redacted]

helicopters aided in the second operation where mountainous terrain made low-level flying extremely hazardous. During this period the Saigon-Phan Thiet railroad was also defoliated, as well as many other roads and canals.

10. In August, spray aircraft were again used against locusts. Two C-123s flew 17 sorties in Thailand, starting 31 August, completing the project on 16 September 1963. In October and November 1963, RANCH HAND aircraft resumed defoliation missions in Vietnam. Four projects, involving 65 sorties, were flown during these two months.

11. In September 1963, in response to a Department of Defense request, MACV conducted an overall evaluation of all defoliation operations conducted between September 1962 and September 1963, and concluded that defoliation operations had a definite military value in counterinsurgency operations and recommended the program be continued. With subsequent approval by the State and Defense Departments the program increased in magnitude. In January 1964, authority was delegated to division senior advisors for hand-spray operations. This greatly reduced the lag time that had existed from proposal to completion of small defoliation projects: i.e., around depots, airfields and outposts.

B. NIGHT MISSION TRIALS

1. In most cases, during 1963, all of the areas to be defoliated were not secured by friendly ground forces and enemy ground fire was being encountered more and more often. To reduce ground fire effectiveness and to take advantage of optimum weather conditions for herbicide spraying, (i.e. low temperatures and surface winds), night missions were proposed in December 1963. Initial attempts, utilizing a flare-ship to light the target area, proved disadvantageous in that the flares silhouetted the spray aircraft. Additional objections to these night missions noted the reduction of changes for rescue and survival, plus the requirement for targets to be located in relatively unobstructed areas to permit rapid maneuvering - an uncommon situation. Coordination procedures attending the use of flare-ships imposed an additional disadvantage. As a result of these drawbacks, night missions were used sparingly and were never flown over the same target on successive nights. 1087

C. EVOLUTION OF EFFECTIVE FIGHTER COVER

1. During 1963, fighter cover began to be used in conjunction with defoliation missions. However, the rules of engagement in effect at that time precluded the most effective use of this fighter support. Fighter

1601

aircraft were not allowed to prestrike a target, but were limited to defensive actions for rescue operations or post-strike action when the spray aircraft had been fired on by the enemy. Many of the targets sprayed by RANCH HAND crews were not secure and ground fire was increasing as the enemy became aware of the role of the camouflaged C-123s.

2. As happened in 1963, from January to June 1964 RANCH HAND aircraft were used mainly for MULE TRAIN logistics missions and Tactical Air Positioning (Decca) tests. Some projects in the Mekong Delta were completed during this period; largely defoliation of lines of communication and around special forces camps. As 1964 proceeded, ground fire became more accurate as the VC improved their antiaircraft techniques. Delta projects were rapidly becoming among the "hottest" in Vietnam as the VC gained control of the IV corps region. Areas previously secure were now being fortified by enemy forces. Some ground security was realized through coordination with the Vietnamese Navy, who would hit targets as far inland as their weapons permitted but, basically, it was the fighter escort.

D. DEVELOPMENT OF NEW TACTICS TO COUNTER ENEMY GROUND FIRE

1. Because of the increased concentration of VC in the delta south of Ca Mau, the crews of RANCH HAND developed a new "pop-up" delivery technique. This involved flying very low (about 20 feet above the ground) through open areas and then "popping-up" to 150 feet for the spray run over the target. The average number of hits per aircraft per mission amounted to about four until 30 April 1964. On this date, 50-caliber antiaircraft fire and, apparently, air-burst mortar fire was encountered on one mission. The co-pilot of the lead aircraft was wounded and over 40 holes were counted in this aircraft. Missions were suspended pending military evaluation of the situation. The policy was then established to schedule multiple targets in the delta area. This would allow the RANCH HAND crew to break off a hot target and spray one that was not as active. As a further measure, the same target was not sprayed more than two days in succession. This gave the VC little time to amass troops and antiaircraft weapons in the area.

1601

2. During May and June 1964, RANCH HAND moved temporarily to Da Nang to defoliate along dirt roads connecting Vietnamese outposts along the border. These roads wound through mountainous terrain, making spray delivery extremely difficult. On the other hand, the short turn-around time from Da Nang made it possible to fly more missions, covering several targets in a short period of time. This prevented the VC from getting large number of antiaircraft into the target area before the project was completed. As a result of this timely scheduling and spraying, only four hits were sustained during the 26 sorties out of Da Nang.

3. In July RANCH HAND began spraying more targets in the delta, including mangrove areas in the Go Cong Province. The Viet Cong had gained almost complete control of the area by this time, and antiaircraft fire was a regular event on these missions. Nevertheless, the necessary sorties were fragged into the area until the project was completed on 22 July 1964.

4. It was about this time that the first PCS pilots were reporting to RANCH HAND. During the first two and a half years, RANCH HAND crews had been assigned on a four-to-six month TDY basis. During this time period, 800 sorties had been flown and 250,000 gallons of defoliant dispensed over some 80,000 acres.

E. DEVELOPMENT OF CROP DESTRUCTION TECHNIQUES AND CONCEPTS

1. During the same three year period, 1961-64 crop destruction techniques and concepts were developed for use in the RVN. Research of crop destruction techniques had begun at the same time as defoliation research. However, there existed a natural aversion to destruction of food resources, and that, coupled with a desire to not be placed in a politically embarrassing situation, held back crop destruction operations. The period from March - October 1962 was marked by messages and meetings discussing the merits and disadvantages of crop destruction. At one such meeting, between Mr. Thuan, RVN Secretary of State, and President Kennedy (25 September 1962), the latter stated that the United States needed assurance on two points concerning crop destruction; "First, that the GVN could differentiate between Viet Cong crops and Montagnard crops and, secondly, that the usefulness of such an exercise would outweigh the propaganda effect of Communist accusations that the United States was indulging in food warfare." As a result of the meeting, President Kennedy queried MACV/AMEMB with the following: "1) The accuracy of current aerial delivery systems? 2) Can sufficient numbers of targets in a susceptible stage of growth be attacked with enough significant effect to warrant political cost of operation? 3) What alternative sources of food can be provided to take care of friendly people whose crops may be affected? 4) What targets would you now recommend in light of foregoing questions?"

2. MACV answered all questions in an acceptable manner and, on 4 October 1962, the State/Defense Departments authorized crop destruction in principle, and gave the following guidelines to the Country Team for program implementation: "(1) The program should only be implemented where stage of crop growth gives reasonable prospects of success; (2) targets should be selected in area where maximum damage is done to Viet Cong and minimum to noncommunist peasants; and (3) the Country

[redacted] [redacted]

Team should consider psywar aspects carefully with a view to minimizing anticipated adverse political repercussions both inside and outside RVN."

3. On 21-23 November 1962, the first crop destruction missions were flown in Phuoc Long Province. The operation, using H-34 helicopters and hand sprayers, destroyed an estimated 300 hectares of crops consisting of rice, beans, and manioc. An estimated 1,000 tons of food was later confirmed as having been denied to the enemy as a result of the operation. More projects of the same nature were completed between November 1962 and March 1963. On March 20, 1963, with MACV concurrence, the Embassy sent a message to the State Department recommending that defoliation and crop destruction be continued in specific situations and areas where their employment would hurt VC military effectiveness. The message further recommended that the Ambassador and COMUSMACV be given authority to approve crop destruction requests. Because of the increasing propaganda being disseminated by the enemy, the State Department, in May 1963, requested an evaluation of the crop destruction program and set forth the following doctrine for crop destruction operations.

> "...All crop destruction operations must be approved in advance by Assistant Secretary Far East and the Department of Defense."
>
> "Crop destruction must be confined to remote areas known to be occupied by VC. It should not be carried on in areas where VC are intermingled with native inhabitants and latter cannot escape. Also should be limited to areas where VC do not have nearby alternative sources of food or areas in which there is available food deficit, e.g. high plateau and Zone "D"

4. Task Force Saigon Evaluation Team reviewed the crop destruction program and in October 1963, advised the State Department that this type of operation was an effective weapon against the VC and recommended that authority be given to the Ambassador and COMUSMACV to approve crop destruction operations as military requirements presented themselves. Still the State Department withheld the approving authority that had been requested. Authority to conduct crop destruction operations was granted Ambassador/MACV for individual areas, but it was not until 29 July 1964 that authority for approval of all crop destruction activities was delegated to the Ambassador and COMUSMACV.

1601

5. During the period March 1963-July 1964, crop destruction missions were flown against targets which lay in areas outside government control. These targets included areas surrounding VC training centers,

[redacted]

hospitals, logistic supply installations, and way stations along infiltration routes. Since the first crop destruction projects, a total of 1,325 hectares of VC foodstuff had been destroyed. Three hundred hectares were completed in 1962, 79 hectares in 1963, and 946 in 1964, up to the time of delegation of authority for target approval to the Ambassador.

F. DEVELOPMENT OF EQUIPMENT AND TACTICS DURING 1964

1. New pumps were installed on RANCH HAND aircraft to increase the spray delivery rate to three gallons per acre. Further modifications included the addition of armor to protect the spray equipment operator, and armor around the instrument panels of all RANCH HAND aircraft.

2. Crop destruction missions during July and August were flown by H-34 helicopters in Binh Thuan Province and resulted in 80 percent destruction of VC crops within that province. Although the projects in Binh Thuan Province appeared successful, the overall results of crop destruction operations was somewhat limited. This was largely due to failure to obtain approval for crop destruction missions when VC control of the people and terrain was limited. Other reasons were lack of experience and motivation on the part of RVNAF pilots and poorly engineered equipment. These factors eventually led to the FARMGATE concept, using mixed US/VN crews.

3. Defoliation missions against communication/transportation targets continued through the fall of 1964. On 3 October, RANCH HAND flew its first crop destruction mission under the FARMGATE concept, involving the major food producing areas adjacent to War Zone D. This project, nicknamed "Big Patches", covered a period of ten days during which heavy ground fire was experienced. As a result of this small-arms antiaircraft activity, spray aircraft sustained 40 hits.

4. On the second crop destruction project in the Phuoc Long Province, one spray aircraft took a hit in its left engine. The engine burst into flames and was immediately shut down. The fire extinguisher had no effect on the flames and the left engine nacelle fuel tank was subsequently jettisoned. The aircraft made an emergency landing at Bien Hoa with the fire still burning. This was the first emergency combat incident recorded.

5. In December 1964, RANCH HAND received another C-123 so that, at the end of 1964, four spray-equipped aircraft were on hand. Each C-123 could be expected to fly a maximum of 45 hours a month (20-25 sorties), assuming no additional maintenance time was required due to

1601

[redacted]

[redacted]

battle damage. The C-123 had proven to be an excellent choice for spray operations with its dual, rugged and simple support systems backing up two reliable reciprocating engines. Up to this time, a total of 139 hits had been received but RANCH HAND had not lost an aircraft or a crew member during tactical missions.

6. During 1964, a total 257.7 square kilometers of roads, railroads, canals, and VC base areas were defoliated and 15,215 acres of crops were destroyed, as the result of 363 spray sorties flown by RANCH HAND crews.

G. INCREASED FIGHTER SUPPORT

1. Project "Swamp Fox" was to become the largest defoliation project to date in South Vietnam. Targets included areas in Bac Lieu, Ba Xuyen, and Vinh Binh Provinces. The VC stronghold in these areas contained arms factories, repair shops, hospitals, and training camps, all operating without fear of harassment. Defoliation operations would help aerial surveillance and permit observation of supply and troop movements in the area. These operations started on 30 April 1965. A-1E aircraft from Bien Hoa prestruck each target area and provided cover for the 84 RANCH HAND sorties. A Forward Air Controller was also used. The project was terminated on 25 May 1965. Spray aircraft sustained 124 hits and dispensed 77,600 gallons of defoliant. Five crewman were slightly injured as the result of ground fires. The project was about 70 percent complete when it was terminated because of the heavy ground fire.

2. Following the termination of "Swamp Fox", an evaluation of herbicide operations was conducted by MACV-J2. Herbicide operations were concluded to be of great tactical use and a desirable weapon, although 2AD and PACAF expressed concern for the safety of the crews. A study indicated the need for an increase in the ratio of fighters to spray aircraft and also concluded that more time on target for the fighters was desirable. As of 30 June 1965, RANCH HAND aircraft were to fly cargo missions until more A-1E aircraft at Bien Hoa finished their training to fly cover for spray operations.

1601

3. The A-1E had several advantageous features in its use as a support aircraft for spray missions. It had the necessary airspeed and maneuverability and could carry the ammunition required to suppress ground fire during spray operations. In the IV Corps area, four A-1Es were generally used per mission. Each was armed with mixed loads of bombs and 20mm ammunition. The fighters pre-struck VC gun installations, based on reports

[redacted]

from the FAC working in the area, followed three to five minutes later, by the C-123s.

4. During the summer and early fall of 1965, crop destruction missions were flown in the Kontum and Binh Dinh Provinces. On 20 October 1965, operations commenced in War Zone D. This project continued until 17 December, with 163 sorties being flown and 137,650 gallons of chemicals being delivered. Fighter support for the C-123's now included F-100, F-5 and A-4 aircraft in addition to the A-1E. Also, during September and October, three more C-123 aircraft were being modified for spray operations by the Fairchild-Hiller facility at Crestview, Florida. These three aircraft were brought to Tan Son Nhut by newly trained crews and were in place by 12 November 1965. In November, the designation of the spray-configured aircraft was changed from C-123 to UC-123. Other changes in the RANCH HAND operation included the use of flying helmets with a clear, extended visor. This was done to minimize the effects of shrapnel and other flying debris in the cockpit as the result of ground fire.

5. Tactics were also changed to prevent the number of hits from increasing. Spray aircraft flew in a close-up, nose-to-tail echelon formation on straight targets where undisciplined forces were found. This was not done, however, where fire was concentrated or where troops were highly disciplined and trained in firing at aircraft. Fighter tactics still included prestrike, poststrike, or a combination of both. There existed some question whether fighter prestrike to gain ground security was of more value than the natural element of surprise. The complex process of target acquisition was also becoming a problem about this time. The coordination process required as much as a year, at times, and as a result, the backlog of RANCH HAND work had occasionally dwindled to a single project.

TO P.14

6. In November and December 1965, targets included more "lines of communication" type of defoliation missions. On 25 November, a smaller project began along the banks of the Oriental River. In 18 sorties 24.2 square kilometers were sprayed with 14,000 gallons, with 34 hits being received. Cover was provided by F-100s with help from a FAC and with the "Jolly Green Giant" rescue helicopter standing by. Other projects in December included areas in Kien Hoa Province and Phuoc Tuy Province. These projects were larger and, in Kien Hoa, 70,450 gallons were delivered between 7 December 1965 and 31 May 1966. The Phuoc Tuy project began on 18 December 1965 and ran through January 1966 with 60,000 gallons of defoliant delivered.

1601

7. One project of note involved a plan to fly missions near Tan Son Nhut without a navigator. The idea was to take off from Tan Son Nhut, fly a

predetermined fixed heading until intercepting a Tacan position, then turning onto the target based on the Tacan Fix. This project was started on 20 February and discontinued on 29 August 1966, because later observations of the target areas revealed spray strips that were somewhat randomly positioned.

8. In June 1966, the first RANCH HAND aircraft to be lost during a tactical mission was downed by ground fire during a defoliation mission in Quang Tin Province in I Corps. The two spray aircraft involved had received sporadic ground fire and, on the fifth pass over the area, one lost an engine. It impacted in a hedge row near a rice paddy and subsequently burned. Six USMC helicopters responded to the May Day call. Two of these landed amid ground fire and rescued all three crew members.

9. In August 1966, crop destruction targets were scheduled in the A Shau Valley just before the September period when it became a very "hot" target area.

10. Area defoliation in War Zone D began again in August under a low priority. Many sorties during August and September were also flown in the Iron Triangle region, also a priority target at the time. War Zone C defoliation began around the first of September and continued throughout the fall of 1966, with many smaller targets along roads also being covered from time to time. New activity in IV Corps began in August, in the Mekong Delta area. In short, the herbicide operations were now being performed in all areas of the RVN with hostile fire being encountered in most of them.

11. In April 1966, COMUSMACV had decided to defoliate War Zones C and D and had requested 11 additional UC-123s to assist in this task. At that time RANCH HAND had been operating with a total of seven aircraft. Three aircraft arrived from CONUS in August, four in September, so that by 10 October 1966, 14 UC-123 aircraft were in place at Tan Son Nhut. In September, scheduling commenced for defoliation missions in the area just south of the DMZ. Clear weather in that area and the short flight time from the Da Nang base of operation sometimes permitted as many as four sorties per aircraft during a single day.

1601

12. At the present time an average of seventeen (17) available UC-123 spray aircraft out of 23 aircraft assigned and 20 operationally ready have been conducting about 400 sorties per month with about ten percent of the effort being devoted to crop destruction with the remainder devoted to defoliation. The crop destruction program and the defoliation program

both slipped behind schedule during February and March of 1968 because all herbicide aircraft were transferred to a troop carrier role from 8 February to 17 March 1968 as a result of the TET offensive. No crop missions were flown for the first five months of CY68 for two principal reasons: (1) the backlog of high priority defoliation targets created by the February-March stand-down and, (2) the inordinately dry spring season which failed to produce profitable crop targets. Crop missions began again in June and will continue through the growing season.

A.

1.
sign
the
brie
prog
as l

B.

1.
defo
Mar
of re
put i
postv
inclu
other
Howe
Chem
proje
resea
progr

C.

1.
Camp
herbi
Impro
to spr
mile a
the Ca
been s
of the
later i
growth
tion of
predor
in som
appear
howeve
ment i

1601

SECTION III

SUMMARY OF HERBICIDE TEST AND EVALUATION PROGRAMS

A. SUMMARY:

1. During the past twenty-five years there have been a number of significant herbicide test and evaluation efforts in the United States, the Republic of Vietnam, and in Thailand. Each of these is described briefly in the following: (Additional information on any of these T&E programs can be obtained by examination of the pertinent reference as listed in the back of this report).

B. EARLY EVALUATION AND USAGE WORLD WAR II to 1957:

1. An integrated program for screening and evaluation of candidate defoliating agents was conducted by the Chemical Corps at Fort Detrick, Maryland, during World War II. As a result of this intensive program of research, screening and field testing, some defoliants were actually put into operational use in some of the theaters of war. In the immediate postwar years, two projects were established for defoliants. One included a screening program for candidate defoliating agents and the other applied further developmental research on selected defoliants. However, in 1950 these two projects were terminated by action of the Chemical Corps Technical Committee (CCTC). Although no approved project existed for further work on defoliating agents, a minimum research effort was conducted under the general anticrop warfare program from 1950 to 1957.

C. CAMP DRUM TESTS, 1959-1962:

1. In the spring of 1959 a vegetation control mission was conducted at Camp Drum, New York, utilizing components of the standard ORANGE herbicide material which is currently being used in South Vietnam. Improvised dissemination equipment was used with the H-21 helicopter to spray approximately 2,200 gallons of the defoliant over a 4-square mile area. It was noted that the defoliants were applied to the trees in the Camp Drum area 4 to 6 weeks later in the season than would have been selected by the technical advisors. Evaluation of the effectiveness of the defoliants on the vegetation were made in the summer of 1960 and later in October 1962. In 1960 no basal sprouts or other signs of re-growth had occurred in the area which had been sprayed. Upon examination of the area in 1962, it was observed that the maple trees, which are predominant in the area, appeared to be dead. Sprouting had occurred in some other species of trees and, along the river, hawthorn trees appeared to have recovered from the effects of the chemicals. In general, however, trees throughout the area were dead and the resulting improvement in visibility was almost 100 percent.

1601

D. FIRST RVN TESTS, 1961-62:

1. From July 1961 to January 1962 the U.S. Air Force conducted a research phase of operational testing of the defoliating effects of certain herbicides on plant life in Vietnam. Operational testing on a larger scale was also carried out in that country from January to October 1962. During this latter period the research program was continued, but the scope was broadened to include additional chemicals. Technical advice was provided by the U.S. Army Biological Laboratories to the Air Force and MAAG upon request in their program of operational testing. All phases of the testing program in Vietnam were coordinated with the Advanced Research Projects Agency (ARPA) and approved at the DOD level. A team was selected by ARPA to investigate and make a technical evaluation of the defoliant program conducted in Vietnam from July 1961 to 1962. The mission of the team was to determine from a technical viewpoint the effectiveness of the herbicides used on vegetation in South Vietnam and to assess the effectiveness of herbicides in improving vertical and horizontal visibility from the air and ground. A resume of the results of the team's investigation is shown in the following table.

ARPA Team's Techical Evaluation of Defoliation Results on 21 Targets in Vietnam (U)

Criteria	Percentage of Effectiveness	
	Evaluation made from Air	Evaluation made from Ground
Defoliation	60-90 Mean of 80	40-90
Canopy kill	60-90 Mean of 80	40-90
Vertical visibility	60-90 Mean of 80	
Distribution of defoliant	30-80 Mean of 60	10-80 Mean of 50
Horizontal visibility		40-70 Mean of 50
Total target effectiveness[2]	50-90 Mean of 70	30-80 Mean of 60

1601

E. TASK FORCE SAIGON EVALUATION, 1963

1. In September 1963, a Task Force Saigon team was established by the Commander, U. S. Military Assistance Command, Vietnam, at the request of the Departments of State and Defense, to evaluate the herbicide operations conducted in the Republic of Vietnam from September 1962 to September 1963. The evaluation included nine defoliation targets, all of which were along lines of communication. The survey showed that the average percentage visibility over the range of the nine target contiguous areas was about 40% vertical (range 25 - 75%) and 30% horizontal (range 15 - 60%). The average percentage of visibility over the range of the corresponding defoliated areas was about 80% (range 60 - 90%) and 75% horizontal (range 50 - 85%). The T/F Saigon team's survey showed an increase in the horizontal visibility over that estimated by the earlier ARPA's team, but the vertical visibility estimates were the same. COMUSMACV concluded that defoliation operations had a definite military value and recommended the program be continued. Both State and Defense Departments subsequently approved the program and it continued to increase in magnitude and effectiveness through the remainder of the year.

F. THAILAND TESTS, 1964 - 1965

1. A test program was conducted in Thailand in 1964 and 1965 to determine the effectiveness of aerial applications of Purple, Orange, and other candidate chemical agents in defoliation of upland jungle vegetation representative of Southeast Asia on duplicate 10-acre plots. Aerial spray treatments were applied at rates of 0.5 to 3.0 gallons per acre on two test sites representing tropical dry evergreen forest and secondary forest and shrub vegetation. Applications were repeated in alternate 2- to 3-month period to determine minimal effective rates and proper season of application.

a. Applications of Purple, Orange, and Pink at rates of 0.5 to 3.0 gal/acre were made in alternate 2- to 3-month periods to determine minimal effective rates and proper season of application. Cacodylic acid and other desiccants and herbicides were evaluated in dry season and rainy season applications. Treatments were made on duplicate 10-acre plots, approximately 300 by 1500 feet.

1601

b. Defoliation effectiveness was evaluated by visual estimates of overall vegetation and individual species defoliation, measurements of changes in canopy obscuration by a vertical photography technique, and measurements of changes in horizontal visibility of a human-sized target at various ranges. Data provided by these techniques were used in comparative evaluation of defoliant chemicals in relation to rate, volume, season of application, canopy penetration, and vegetation response. Results of the test program showed that:

(1) Purple, Orange, Pink, Dinoxol, and Tordon were effective for long-term defoliation.

(2) Cacodylic acid and diquat were effective desiccants for rapid, short-term defoliation. Maximum defoliation occurred 2 to 4 weeks after treatment.

(3) Dicamba gave marginal but generally ineffective defoliation. Merphos or Folex, Endothall, tributyl phosphate, butyne diol, and amitrole were ineffective in defoliation.

(4) Purple and Orange were essentially equivalent in all respects. Pink was equal to Purple or Orange at slightly lower application rates.

(5) Minimum effective rate of Purple and Orange in dense forest vegetation with multiple canopy was 2.0 gal/acre (15 lb/acre acid equivalent) applied during the rainy or growing season. Applications made at this rate were effective for 4 to 6 months after treatment.

(6) Minimum effective defoliation with Purple and Orange was obtained with rainy season applications of 1.5 gal/acre in forest and secondary shrub vegetation of light to moderate density and with a single canopy.

(7) More complete defoliation and a longer duration of effective defoliation response was obtained in all vegetation types with applications of Purple and Orange at higher rates of application (2.5 to 3.0 gal/acre).

(8) Pink gave effective defoliation at slightly lower rates than Purple or Orange. Minimum effective dosage of Pink appeared to be 1.0 to 1.25 gal/acre (8 to 10 lb/acre acid equivalent) in rainy season applications. Applications at 2.0 gal/acre gave effective defoliation for 8 to 9 months.

(9) Cacodylic acid or sodium cacodylate applied in water solutions at rates of 5 to 6 lb/acre gave effective desiccation and defoliation of undisturbed forest and secondary forest and shrub vegetation in both rainy-and dry-season applications.

(10) Diquat was equivalent to cacodylic acid in defoliation response at rates of 3 to 5 lb/acre. Diquat was effective only in growing-season applications.

(11) Limited tests indicated that Tordon applied singly or in mixtures with 2, 4-D, diquat, and Orange was highly effective on a per-pound basis but gave generally slower defoliation response than Purple or Orange.

(12) The defoliation responses to aerial applications of Purple, Orange and other similar chemicals were influenced more by rate than by volume of spray solution applied. Applications of 1.0 to 1.5 gallons per acre of Purple, Orange and Pink as pure chemical gave similar defoliation responses to applications of the same amount of chemical diluted with one or more volumes of diesel fuel.

(13) Minimum application volumes commensurate with good spray deposits proved to be about 1.5 gallons per acre for oil-soluble chemicals (Purple, Pink, Orange), and 2.5 to 3.0 gallons per acre for water-soluble compounds (cacodylic acid, diquat, Tordon).

(14) Good penetration of sprays, and therefore, most effective defoliation responses were obtained more readily on shrubby secondary forest than in a dense, undisturbed forest with multiple canopy.

(15) Optimum droplet sizes for rapid fallout and best penetration proved to be in the range of 275 to 350 microns MMD.

(16) Responses to all systemic herbicides, such as Pink, Purple, Orange, Tordon, and Dinoxol were much better during the rainy season with its generally favorable soil moisture and growing conditions than during the dry season.

(17) Some combinations of herbicides were found to have very promising prospects, but need more extensive evaluation in the future. The best combinations were 2.3 pounds of Tordon plus 5.3 pounds of 2, 4-D and 1.2 pounds of Tordon plus 2.5 pounds of diquat. These mixtures were effective at rates of 1 to 3 pounds of Tordon per acre with the associated compound in proportion.

1601

(18) Maximum defoliation responses of 85 to 95% were recorded, but complete defoliation of all species was not obtained in any plot.

(19) Visual estimates and measurements of canopy obscuration from vertical photographs gave closely comparable evaluations of defoliation effectiveness. Horizontal visibility measurements gave lower values for defoliation than visual estimates or canopy

obscuration measurements. Changes in horizontal visibility due to chemical treatment reflected defoliation sustained by the shrub understory.

G. CINCPAC EVALUATION - 1967:

1. Late in calendar year 1967, the crop destruction program in South Vietnam was re-evaluated on the CINCPAC level with support from subordinate commands.

2. Objectives of the crop destruction program as outlined in the 1967 Combined Campaign Plan, and restated in the 1968 Plan are: "Crop destruction operations as a part of economic warfare will be conducted in I, II and III CTZ's to deny food (rice, cereals and broad leaf crops) to the VC and VC sympathizers, to direct VC manpower to crop production, and to weaken VC strength in these areas."

3. Crop destruction targets are carefully chosen in accordance with established GVN and MACV directives and are limited to food-scarce areas which are VC controlled. The GVN supports this program at all levels.

4. The herbicide psywar effort which is an important part of the overall program has been accelerated in 1967. Both aerial loud-speakers and leaflets are used to explain necessity of the program to the people, to emphasize the non-toxicity of chemical defoliants to humans and animals, and to gain understanding and support from the civilian population. Procedures to reimburse civilians for inadvertent losses are also provided.

5. Review of the 1967 operations indicates that the target areas are carefully selected. The areas of South Vietnam are divided into five categories, uninhabited, VC controlled, contested, undergoing securing, and secured. Analysis of all missions conducted in 1967 indicates that 22% have been in uninhabited areas, 76% in VC controlled, and 2% in contested areas. Only one sortie was over an area undergoing securing and none over secured areas. About one-third of the total missions was conducted over or in the immediate vicinity of major VC base areas.

6. The fact that spray aircraft suffered 297 hits from ground fire in 630 sorties, and lost 1 aircraft in operations over areas classified as uninhabited or VC controlled, demonstrates that VC were, in fact, present in the target areas selected for crop destruction.

[redacted]

[redacted]

[redacted]

7. Analysis of 1967 crop destruction activities also indicates that all missions were conducted in rice deficit provinces, 27% in I CTZ, 67% in II CTZ, 6% in III CTZ, and none in IV CTZ. No crops have been destroyed in rice surplus province.

8. There are few people other than VC/NVA troops in areas sprayed. By examination of civilian population densities in areas sprayed during 11 months of CY 1967, it is estimated that an extremely small number of South Vietnamese were directly affected by crop destruction missions. 88% of all missions have been conducted in areas where the population is less than 250 inhabitants per square mile and over 20% in "uninhabited" areas.

9. Review of a large number of interrogation reports, captured documents and agent reports for the calendar year 1967, leads to the conclusion that the crop destruction program has had a significant adverse effect on VC/NVA food supply, logistical requirements, and combat effectiveness.

10. Effect on food supply. In 1967, an estimated 120,000 short tons of rice and other foodstuffs were destroyed through herbicide crop destruction operations. Of this total, approximately 82,700 short tons were rice and the remainder consisted mainly of broad leaf crops in several provinces. This constituted at least 80% of the crop grown in VC controlled territory.

a. The estimated rice requirement for VC/NVA units in RVN is 137.5 tons/day. Losses of rice as a result of ground operations have been 38.4 tons/day. An estimated average of 250 tons/day have been destroyed in crop destruction missions. The VC consider themselves to be economically defeated in certain areas.

1601

b. The belief persists among some VC as a result of their own propaganda that food which has been sprayed cannot be consumed.

c. Serious localized food shortages are reported from all areas in which crop destruction missions have been conducted.

11. Effect on VC/NVA tactical operations and manpower resources:

a. In certain instances, the VC have been forced to divert tactical units from combat missions to food procurement operations, and food transportation tasks.

b. As a countermeasure to crop destruction missions, troops

[redacted]

[redacted] [redacted]

are being used to produce food in small scattered locations to make it more difficult for aircraft to discover the plot.

c. In certain areas, the task of producing rice has become as important as the task of waging war.

12. Effect on VC/NVA morale:

a. In local areas where extensive crop destruction missions were conducted, defections to GVN increased as a result of low morale resulting principally from short food rations.

b. Lack of food has caused enemy personnel to pretend to be sick to avoid fighting.

c. As a result of loss of popular support, VC morale is low, and is declining in areas where crop destruction has occurred.

13. Effect on civilians in VC controlled areas:

a. Civilians complain that the VC were responsible for crop destruction because they had "liberated" the areas.

b. After crop defoliation operations, large number of civilians move to GVN controlled areas, confirming the policy of conducting crop destruction operations only in VC controlled areas.

c. The physical exodus of people from VC controlled areas has resulted in a manpower shortage for support purposes.

14. In summary, crop destruction was determined to be an integral, essential and effective part of the total effort in South Vietnam, and an extensive review of the program indicated that program objectives, as stated in the Combined Campaign Plan, were being met.

1601

[redacted]

H. MRI/ARPA ASSESSMENT OF ECOLOGICAL EFFECTS: 1967:

1. The most comprehensive study of possible long term ecological effects resulting from use of herbicides in Vietnam has been written by the Midwest Research Institute. Although the complete report is not available at this headquarters, a summary digest has been received which presents the major findings. This summary digest is presented here in its entirety because of its pertinency to questions which are frequently asked on ecological effects of herbicides.

TO P. 22

Summary Digest of Midwest Research Insitute Report

"Assessment of Ecological Effects of Extensive or Repeated Use of Herbicides" by W. B. House, L. H. Goodson, H. M. Gadberry, and K. W. Doktor. Midwest Research Institute, Kansas City, Missouri. Final Report, 15 August - 1 December 1967. Contract No. DAHC-15-68-C-0119. Advanced Research Projects Agency, 369 pp. (ARPA Order No. 1086, Project No. 3103-B).

1. In this report prepared by the Midwest Research Institute assessment is made of the ecological effects of extensive or repeated use of herbicides or vegetation control chemicals. Military usage of large amounts of herbicides in defoliation and crop destruction in South Vietnam has led to concern as to the ecological consequences of herbicide use. The report furnishes a review of herbicide application on noncropland areas; military use of herbicides; toxicological effects of herbicides; residues and their persistence in vegetation, soil, water and fauna; and the ecological effects of herbicides, defoliants and desiccants on vegetation, animal life and the physical environment.

2. The basic intent of the investigation was to examine the status of knowledge about the ecological consequences to be expected from the extensive use of these vegetation control chemicals. Emphasis was given to ecology, the study of the interrelationships of organisms in and to their complete environment, in providing the basis for an objective evaluation of the problem. However, relevant scientific studies in this area were found to be very scanty.

1601

3. This preliminary assessment has assembled information from more than 1,500 articles in scientific literature supplemented by information contacts with over 140 knowledgeable poeple in government, universities and chemical industry.

4. Man's use of fire, the ax and the plow as tools to create greater

agricultural productivity and to clear land have caused major ecological disturbances. The ecological changes caused by herbicides at the current rate of use have in no measure reached the proportion of ecological disturbance as those caused by the plow, ax and fire. Herbicides differ from other types of vegetation control agents in that they enter into biological systems, are selective in their effects, and have some degree of persistence.

5. Within the past 20 years herbicides have become a major tool used to selectively control or destroy vegetation -- rapidly, economically and over large areas. In 1965 about 120 million acres of U.S. cropland were treated with herbicides at a cost of $493 million. In the past few years herbicide usage has more than doubled to a current annual production of nearly 250 million pounds, nearly half of which is used on noncropland.

6. Applications in Vietnam in 1967 used enough herbicide to treat 965,000 acres. However, because many areas were re-treated, the total defoliated area was significantly less.

7. Three basic herbicides have been used in Vietnam:

a. ORANGE, a 50:50 mixture of n butyl esters of 2, 4-D and 2, 4, 5-T; used in jungle defoliation.

b. WHITE, a combination of picloram and 2, 4-D in a low-volatile amine formulation for woody plant control and areas in which accurate spray placement is essential.

c. BLUE, cacodylic acid, a contact herbicide for grass control and destruction of rice crops used by the Viet Cong.

8. Major targets include: Nipa palm and mangrove woodland in coastal areas and along traffic routes in rivers and canals of South Vietnam; moist evergreen or rainforests surrounding Viet Cong strongholds; dense shrubbery and second growth forest along highways, supply roads and railroads to reduce ambush; perimeters of villages and military bases; infiltration routes and supply trails in upland forests; and the Demilitarized Zone.

9. The response of vegetation to defoliant applications in Vietnam, as would be expected, varies widely due to: diversity in plant species and vegetation types, seasonal variations and monsoons; and differences in herbicides. Only a few scientific reports are available from the areas of operational use in Vietnam as to vegetational response to the defoliation

chemicals, although there are many operation reports as well as observations by qualified personnel. However, detailed findings from controlled research tests of defoliation in Thailand and Puerto Rico have shown that: (1) complete defoliation has not been obtained of all species in mixed forest types; (2) maximum defoliation from ORANGE occurs 2 to 3 months after application, and regrowth of some species begins in about 6 months; (3) BLUE causes rapid desiccation and leaf fall, reaching a maximum at 3 weeks but regrowth occuring within 3 months; (4) woody species vary greatly in duration and degree of defoliation; and (5) herbicide applications made during the rainy season are more effective than during the dry season.

Conclusions:

1. Conclusions from the assessment in relation to the ecological consequences of use of herbicides are as follows:

a. Destruction of vegetation is the greatest direct ecological consequence of using herbicides.

(1) The impact of herbicides varies in the amount and type of residual vegetation on the areas. Secondary growth of replacement vegetation invades rapidly under the tropical conditions of Vietnam, and partially killed or defoliated trees exhibit rapid recovery.

(2) Three primary temporary changes occur as a result of an ecological disturbance: (1) simplification of the plant community; (2) reorienting the community to a subclimax or unstable condition in which some ecological niches are vacant; and (3) altering competition within the treated area. The general pattern of plant succession in Southeast Asia following defoliation or other similar disturbances includes first stage dominated by grasses and weeds, followed within a year by a shrub stage, this in turn rapidly replaced by fast growing trees, eventually reaching the previous condition.

b. Long term effects on wildlife may be beneficial or detrimental.

(1) In many temperate zone areas, herbicidal treatment of forest has improved the wildlife habitat and favored animal production through increases in wildlife food plants.

(2) Destruction or modification of the habitat may greatly influence fauna that are rare or in danger of extinction. The increase in grasses and shrubs following defoliation may cause shifts in animal

population depending upon their food requirements. Animals such as the rare kouprey, an ancestral bovine, may be favored by the increase in bamboo and grasses following defoliation.

(3) The many unknown factors, including feeding habits of many indigenous animals, makes specific effects on wildlife difficult to predict.

c. Herbicides now in use in Vietnam will not persist at a phytotoxic level in the soil for long periods.

(1) Under the average temperatures and rainfall in Vietnam, it is reasonable to expect that ORANGE will be dissipated quickly. In temperate regions, 2, 4-D persists for about one month regardless of the rate of component of the herbicide WHITE, is persistent in soils but will tend to reach to depths of two to four feet under average rainfall and soil conditions. Cacodylic acid or BLUE presents no phytotoxicity problem from soil residues. Crops can be planted within a few days after spraying at heavy rates without risk of injury. More rapid disappearance could be expected in the tropics because of the high rainfall and soil temperature.

d. The possibility of lethal toxicity to humans, domestic animals or wildlife by use of herbicides is high unlikely.

(1) Direct toxicity hazard to people and animals on the ground is nearly nonexistent. All three herbicides used present no hazard from skin absorption. If wildlife is affected, it would be from removal of habitat or food rather than direct toxicity.

(2) Extensive studies of toxicity of 2, 4-D and 2, 4, 5-T have shown that the risk of human and animal toxicity from these herbicidal components of ORANGE is very, very low. Applications of ORANGE and WHITE along rivers and canals or even the spraying of the water area itself at rates used in Vietnam for defoliation is not likely to kill the fish in the water.

1601

(3) Data on toxicities of picloram and WHITE show that at recommended rates there is little direct toxicity hazard associated with their use. Cacodylic acid, unlike trivalent arsenic compounds, has a very low oral toxicity.

(4) The report indicates that food produced from the land treated with herbicides will not be poisonous or significantly altered in nutritional quality.

e. Unlike many insecticides, herbicides seldom persist in animal or insect tissues.

(1) Transfer of herbicides to the next animal in the food chain on defoliant-treated areas is negligible. Most herbicides, including all of those used in Vietnam, are readily excreted and do not accumulate in the animal body.

f. Indirect effects of herbicides resulting from destruction of aquatic vegetation may produce changes in the biota of the aquatic environment.

(1) Direct toxic effects on fish and aquatic organisms are negligible. Destruction of specific plants used for fish foods will lead to changes in the food chain of the aquatic ecosystem. Application of herbicides to remove floating aquatic weeds will provide important benefits because their presence depletes the oxygen content of the water.

2. Areas of inquiry in which reliable judgments could not be made in this study were as follows:

a. Effects of spraying 2, 4-D and 2, 4, 5-T esters on water quality.

(1) One of the important problems from the standpoint of effect of herbicide residues and the persistence of these residues in the ecosystem involves water supplies. With increasing use of herbicides on non-cropland, it is important to evaluate their persistence in surface water. For example, the herbicide, 2, 4-D, is degraded rapidly in surface water when applied at amounts up to 5 pounds per acre. Oregon studies showed that detectable quantities of herbicides were found in virtually all streams sampled after helicopter applications of 2, 4-D and 2, 4, 5-T at 2 pounds per acre on forested areas, but persistence was measured by days.

(2) No firm conclusions could be drawn with respect to effect on water quality in Vietnam. Direct toxic effects would be quite unlikely.

1601

b. Effects of defoliation on mammals and birds in danger of extinction.

(1) Whether the application of herbicides will be a critical point in survival of rare species is not known.

c. Effects of defoliation on climate and the hydrologic cycle.

(1) The climate, microclimate, weather and hydrologic factors of an ecosystem must be considered in any attempt to assess the ecological consequences resulting from indirect effects of herbicide treatments. The relative effects on these factors under tropical conditions would probably not be significant.

d. Effects of defoliation on soil erosion.

(1) The use of herbicides on the forests and rangelands of the United States for vegetation control and management has generally been effective in reducing soil erosion by comparison with mechanical methods of vegetation control and other techniques. On sagebrush lands of the West the proper application of herbicides decreases both wind and water erosion hazards. In the Great Plains area, the use of herbicides to achieve chemical fallow has also reduced soil erosion.

(2) In tropical areas removal of forests on lateritic soils may result in modification of the soil to an impervious lateriate rock. No evidence has been obtained that such irreversable changes have resulted in areas in Vietnam subject to defoliation. Observers in Vietnam have indicated that the vegetational succession following defoliation in tropical forest is one in which grasses rapidly cover the ground in dense stands followed by rank growth of weeds and vines which are effective in minimizing soil changes.

I. U. S. MISSION EVALUATION - 1968

1. A Herbicide Policy Review Committee was established in early January 1968 by direction of the United States Ambassador to Vietnam to conduct a comprehensive review of the US/GVN Herbicide Program. To carry out the policy review of committee was organized in mid January 1968 under the chairmanship of a representative of the American Embassy (AMEMB), Saigon, and with membership made up of representatives from USAID, JUSPAO, and HQ MACV. The policy review was accomplished by organizing the committee into subcommittee to study the following major subject areas of the herbicide program: ecology, indemnification, PSYWAR activities, refugees, crop destruction, defoliation, planning and procedures. The following discussion will summarize the purpose, major areas of interest, and findings of each of the subcommittees.

Defoliation Review

1. Perhaps the most important subcommittee area was defoliation.

[redacted] [redacted]

Defoliation represents approximately 90 percent of our herbicide effort. It is certainly the most important program from a standpoint of military value. This military work has largely been recognized by the agencies that make up the mission council. However, complaints have been made in the public and scientific press which highlighted the backlog of unprocessed claims; called attention to the large area defoliation projects accomplished in II CORPS during 1967; decried the amount of crop damage from herbicide drift, especially in Long Cong Province and in the rubber plantations; and lastly questioned seriously the possibility that herbicide employment on such a large scale basis as was accomplished in 1967 would actually upset the ecology of South Vietnam

2. In its findings, the defoliation subcommittee recognized the military worth of defoliation beyond any doubt. It emphasized the importance of the program in locating the enemy in a heavily forested country to permit the application of superior mobility and firepower, and to enhance the security of the economic and psychological costs of the program. It called attention to the loss of valuable stands of timber in war zones C and D which can be avoided only if salvage operations are commenced in the next two years. It also expressed concern over the success of the Viet Cong in promoting propaganda about the program which reflects adversely on US motives and actions. The committee also called for improved operational and program controls to minimize the effect of herbicide drift on crops contiguous to target areas.

Crop Destruction

1. The second most important element of the herbicide program is crop destruction which represents approximately ten percent of the total effort. It is interesting to note that it is this program that most concerns personnel of the United States Embassy. The economic planner finds it especially difficult to permit the military to destroy thousands of tons of rice (80,000 tons in 1967) while at the same time arranging for the import of several hundred thousand tons of rice to feed the local population. Further, the Embassy believes that military crop destruction is only one element of a total food denial program and that the scale of the military effort should be determined on the basis of a total food denial program.

1601

2. The committee found that the crop destruction operations have been successful in denying food to VC/NVA military units and to VC sympathizers and in weakening enemy strength. However, available evidence indicates that the civilian population in VC controlled areas

[redacted]

bears the brunt of these operations and thus incur considerable adverse political and psycho-political costs. The subcommittee called attention to the fact that herbicide crop destruction is only one part of the total food denial program. Consequently, if crops are destroyed while other sources of food acquisition remain available, then the program is rendered less effective. The committee found that past food control activities have not been sufficiently coordinated at mission level and therefore have not realized their full potential.

Psywar Review

1. The Psywar subcommittee got underway with the full knowledge, based on observations from the Saigon level, that the program had been unresponsive. The subcommittee made field trips to visit U. S. advisors at province level, reviewed the number and quality of leaflets dispersed and broadcasts made in connection with the program, and checked the knowledge and operations of local Psyop personnel. The subcommittee also made an analysis of public opinion and reactions concerning the herbicide program in South Vietnam, the United States and the rest of the world.

2. The committee found that the herbicide issue does not loom large at present. It carries with it, however, a strong potential for trouble due to its emotional content. In secure hamlets of South Vietnam, the herbicide issue is far from uppermost among villager grievances. In the United States, the public has shown surprisingly little interest. In the rest of the world, all but one USIS post reported that the issue has little public impact. The exception was Stockholm where leftist groups exploit and scientific groups criticize the issue. Concerning Psywar activities in South Vietnam, the subcommittee found that the GVN has failed to provide the necessary support for the herbicide program and that Psyop personnel at province level are often unaware of the herbicide program and its implications. As a result, the VC are active in exploiting our vulnerability and the subcommittee also noted that a responsive indemnification program could minimize the psychological damages incurred.

Indemnification Policy

1. The purpose of the indemnification program is to promote friendship between the people of SVN and the Army by giving solatium to those persons who have suffered injury or property damage as a result of RVNAF, US, FWMAF herbicide operations. It is operative only in secure and in some contested areas. Since this program is managed

1601

and administered almost entirely by the GVN, the subcommittee was faced with a difficult task in evaluating the effects and determining the bottlenecks. This committee conducted most of its investigation through visits to the province and district levels. The subcommittee found that the indemnification program provided only for solatium as opposed to full or reasonable indemnification for damages compared to 381 million piasters for war damage. However, it was noted that the administration of the program is poor and the processing of claims is cumbersome and time consuming. Also, there is evidence that the program is fair game for corrupt province and district officials. Eighty percent of the claims amount to 60 thousand piasters or less. These should be handled with dispatch in order to improve the general public attitude toward the program and the central government.

2. The refugee subcommittee conducted hearings to determine the nature and extent of the refugee problem. The subcommittee findings in this area were rather surprising. It was concluded that herbicide operations alone have not generated a significant number of registered refugees. Although Montagnards have been adversely affected by these operations, the program has not had a serious enough impact to cause these people to come over to GVN control. The committee noted that contingency plans for refugee support were largely pro forma in nature and that management should place more emphasis on this aspect of the program.

Ecological Effects Review

1. The committee called on the Department of Agriculture for a representative to evaluate the ecological question. Since the major area of concern was III Corps, the representative focused on this area in his investigation. An extract on ecological consequences reads: "The ecological impact of herbicide operations to date does not appear to be serious. The herbicide program has no effect on precipitation, caused very minimal laterization of the soil, and apparently has had little or no effect on micro-organisms in the soil system. It has killed large stands of mangrove which will probably re-establish themselves in about 20 years. There has been no apparent effect on fish. It has probably caused some reduction in the number of birds and invertebrates living in the mangrove swamps. Semideciduous forests, especially in war zones C and D, have been severely affected. The regeneration of these forests could be seriously retarded by repeated applications of herbicide."

Program Planning and Procedures

1. The task assigned to the program planning and procedures

subcommittee was to study current procedures and, where required, to devise new procedures which would assure the development of data required by management to permit project approval on a timely basis. Such project approval was to be responsive to the military requirements of the field commanders and at the same time take into consideration the social, economic and psycho-political objectives of the civil operations and revolutionary development program. To overcome the procedural weaknesses revealed by the subcommittee study the subcommittee found that:

a. The 203 committee should meet regularly to pass upon projects, become more familiar with the program as a whole, and reduce the time of processing at the Saigon level.

b. That check lists are required which would emphasize the data required by PSYWAR and civil affairs personnel for determination of adequacy of the project. Separate check lists should be provided for proposed crop destruction and defoliation projects.

c. That authority be delegated to major field commanders to approve helicopter defoliation operations for vegetation control in support of local base defense, known ambush sites along lines of communications and Rome Plowed areas.

d. That large areas be approved for the attack of crops to permit flexibility and rapid response to these targets as the optimum time for spraying is reached.

e. That in order to determine the effectiveness of the management of the herbicide program, a system of post attack evaluation should be provided.

Principal Recommendations of U. S. Mission Evaluation

1. Defoliation: Given the comparatively high concentration of efforts in III CTZ to date, further defoliation operations there should be held to a minimum compatible with the overall requirements for the prosecution of the war.

2. Economic Costs:

a. As soon as security conditions permit, the GVN, USAID and MACV should expand timber salvage operations to include all merchantable

1601

[redacted]

dead or damaged trees in war zones C and D. USAID should also prepare plans for the reforestation of defoliated forest areas. TOP, 34

b. MACV should obtain the full-time service of a qualified plant pathologist to assist in the investigation of claims for damage allegedly caused by defoliation operations. He would also orient program personnel in the field about the effects of defoliants upon plant life.

c. MACV should ensure, in accordance with the proposed new program management procedures, that CORDS agricultural, refugee and psywar advisors in the field are fully consulted in the preparation and post-audit of all herbicide projects.

d. MACV and the RANCH HAND squadron should maintain and continue to improve the review of all flight operational and navigational controls, spray delivery equipment, and methods of obtaining information about the atmospheric conditions over target areas, in order to ensure that everything possible is being done to minimize the chances of accidental damage to crops.

3. Crop Destruction: The mission should develop a comprehensive economic warfare program designed, among other things, to deny food to the enemy. The proper scale of crop destruction operations, should be determined on the basis of that program. In the meantime, the mission should:

a. Attempt to obtain more systematic information about the effect of crop destruction operations upon both the civil population, especially the Montagnards, as well as enemy forces.

b. Review the crop destruction program prior to December 31, 1968, on the basis of information provided by the new checklist and post-audit system proposed in program planning and procedures in order to determine the most effective scale of the program.

4. Ecological Consequences:

a. MACV should plan and execute any possible future area defoliation targets so as to ensure that strips of forest are left undefoliated which will serve as a seed source for regeneration and as habitat for wildlife.

b. USAID, with the assistance of MACV, should maintain a continuing assessment of the impact of herbicide operations upon the

[redacted]

forest and the watershed.

c. With the end of hostilities, USAID should arrange with the GVN for the establishment of a comprehensive program of ecologic research designed to assist in the economic recovery of the country.

5. PSYOPS: The GVN has not provided the necessary effective PSYOP support for the herbicide program. MACV and JUSPAO should therefore now assume responsibility for ensuring that effective PSYOP programs are executed. To this end, they should utilize US and GVN resources as required.

6. Claims:

a. MACV, the Joint Economic Office, and JGS should undertake to simplify GVN military civil assistance program (MILCAP) procedures in order to permit up to $VN60,000 to be paid on a valid claim within one month of filing. This will expedite the payment of 80 percent of all herbicide claims.

b. MACV should make a concerted effort to increase its advisors knowledge, especially at province level, regarding the policies and procedures of MILCAP so that they can more effectively advise their counterparts.

7. JUSPAO Participation: JUSPAO should be represented on the Saigon-level "203 committee".

8. Management: MACV should adopt the following new methods and procedures in order to make the program more responsive to the tactical requirements of major commanders, and to improve the quality of information about operations needed for maintaining Saigon-level policy review of the program:

a. Ensure the CORDS agricultural, PSYOPS and refugee specialists are fully consulted in the preparation and post-audit of all projects.

1601

b. Require that checklists containing all relevant military, economic, psychological, and demographic information are completed in the field for all projects and forwarded to Saigon-level officials for use in the evaluation of projects.

c. Require that post-operations audits be conducted for projects on a regular basis as a means of strengthening program management

[redacted]

and policy review.

d. Delegate authority to Corps Commanders to carry out US helicopter defoliation operations in order to maintain defensive fields of fire around allied base camps, retreat Rome Plowed areas as required, and uncover known small ambush sites along LOCs. These operations will be monitored by Headquarters, MACV and carried out in accordance with the same policy guidelines and operational controls that apply to C-123 spray missions.

e. Introduce area clearances for crop destruction operations according to which crop targets of opportunity may be executed within areas approved for such operations by the "203 committee". Such targets will be confined to low population density areas under enemy control. Approval will extend to 12 months or 2 growing seasons. MACV Headquarters will review specific targets to ensure that they are in accord with all policy and operational guidelines.

9. Implementation: MACV, in coordination with JUSPAO and USAID, should consult with appropriate GVN authorities in order to implement these recommendations as soon as possible.

10. Public Affairs Exploitation: A public affairs plan should be developed and carried out by appropriate authorities in Washington and Saigon to exploit selected portions of this report, especially section F on "Ecological Consequences" in support of US policy goals.

11. In summary, the herbicide policy review committee made no policy changes in the program. It recommended certain measures be taken to increase management control and improve administration. Additionally, it suggested restraint in certain aspects of the execution of the program.

1601

[redacted]

Shredout, 02 begins here.

SECTION IV
CURRENT OPERATIONS

A. CURRENT OPERATIONS

1. The 12th Air Commando Squadron of the 7th Air Force, operates some twenty-four specially equipped and armored UC-123 type spray aircraft at two principal bases (Bien Hoa and Da Nang) in South Vietnam and has the primary responsibility of herbicide operations in South Vietnam. The U. S. Army, using hand equipment and H-34 type helicopters, conducts other spray operations of smaller dimensions, such as defoliation around special forces camps, clearing perimeters around airfields, depots and other bases, and small-scale crop destruction of small VC food growth areas in rugged mountain areas which would be difficult to reach with the large UC-123 type aircraft.

B. TYPES OF EQUIPMENT

1. The types of equipment used to accomplish the various spray operations include the UC-123 aircraft, H-34 helicopters, Buffalo turbine units, and hand spray units. The UC-123 is made by Fairchild and is a very reliable aircraft. With two R-2800 reciprocating engines, it has a combat range of 250 miles and takes a crew of four when a navigator is used. TACAN navigation equipment is available and communications equipment includes UHF, VHF, ADF, FM, and HF capability. The UC-123 utilizes an MC-1 spray tank of 1,000 gallon capacity and associated spray equipment such as the wing and tail booms, pumps, and plumbing, all of which made up the A/A 45Y-1 Dispenser System. This system provides three gallons of defoliant per acre which is delivered at a speed of 135 knots and is capable of clearing an area 80 meters wide and 16 kilometers long.

2. The H-34 helicopter spray system was initially developed by the U.S. Navy Disease and Vector Control Center as a potential insecticide delivery system. The HIDAL system using the H-34 has a capacity of 200 gallons and a delivery rate of three gallons/acre. The spray is normally delivered at 50 knots and cuts a swath of 75 meters. This system is vulnerable to ground fire because of the slow delivery speed and requires excessive maintenance.

3. The Buffalo turbine is a trailer-mounted spray system used in ground operations. The turbine is gasoline driven, has a 100-gallon

1601

capacity, and is used primarily along roads and similar targets. Under favorable wind conditions, this ground system can effectively spray a strip 75 meters in width.

4. The hand spray units, used on the smallest defoliation projects, consist of a back-pack type of dispenser with a capacity of three gallons.

C. COMMAND AND CONTROL

1. The control of the use of herbicides for defoliation and crop destruction is a joint effort by the GVN and the U.S. government. The responsibilities of the GVN are exercised through the JGS 202 Committee, which meets, as necessary, to consider requests and to write directives for herbicide operations. It is composed of members from High Command J-3 Section, J-2 Section, J-4 Section, J-5 Section, VNAF, and RVNAF/CDTD.

2. COMUSMACV and the Ambassador have the authority to approve U.S. missions in support of GVN herbicide projects. Senior U.S. advisors at corps and division level are delegated the authority to approve defoliation requests which employ hand-spray and ground-based power spray operations falling within defined guidelines. The State Department and the DOD establish the overall policies for herbicide use.

3. The Director, COC, is responsible for all target planning and operation. He reviews all plans of selected targets forwarded by the JGS 202 Committee. His recommendation is then forwarded to the MACV 203 Committee for evaluation and review of the proposal. This committee has the MACV Staff Chemical Officer as its chairman and is composed of members representing COC, J-2, POLWAR Advisory Directorate, USAID, and the Embassy. Seventh Air Force will be represented when aerial missions are involved.

4. A typical project request will originate from a province chief, a U.S. field commander, and/or an ARVN commander. It then goes through the JGS 202 Committee procedure and is forwarded to MACV for their coordination. After review by the 203 Committee, the proposal is formally coordinated with J-2 and the POLWAR Directorate. Then, after approval of the U.S. Embassy, the Chief of Staff, MACV, will send a letter to the Chief, JGS, signifying U.S. approval of the project. The Chemical Branch then notifies 7AF TACC, who forwards this approval to 12th ACS for execution of the project.

1601

5. The targeting priorities are established by MACV. These priorities are based on command guidance, the Combined Campaign Plan, priorities requested by JGS and major subordinate commanders, climatological data and optimum aircraft utilization. However, crop destruction projects are attacked as specific targets are developed and normally are given priority over defoliation.

6. Upon receiving execution approval from TACC and the target priority from MACV, 12th ACS submits a request for a fragmentation order to TACC. TACC, in turn, sends out a warning order to the field units who are in or might be entering the target area. TACC will then publish the final fragmentation order for project execution.

7. During the initial coordination of the project, a survey flight of the area had been conducted by RANCH HAND personnel and a representative of MACV. A coordination meeting was also held between the province chief, MACV Chemical Officers, Vietnamese military personnel, and RANCH HAND personnel. These meetings and survey flights help to familiarize RANCH HAND personnel with the objectives and the peculiarities of each project. Then, on the day before the actual spray mission is flown, the crews can review the project and plan the mission.

D. MISSIONS AND TACTICS

1. The actual mission is usually flown during the early morning hours to take advantage of the optimum weather conditions. Temperature in the target area in excess of 85 degrees or surface winds greater than 8 - 10 knots can result in a mission abort. High temperatures can cause the spray to rise off the target; excessive surface winds will blow the spray away from the area. Both effects will render the mission largely ineffective and, in fact, may cause damage to friendly areas which may be near the target. Weather must also be considered because of the limitations of the cover aircraft who fly support for the spray sorties.

2. All RANCH HAND flights require fighter cover and are flown under the control of a FAC. The mission itself may take 45 minutes or more in the target area because of the necessity to maneuver up and down the sides of mountains. The "spray-on" time is four minutes, which permits the 1,000 gallon tank to be emptied at the rate of three gallons per acre. The spray aircraft fly as low as possible without sacrificing safety and delivery speed is at 130 knots. Each aircraft sprays a swath about 80 meters wide and 16 kilometers long.

1601

3. Between 18 and 27 sorties are flown daily, six being scheduled out of Da Nang. The number of aircraft flying each mission varies with the target, but generally three or four aircraft spray each target in loose trail formation. Each has a crew of three (pilot, co-pilot, and flight mechanic), except the lead aircraft which has four crew members, the fourth being the navigator for the mission. In the past, these crews were made up of volunteers who received C-123 training at Hurlburt Field (Eglin AFB, Fla.) after which special spray training was given for three-four weeks at Langley AFB. As of 1 July 1967, all training will be conducted at Hurlburt.

4. The tactics used on spray missions vary with target type and depend, generally, on weather, target terrain, and the amount of ground resistance expected. If the weather is clear, the spray aircraft will remain at altitude (3,000 feet AGL) and then rapidly descend at about 2,500 feet per minute to spray altitude. If ceilings are low, a low-level approach may be made to reach the "spray-on" point. If terrain permits, one long straight run will be made. Other spray patterns include flying a race track pattern or a "Plum Tree" tactic, which involves making 90 - 270 degree turns at the end of the target area. If the target is discovered to be "hot", the spray aircraft can make one pass and then divert to another target for the rest of the mission. On all spray missions, regardless of the tactics used, a FAC can be very helpful in directing the UC-123s after observing the previous spray run.

5. In mountainous country, such as I Corps, special tactics have been developed. The roads were overgrown with foliage and the path was hard to follow. Sometimes a lead aircraft would fly at a slightly higher altitude, where visibility was greater, and thus be able to lead the other spray aircraft along the road. At the end of one run, a different aircraft would take the lead. Another technique involved throwing smoke grenades to mark the road before starting the spray run. In this case, the procedure is to fly from smoke-point to smoke-point, thereby following the road. A third tactic, not as effective as the other two, is to have the navigator DR the path of the spray aircraft along the road. This technique requires a prior knowledge of the road, however, Along the sides of the mountains, a contour-type of spraying is employed.

1601

6. Fighter tactics are also important to the success of the RANCH HAND mission. On a "cool" target, fighters may fly top cover for the "Hades" aircraft and conserve their fuel for a more lucrative target. On some other targets, low-level dry runs are sufficient to keep the

guns quiet. On hot targets, in a free bomb zone, a prestrike may be called for. This involves the use of CBUs, napalm, 20mm, or all three. Two different kinds of CBUs are currently used: CBU-2 (anti-personnel) or CBU-12 (white phosphorus). The spray aircraft start their run shortly after the prestrike to take advantage of the ordnance effects. Many times, the FAC will call a post-strike after the spray mission is completed. The effectiveness of the fighter cover can be seen by the declining hit/sortie ratio. For example, in April 1967, 164 hits were taken by 499 sorties. In May, only 88 hits were received while flying 519 sorties. Finally, in June, 67 hits were received by 581 sorties.

7. When ground fire is received, the flight mechanic, who sits in a bullet-proof box at the rear of the aircraft, will throw a smoke grenade out the rear door. This will generally emit a red smoke, but can be any color. At the same time, the pilot will make a radio transmission to the effect that ground fire was received from the right or left, as the case may be. Due to the lag time associated with the smoke grenade, an accurate strike will be obtained if the FAC will direct the fighters to a point about 300 meters behind the smoke.

8. At the present time RANCH HAND has a secondary mission, that of spraying insecticide for the control of malaria-carrying mosquitoes. An insecticide test program started on the 14th of October at Bangkok, Thailand; and on 17 October, a combined test and treatment program was started in the RVN. One aircraft currently being used is the UC-123 that made the "round-the-world" flight, "Patches". This aircraft is not camouflaged because the insecticide has a corrosive effect unless the aircraft is coated with an alodine treatment.

9. Insecticide spraying involves longer missions and the conservation of fuel becomes critical. On the other hand, it is not as vital to spray along exact coordinates because mosquitoes are migratory insects. RAND HAND currently flies about 20 sorties per month, dispensing 12,000 - 13,000 gallons at the rate of 8 ounces of insecticide per acre. At this rate, one tank of insecticide will cover about 15,000 acres.

10. The insecticide aircraft and 15 other CU-123s used for the defoliation and crop destruction missions are stationed at Bien Hoa Air Base. The other three aircraft are deployed to Da Nang Air Base. The operation at Da Nang is limited to flying crews and maintenance personnel, with very little administrative work being done there. The targeting officers maintain target folders and working charts for each project. Other records are kept at Bien Hoa, where the 12th ACS has its headquarters.

1601

11. One of the main jobs at both Bien Hoa and Da Nang is that of targeting officer. He is responsible for preparing "frag" request, attending project coordination and planning meetings, going on the survey flights, preparing and maintaining the project folders, recording and reporting mission results, and maintaining a project chart or log. Frag requests are called in to TACC five days in advance of the mission. In these requests are included the project and target number, fighter rendezvous coordinates, FAC rendezvous coordinates, the time over target, and special requests such as flak suppression artillery fire, etc. After the mission, a DAAR is completed and relayed to TACC on a daily basis.

12. Two modifications in equipment have recently been made to improve the operation. One of these has been the addition of an orange stripe across the top of the aircraft to aid in fighter recognition. Prior to this addition, fighters would have trouble locating the camouflaged spray aircraft until the spray was turned on. The second modification includes a change in ground handling equipment. To facilitate refilling the MC-1 spray tanks, a group of old F-6 refueling trailers have been joined in tandem. A system of high capacity pumps and manifolds has made it possible for four aircraft to be filled with any of the three herbicides currently in use at the same time. At Da Nang, 12 of these F-6 trailers have been hooked up, providing a storage capacity of 60,000 gallons. At Bien Hoa, 18 trailers are available, giving a storage capacity for 90,000 gallons of herbicide, although only half of the system is hooked up for use.

75 p. 42

1601

SECTION V
DEFOLIATION AIRCRAFT ATTRITION

1. Due to the nature of herbicide missions, low altitude (about 150 ft) and slow speed (about 130 knots), UC-123 defoliation aircraft are frequently hit by ground fire, principally small arms and automatic weapons. Only occasionally is 50 caliber fire reported.

2. Following is a summary by year of ground fire hits on these aircraft in RVN.

Year	Herbicide Sorties	Hits	Hits/Sorties	A/C Loss to Ground Fire	Hits/ Loss
1965 (Last 3 months)	231	129	0.558	0	
1966	2364	682	0.288	2	341
1967	4804	779	0.161	1	389
1968 (to 24 Aug)	3495	304	0.087	1	304

COMUSMACV's estimated herbicide sortie requirements for FY69 and FY70 are as follows:

Type of Target	Sorties	Required
Enemy LOCs and Avenues of Approach	1278	857
Friendly LOCs	431	862
National Boundaries (Major border areas of enemy entrance)	1582	895
Crops	1000	1100
Enemy base areas	2380	2257
Totals	6671	5971

1601

3. Based upon the combined 1967 and 1968 attrition rates, FY69 UC-123 losses might be 1.61 aircraft, and FY70 losses, 1.44 aircraft. COMUSMACV estimates an attrition of 2 aircraft per year which seems reasonable and slightly conservative.

4. Appendix A presents a complete record of sorties flown in RVN, both defoliation missions and crop destruction missions for CY65, 66, 67 and 68 (to 24 August), along with the numbers of hectares sprayed, the number of ground fire hits on defoliation aircraft, and losses to enemy action.

1601

SECTION VI

ASSESSMENT OF PSYCHOLOGICAL EFFECTS OF THE CROP DESTRUCTION PROGRAM

A. INTRODUCTION

1. This section prepared by the CINCPAC Social Sciences Research Team of the Scientific Advisory Group is an assessment of the "purely" psychological aspects and effects resulting from the use of herbicides or vegetation control chemicals to destroy crops which were providing food to the VC/NVA. Although previous Scientific Advisory Group studies have clearly demonstrated that the program of crop destruction has, in fact, denied food (particularly rice, cereals, and broad leaf crops) to the VC/NVA sympathizers and, to some considerable extent, redirected VC manpower to crop production, questions continue to be raised as to its psychological consequences.

2. The essential goals of this investigation were to (1) review the current status of knowledge on the psychological effects of the crop destruction program, and (2) coalesce available relevant scientific studies and first hand accounts of the program's effect to provide an adequate base upon which a comprehensive assessment of the psychological effects could be presented. Unfortunately, relevant and knowledgeable investigations into the psychological effects of crop destruction were found to be very meager.

3. This preliminary study assembles and evaluates information collected from ten research reports and several hundred interrogation reports, intelligence reports, and other unevaluated messages and reports. Source material included Air Effects Questionnaires (PACAF), interrogation reports of the Combined Military Interrogation Center (CMIC) and the National Interrogation Center (NIC), the USMC interrogation data base, and several miscellaneous messages and reports. These are carefully referenced as they are drawn upon to support conclusions reached in this report.

4. With or without an ongoing crop destruction program, certain psychological pressures upon the peasant and the military forces are inevitable in an environment such as exists in South Vietnam today. At best, a content analysis of the appropriate interrogation reports can only

1601

suggest a possible "cause and effect" relationship between certain psychological effects in the aggregate and the crop destruction program. Of course, individual reports may very well point out, for a given instance, such a relationship. The sample sizes for various effects are too small for statistical inference to be established.

B. SUMMARY

Following is a summary of the observations resulting from this analysis of reports.

1. Food shortages are probably the enemy's largest single problem.

2. Averaged over a 3 year period, 23% of reports indicated that food was destroyed or in short supply.

3. A time trend analysis shows that less than 10% of reports indicated food shortages in early 1965, but by early 1968, the percentage increased to over 50%.

4. There are numerous accounts of increased tensions between VC/NVA units and indigenous population resulting from farmers' irritation with VC over the herbicide program as well as VC stealing food from the people.

5. Peasants in VC controlled areas blame both the US/GVN (about 60%) and the VC/NVA (about 40%) for the hardships resulting from crop destruction operations.

6. Sample showed decline in VC morale resulting from shortage of food.

7. The VC/NVA have been conducting a vigorous and effective propaganda campaign to counter herbicide operations, and many VC/NVA have a tendency to believe their own propaganda with respect to the "poisonous" effects of herbicides.

1601

8. There was no mention of "inherent repugnancy" of herbicide operations to the peasant.

9. There are several reports which mention large numbers of the population moving from VC to GVN controlled areas as a result of herbicide operations.

10. There was no evidence that herbicide operations strengthened the VC's resolve to resist.

TO P.54

C. CONTENT ANALYSIS OF REPORTS

1. In a content analysis of the Combined Military Interrogation Center (CMIC) and the National Interrogation Center (NIC) reports conducted by PACAF, * food shortage was mentioned quite often. This study went further: "A count of effects mentioned in interrogation reports shows that food shortage is the largest single enemy problem." It reported that 13% of the 1965-67 interrogation reports examined, contained indications of food shortage (especially rice).

2. Of the reports examined in this investigation, 23% indicated that food was either destroyed or in short supply. The sample included 439 randomly selected interrogation reports from 1965 through March 1968. Table 1, below, shows how these reports of food destruction or food shortage were distributed in the four Corps Zones.

TABLE I

CTZ	Percent of 439 Interrogation Reports containing indications of food shortage or destruction
I	41
II	28
III	9
IV	14

3. Slightly offsetting the above were 26 (or about 6%) reports of adequate food supply.

4. Over time, a trend was observed in the percent of interrogation reports containing indications of food shortage or food destruction. Table 2, below, displays the data on a monthly basis.

1601

* Detachment 6, 6499th Special Activities Group, PACAF, Air Effects Analysis...NVA/VC Problems and Their Causes (1965-67 Reports)

[redacted] [redacted]

TABLE 2

Relevant Statistics from Sample of 439 Interrogation Reports

Month	No. of Times That Specified Month Was "Covered" by An Interrogation Report	No. of Times That Some Mention of Food Shortage was Contained in an Interrogation Report Covering the Specified Month	Percent of Reports Indicating Food Shortage
Jan 1965	62	6	9.4
Feb 1965	62	6	9.4
Mar 1965	64	5	8.1
Apr 1965	68	6	8.8
May 1965	70	6	8.6
Jun 1965	71	7	9.8
July 1965	79	7	8.8
Aug 1965	78	6	7.7
Sep 1965	78	7	8.8
Oct 1965	80	7	8.7
Nov 1965	81	8	9.9
Dec 1965	81	8	9.9
Jan 1966	105	14	13.4
Feb 1966	106	16	15.1
Mar 1966	109	20	17.4
Apr 1966	105	20	19.0
May 1966	109	21	19.2

1601

[redacted]

TABLE 2 (continued)

Jun 1966	111	20	18.0
July 1966	111	22	19.2
Aug 1966	112	23	20.5
Sep 1966	119	23	19.3
Oct 1966	120	25	20.8
Nov 1966	120	24	20.0
Dec 1966	120	25	20.8
Jan 1967	108	30	27.7
Feb 1967	111	32	28.8
Mar 1967	110	32	28.9
Apr 1967	105	32	30.4
May 1967	100	33	33.0
Jun 1967	102	33	32.3
July 1967	100	33	33.0
Aug 1967	100	33	33.0
Sep 1967	98	34	34.7
Oct 1967	98	30	30.6
Nov 1967	93	30	32.2
Dec 1967	93	31	33.3
Jan 1968	18	7	38.8
Feb 1968	18	9	50.0
Mar 1968	16	9	56.2
Total	3490	739	21.2

[redacted] [redacted]

5. The data from Table 2 are portrayed graphically in Figure 1. The curve reflects a sharply increasing trend in "mentions of food shortage."

6. There were numerous accounts of aggravation of the tensions between the VC/NVA units and the indigenous population, resulting both from the irritation caused the farmer by the herbicide program as well as evidence of the VC stealing food from the local population. One report suggested that once-helpful civilians (to the VC) ceased to be "water" to the "fish"; "...they (the VC) were insufficiently fed, so they robbed the local people of their pumpkins, gourds, Indian corn and other vegetables... the cadres and soldiers ceased to be well-considered..."

7. Many other reports indicated that the VC had to obtain their food in an obtrusive manner without any mention of whether or not the local population was previously "sympathetic." The following excerpt is typical: "Neverless the people, who were poor, were still required to give rice to the VC troops." There were many accounts of the local people blaming the VC for herbicide operations, e.g., "... their (the VC) propaganda efforts enjoyed only limited success. The populace associated defoliation with VC-controlled areas and was aware that GVN-controlled areas were not subjected to it." However, it must be pointed out that in the sample of 439 IRs, there were more instances of the local civilians blaming the US/GVN forces for any ill effects suffered as a result of crop destruction or defoliation. The actual count (4 to 3) is not important, but statements such as "Civilians complain that the VC were responsible for crop destruction because they had 'liberated' the area" should, at least, be qualified to reflect the definite anti US/GVN sentiments also engendered by the program. The content analysis conducted by the 6499th Special Activities Group (PACAF) contained the following: "Negative results (re: defoliation) were obtained from the civilian population, however, where six out of eleven reported opposition to the US because of defoliated crops." This, roughly, agrees with the findings from this analysis.

1601

8. Generally, the sample showed a decline in VC morale resulting from the shortage of food. Over 90% of all responses that discussed morale of the VC whose rations were affected by the crop destruction program indicated a decline. (11 of 12) Of course, other psychological effects were often confounded with the effects attributed to the "pure" aspect of food shortage. Two somewhat conflicting sets of excerpts point up the complexity of "measuring" the effect of herbicide operations on food shortage: (contrast a. and b. with c. below).

a. Because of the loss of the crops, the Highlanders were forced

[redacted]

Figure 1

to move away. The VC were not affected because they had rice and could be easily supplied." "Food...supply was not affected. The unit did not obtain any foodstuffs from the local population. All food was in dry form and supplied by the regiment. The regiment received rice from Cambodia."

b. "The VC considered the exposing of their base camps to be more significant than the destruction of food crops because they could always buy food on the local economy."

c. "The loss of food was the worst effect of the spraying. Units usually only carried enough food for one day at a time...Source said that denial of cover was not as important a consideration. A camp could always be moved, new hiding places found elsewhere, but food was usually irretrievable." "Destruction of crops in the area eliminated an important source of food...caused a drop in the morale of the men..."

9. Of the Interrogation reports included in the sample, a large percent of defoliation or chemical spray crop destruction referred to (1) fear of the spray itself, (2) countermeasures employed to protect persons from physical contact with the defoliants, or (3) accounts of physical (bodily) damage attributed to the spray. No less than 70% of the reports mentioning defoliation operations contained information alluding to a concern on the part of the VC/NVA or local population regarding their effects on humans. Such fears are typified by the following excerpt: "The VC divided poisons into two varieties: suffocating and irritating. To counter the suffocating variety, the VC soldiers used masks to cover their heads..." Whether the fear generated by the herbicide operations is, in itself, an effective deterrent to morale cannot be determined. The evidence is divided. VC/NVA propaganda both "warns" and "assures" the population and their own units about the physical effects of defoliants. In the sample of 439 reports, there were 5 mentions of "authorized" countermeasures and 2 specific instances where the VC attempted to assure the population that the defoliants are not harmful. JUSPAO doctrine states that "We must inform the population...that the herbicidal effect is non-persistent and harmless to humans and animals.."

10. Perhaps the most difficult aspect of crop destruction to assess is its inherent repugnancy to the peasant. Such an effect cannot be measured quantifiably, of course. It can be hardened somewhat, however, by cautious examination of the IR's in the sample chosen for this study. There was not a single explicit mention of inherent repugnancy or strong repulsion of the crop destruction program in the sample of 439 IR's. There were a number of statements that either implied some degree of inherent

repugnancy to the program or indicated that the VC were attempting to point up the crop destruction sorties as an example of US/GVN atrocities. The following excerpt from an IR reporting on a defoliation in Cat Son Village, Phu Cat District, Binh Dinh Province accentuates the attempt by the VC to associate the program with world-wide disapproval: "..the cadres emphasized the story that the US was using this poisonous chemical liquid to make the Vietnamese people go hungry even though this tactic was forbidden by the world. Their ancestors had planted many trees, but they would not be able to enjoy them. The US was creating a desolate landscape..." This was not the only case where the VC identified herbicide operations with the implied disapproval of ancestors. In all, there were 14 IR's which contained evidence that the VC were attempting to convince the peasant that herbicide operations are inherently repugnant. Five reports indicated that they achieved some success in these efforts; seven reports explicitly stated that, in the view of the interviewee, the propaganda efforts enjoyed little success. In no instance did a report imply that the peasants were repulsed by the very nature of herbicide operations without accompanying VC propaganda efforts.

11. Only four interrogation reports from the sample of 439 contained evidence that some derogation of the enthusiasm of the farmers (to farm) had occurred. The following excerpt from the interrogation of a detainee on the effects of crop destruction operations near Cat Tai Village, Phu Cat District, Binh Dinh Province is typical of the four: "The VC tried to ge them to start another crop, but since they were convinced that they would lose money and expend effort to no avail, they took no further interest in farming." Three of the four reports cited above indicated that the VC attempted to persuade the peasants to resume farming. This implies that the VC were indeed dependent on the population for food to some extent. The other report suggested that the VC propaganda "typically" reminded the population that the "people put their energies and life into growing crops, only to have their efforts destroyed in an hour by defoliant aircraft." Although only four reports in the sample showed evidence of farmers actually giving up farming, many other reports mentioned the pressures put on the farmer (by the VC) to continue farming. Usually, the persuasion was couched in terms of the farmer's part in the War of Liberation.

1601

12. No evidence was found in the sample of 439 Interrogation reports that suggested aggravation of VC/population relations due to a refugee burden (induced by the crop destruction program) in VC areas. Quite to the contrary, almost all of the reports mentioning the herbicide program also contained mention of large numbers of the population moving to GVN controlled areas. The following excerpt is typical: "As a result of the defoliation operations the majority of the civilians moved to GVN controlled areas, and only a minority remained."

13. No evidence that the program actually strengthened the VC's resolve to resist was found in the sample of 439 interrogation reports.

[redacted] [redacted]

SECTION VII

RESULTS OF HERBICIDE OPERATIONS

A. ASSESSMENT OF FIELD COMMANDERS IN VIETNAM

1. Results in combat from US/GVN herbicide operations have been specifically described by the field commanders in Vietnam, as follows:

a. "Defoliation has provided a means of insuring terrain denial through improved observation and optimum ground coverage along routes of communication and ground defensive perimeters. Along QL 19 from An Khe to the Mang Yang Pass, frequently used ambush sites have been eliminated as a result of defoliation efforts. As a result there have been fewer convoy interruptions along this critical route." (173rd ABN BDE)

b. "Previous defoliation of possible rocket sites allowed aerial observers of the 7th Squadron, 17th Cavalry to discover and neutralize enemy 122mm rocket emplacements on 10 May 1968 before any rounds were effectively delivered on the 1st Brigade, 4th Infantry Division CP located at Dak To". (4th Inf Div)

c. "C-123 aircraft defoliation operations near the Cambodian border from west of Dak to south of Duc Co has hindered the movement of VC/NVA forces during the hours of daylight and also allowed observers to detect easily recent use of trails and roads." (4th Inf Div)

d. "C-123 operations thus far have defoliated 80% of the first two canopies of dense jungle near the Cambodian border (YA7344) increasing visibility by an estimated 50%." (4th Inf Div)

e. "Helicopter defoliation operations were begun in May 1966 against infiltration routes and mortar and rocket sites vicinity Le Chie Village (ZA8654). Aerial observation of the area is not possible and the Pleiku area has experienced no mortar or rocket attacks since the area was defoliated." (II Corps)

1601

f. "Large area defoliation by C-123 aircraft has increased vertical visibility in hardwood forests from 75 to 80%. Similar improvements in visibility have been accomplished in double canopy jungle where successive missions have been flown." (II FORCE V)

g. "Defoliation is an important adjunct to target acquisition. Aerial photographs can be taken from which interpreters can see to the ground

[redacted]

in areas that were previously obscured. Defoliation also aids visual reconnaissance. USAF FAC's and US Army aerial observers have discovered entire VC base camps in defoliated areas that had previously been overlooked." (III Corps)

h. "Defoliation has increased the security of friendly installations and decreased the number of potential ambush sites available to the enemy. Defoliation of areas from which the enemy can establish mortar positions and rocket launch sites is particularly important. For example, defoliation in the Lai Khe rocket belt is judged to be a major factor in the decline of enemy activity in that area." (II FFORCEV)

i. "Large scale defoliation is being carried out in potential jungle staging areas from which the enemy can launch attacks on Saigon. The "Catchers Mitt" (YT050750) is an example. The "Catchers Mitt" is currently priority number one for C-123 defoliation in III CTZ because it is the traditional area from which the Dong Hai regiment stages attacks toward Saigon." (III CTZ)

j. "During operation Nevada Eagle and Somerset Plain, defoliation proved extremely effective in permitting increased surveillance of enemy infiltration routes and LOCs such as Route 547 out of the A Shau Valley." (II MAF)

k. "Defoliation along friendly LOCs has exposed enemy ambush sites and denied the enemy concealed observation sites. This technique has been used along Route 9 in I CTZ and has considerably reduced frequency of enemy attacks on friendly convoys." (III MAF)

l. "Defoliation in base areas 114 and 101 has provided for improved surveillance and interdiction by fire of areas which previously offered concealment to the enemy. In addition ground troops making sweeps in these areas have been materially assisted by increased ground level observation thereby permitting sweeps of larger areas." (III MAF)

m. "Defoliation operations have resulted in the exposure of Viet Cong routes and storage areas to aerial observation and surveillance which has thus had a tremendous adverse effect on the enemy's activity and his freedom of movement." (IV Corps)

2. Effect on VC/NVA food supply: Crop destruction operations got underway slowly in South Vietnam during calendar year 1968. This was the result of an extremely dry growing season particularly during the months of January, February, March and April, which produced very few lucrative

crop targets. However, there is no evidence which alters the views of this headquarters or any of the field commanders from those expressed in the MACV message 40848 of 071105Z Dec 67. This message stated that the crop destruction program is an integral, essential, and effective part of the total effort in South Vietnam; program objectives are being met, and no program changes are necessary at this time.

3. As of July 1968, the VC/NVA had a daily food requirement of about 215 short tons. About 58%, or 124 short tons, could be internally procured in SVN. Captured documents indicate that enemy military units are assigned a self-production quota to provide their own food for two months of the year. Even considering the limited crop destruction operations executed in calendar year 1968, the field commanders have submitted the following impact statements:

a. "A Chieu Hoi, the former village chief of Canh Lang village, said that the people in his area are short of rice due to airstrikes and herbicide missions." (PSA, Binh Dinh)

b. "Chieu Hoi reports that the VC/NVA in the area are starving and have many diseases due to the lack of food since recent spraying of a large majority of their food crops." (CORDS, Binh Dinh)

c. "Crops on 51 fields in the general vicinity of Van Canh (BR8306), have been destroyed by herbicide. The effectiveness of this program is indicated by the large number of Montagnards who have come down from the mountains with reports that their crops have been poisoned. The Montagnard ralliers indicate that they had been supplying food to the VC/NVA. (CAP ROK Inf Div)

d. "Herbicide operations have been useful in forcing the enemy troops to seek sources of food supply close to allied positions thus exposing them to contact with allied units. A high percentage of VC/NVA troops killed or captured have been engaged in food gathering or food buying missions at the time of contact." (173rd ABN BDE)

1601

e. "A former VC official from Kon Druc hamlet (Montagnard), Lam Dong, said that he rallied because the people of his hamlet were near starvation as a result of crop failures and increased spray missions on rice crops." (II Corps)

4. Psychological effects on VC/NVA forces: defoliation operations result in more enemy casualties by forcing them to make attacks in open territory. Defoliation of enemy base areas results in the exposure of

enemy forces to observation and consequent shelling by allied forces and also necessitates the movement of the base area to another location. Such harassment has a definite negative influence on enemy attitudes and motivation. Crop destruction operations, aimed at denying vital foodstuffs to enemy forces, provide a definite psychological effect on these forces. Crop destruction has contributed to food shortages and morale problems in enemy units. After the crops have been destroyed in a particular area, the procurements and distribution of food requires an increased number of enemy troops. Considerable disappointment and discouragement are likely to ensue if the crops destroyed had been the responsibility of a production unit. In addition, destruction of crops results in considerable animosity among the local populace toward the VC/NVA troops, whose presence brought about the loss.

5. Psychological and economic effect on civilians in VC/NVA controlled areas: crop destruction projects are developed with a view towards minimizing adverse effects upon civilian population living in the target area. These operations, by their very nature, are accompanied by psychological and economic costs. While no empirical data is available on the extent of these costs, all crop targets are located in areas of low population density which are under enemy control.

6. Effect on allied combat operations: All field commanders, without exception, state that herbicide operations have been extremely effective in assisting in the allied combat effort.

B. CROP DESTRUCTION EFFECTIVENESS

1. Crop destruction missions have probably hurt the VC most. It has resulted in the destruction of their immediate food supply (as much as 70 to 80% of civilian production may go to VC IN THE AREA) and made it imperative they bring food in from other areas or move to new positions. If they bring food in, troops are tied up in the process of production and resupply that would otherwise be available for tactical operations. If they move to another area, any long range offensive plans from the former base have to be cancelled. Their base defense measures and equipment must be uprooted and the whole unit is displaced. This requires time which otherwise could be used in maneuvers against U.S. and ARVN activities. In addition, when VC troops are required to move into a new area, the civilian populace are embittered because their own food supply must be used to feed the VC.

2. In order to prevent the necessity for moving to a new area, the VC have undertaken food preservation programs. Harvested food is covered

1607

with plastics and other tight-fitting material to avoid comtamination by the spray. Local farmers are advised by the VC to scatter their crops, to intermix vegetable plots with rice paddies, thereby making them less vulnerable to spray operations in any one area. One contingency plan called for the immediate harvesting of crops following the spray mission in hopes of salvaging portions of the crop. Other attempts to offset the effects of crop destruction include increased emphasis on animal husbandry and wildlife preservation.

3. If attempts to store food and protect crops from the spray are unsuccessful, then the VC must obtain food by other means. Usually VC dietary staples, such as rice and vegetables, are procured by increased taxation, purchases, and transportation of supplies from local caches or from rice depots in SVN and other locations outside of SVN. VC mobile units usually carry only enough food for one day and must rely on obtaining additional food from villages they pass through. This results in a food shortage for both VC and civilians, especially if crops in the area have been sprayed. The unwillingness of the civilians to give up food to the VC was displayed when, during a food shortage in Quang Tri Province in late 1966, VC had to enter hamlets that had not been hit by spray missions and acquire food by force.

4. In 1966, the total area covered was double that sprayed in 1965; however, the total amount of food destroyed by crop destruction operations amounted to only two percent of the total produced in SVN. Crop destruction efforts, however, have been successful because of selective targeting procedures and VC food rations have been reduced up to half the normal amount following crop destruction operations in some VC controlled areas. A captured NVA combat support company commander reported that crop destruction operations have caused both military and civilian food shortages, particularly vegetables. Another document states that loss of crops is a significant and urgent problem and calls on various districts to expedite rice collections to meet combat requirements.

5. Other captured documents and statements reveal that the chemicals are very effective against most types of crops. One VC has reported hearing of a defoliation operation in the Boi Loi area, in July 1966, which killed many food crops: "The affected crops were rice, peanuts, tomatoes, cucumbers, mangoes, bananas, and peppers. After two days, all crops died. First the bananas, then peanuts, rice, cucumbers, tomatoes, peppers, and finally the mangoes died." Another report stated: "The powder sprayed in the first defoliation destroyed all fruit, rice, potato, and manioc crops." Many other reports talk of the destruction of various crops, the spray missions that caused the killing, and the

1601

resulting food shortages that develop.

C. RESULTS OF DEFOLIATION

1. Defoliation missions caused almost as much trouble for the VC. These operations destroy their safe havens, curtail their ambush activities, provide the environment for better reconnaissance of VC movements and operations, and damages the morale of the troops. Among some tactical troops, defoliation which exposes their position is feared as much or more than crop destruction. One captured VC stated: "The canopy of the forest was destroyed by the defoliant spray within two or three days, but the undergrowth was not affected to any great extent. The VC feared discovery of their locations much more than they feared destruction of crops by defoliation."

2. Because defoliation does expose the position and the operations of the VC, many times the sprayed area is evacuated following the spray attack. Area defoliation projects have been successful along these lines. Early efforts in safe haven defoliation in the Go Gong Province resulted in the VC completely evacuating the area, thus assisting the province in their pacification efforts. Another example of area evacuation occurred when the banks of the Vai Co river were defoliated and the VC left their sheltered positions there.

3. The VC do not like to move, however. As previously mentioned, this requires giving up all plans and base defensive operations. It causes the unit to be exposed to our reconnaissance and strike aircraft, and they must either move or fight to stay where they are. Before crossing defoliated areas, VC units may wait for nightfall, use camouflage, or proceed individually and regroup after the entire unit is across the defoliated area. In any case, valuable time is wasted.

4. Because of the disruptive effects of defoliation, the VC attempt to prevent this type of activity. One order that appeared in a captured document points out the VC prohibit cutting of trees along highways and impose rather severe penalties on violators. They fire on defoliation aircraft, even though they will probably receive a strike by the fighters, because they have exposed their position. When they can gain advance warning of the spray mission, they may proposition troops to attempt to shoot down the spray aircraft. Another attempt to curtail spray activity involves placing Claymore mines in the tops of trees and setting them off when the aircraft fly close enough.

1601

[redacted]

[redacted]

D. EFFECTS ON VC MORALE

1. One of the principle effects of herbicide operations is the damage to VC morale. The VC troops become demoralized when they have to break camp or attempt to procure food, after spraying had destroyed their immediate supply. They will not usually eat food once it has been sprayed.

2. The members of food production units are especially demoralized when their efforts prove to be futile. When crop destruction and defoliation activity causes the civilians to turn against them and leave the area, the VC again are discouraged. In cases of civilian dislocation, the VC not only lose the food but also the labor which was producing it, and VC gains from taking over the abandoned property seldom are equal to the loss of productive effort by the departing refugees.

3. Another demoralizing factor is noted in their own propaganda. Even some leaders have misconceptions of the effects of the herbicides. VC medical officers instruct members of units not to eat the contaminated food as it would "damage their health and cause stomach and liver disorders." One recommendation to those who are exposed to the chemicals is to eat green bean soup. Another official VC document discusses plans to "research the utilization of charcoals and ashes to counteract the effects of poison, to draw the poison out of the surfaces of rice seeds and coconuts in order to utilize them," and directs the units to not allow livestock to graze insprayed areas or to be given food that has been sprayed. VC officials also instructed the men to wear homemade or issued gas masks as "bodily contact would cause physical harm or in some cases even death." Propaganda of this type causes concern among the VC troops because of the suggested dangers associated with the spray. On the other hand, it sometimes tends to strengthen their motivation because they feel the poor civilians are being exposed to undue hardships.

E. EFFECTS ON CIVILIAN POPULACE

1601

1. The effects on the civilians are somewhat harsh if they are located within a VC controlled area. Many of the civilians do not understand why the crops and trees are being defoliated. One former Main Force platoon leader related: "Almost none of the people understand the purpose of crop destruction by the GVN. They can only see that their crops are destroyed. Added to that, the VC pour propaganda into their ears. Therefore, a number of people joined the VC because they had suffered from damage." He went on to speculate on the use of spray for maximum effectiveness:

> "In my opinion, to get the maximum result out of the sprayings, the GVN should warn the people beforehand and explain to them

[redacted]

[redacted]

why, call on them to move to the GVN controlled area, and assure them that they will have plenty of jobs in the GVN areas. When the people understand the purpose of the crop destruction, and if they know that their living is assured in the GVN controlled areas, they won't be resentful towards the GVN. Thus, the chemical would become a perfect weapon. "

End

1601

[redacted]

REFERENCES

(a) Project CHECO Southeast Asia Report, "Herbicide Operations in Southeast Asia July 61 to June 67 - Special Report", dated 11 October 1967

(b) "Review and Evaluation of ARPA/OSD Defoliation Program - Research Phase 15 Jul 61 to 12 Jan 62, Operational Phase 13 Jan 62 to March 62". CHMAAG VN (Gen Delmore). Undated report by Delmore, Shaw, Burcham, Minarik and Whittam received at CINCPAC 7 May 1962, R/S 002249-62

(c) "OCONUS Defoliation Test Program", Technical Report 79 by Darrow, Truchelut and Bartlett, U.S. Army Biological Center, Fort Detrick, Md, dated July 1966

(d) Combat Development Study 64-2, "The Use of Defoliants to Support Army Operations", U.S. Army Combat Development Command, January 1965

(e) CINCPAC 102343Z DEC 67, Subj: "Evaluation of Crop Destruction Program

(f) COMUSMACV 25535/301045Z AUG 68, Subj: "Herbicide Operations"

(g) "Measurement of Progress" - CINCPAC AND MACV, July 1968

(h) USARV Chemical Conference Final Report, 20 May 1968

(i) Battelle Report No. RACIC-TR-54, "Defoliation - Incidents Correlation Study", 1 April 1967

(j) "On the Use of Herbicides in Vietnam", a statement by the Board of Directors of the AAAS, Science Magazine, Vol 161, 19 July 1968

(k) "Assessment of Ecological Effects of Extensive or Repeated Use of Herbicides", by W.B. House, L.H. Goodson, H.M. Gadberry and K.W. Doktor, Midwest Research Institute, Final Report 15 August - 1 December 1967

1601

[redacted]

APPENDIX A

RVN HERBICIDE MISSIONS AND ATTRITION DATA

Table 1

Herbicide Operations in RVN by Month

Date		Defoliation Sorties	Defoliation Hectares	Defoliation Hits	Crop Destruction Sorties	Crop Destruction Hectares	Crop Destruction Hits	
1965	Oct	2	220	0	60	6705	37	
	Nov	52	7290	22	33	3390	7	
	Dec	84	11665	63				
1966	Jan	115	14395	43				
	Feb	45	6715	16	36	6625	0	
	Mar	60	8745	12	50	8930	46	
	Apr	78	11540	13	46	7235	40	
	May	161	23445	30	5	1045	4	
	Jun	169	24880	51				
	Jul	71	10740	22	16	2640	16	1 a/c lost crew rescued
	Aug	164	24805	83	29	3545	28	
	Sep	194	27755	20	38	5010	27	
	Oct	218	29545	56	44	5360	53	1 a/c lost
	Nov	376	53330	31	20	2685	21	crew rescued
	Dec	416 2067	62050 297,945	66 443	13 297	1950 45,025	4 241	
1967	Jan	416	65395	69	9	1900		
	Feb	379	55484	44	17	2490	3	
	Mar	422	58795	86	45	5690	50	
	Apr	284	41395	114	44	6000	27	
	May	295	42297	45	37	4808	26	
	Jun	415	57643	25	114	15522	33	
	Jul	335	51719	30	84	11694	21	1 a/c lost
	Aug	241	36685	20	79	9838	59	crew lost
	Sep	304	34919	15	99	10555	55	
	Oct	362	40822	14	84	9118	24	
	Nov	474	54300 548,224	10	14	1620 79,235		
	Dec	251	28770	9				
1968	Jan	544	63820	19				
*	Feb	94	11285					
*	Mar	212	24145					
	Apr	531	60860	57				
	May	550	64274	23				
	Jun	440	51840	33	23	2460	1	1 a/c lost crew lost
	Jul	372	42665 318869	121	29	3363	12	
**	Aug	308	35115	18	42	4872	1	

* All C-123 herbicide spray aircraft were transferred temporarily to a troop carrier role from 8 February to 11 March 1968 as a result of the TET offensive.

** 1 - 24 August 68

1601

[redacted]

6 September 1968

Table 2

HERBICIDE OPERATIONS IN RVN
1965-1968
(by year)

Year	Defoliation			Crop Destruction			a/c Lost
	Sorties	Hectares	Hits	Sorties	Hectares	Hits	
1965 (last three months	138	19,175	85	93	10,095	44	0
1966	2067	297,945	443	297	43,025	239	2
1967	4178	568,224	481	626	79,235	298	1
1968 (to 24 August	3359	389,119	289	136	15,567	15	1

UNCLASSIFIED

A-2

UNCLASSIFIED

[redacted]

[redacted]

1601

[redacted]

[redacted]

Table 3

Summary of UC-123 Aircraft Lost
on Herbicide Missions in RVN

1. 20 June 1966 - One C-123 shot down at BT 252621, crew rescued.

2. 31 Oct 1966 - One aircraft lost to ground fire, crew rescued. From Herbicide Report MACV 07 1346 Z Nov 1966.

   The second RANCH HAND aircraft was lost 31 Oct 66 in the Iron Triangle region. All crew members were rescued, although the aircraft was totally destroyed. From CHECO Report Page 28.

3. 21 July 1967 - One aircraft with crew lost at BS 190240-BS 340340.

4. 24 May 1968 - One aircraft lost left engine, crashed in ocean 1-1/2 kilometers off coast at VQ 990480. All 3 members of 12th ACS perished in crash.

1601

[redacted]

[redacted] [redacted]

APPENDIX B

CHARACTERISTICS OF THE PRINCIPAL HERBICIDES USED IN THE RVN

A. Types of Herbicides

1. The types of herbicides currently in use in the Republic of Vietnam are Orange, White, and Blue. Orange is composed of 2, 4,-D (dichlorophenoxyacetic acid) and 2, 4,-5T (trichlorophenoxyacetic acid) and is used on broad-leaf vegetation and also on mixed targets. It is the best suited for the foliage found in RVN. White (Tordon 101) is composed of trichloropicolinic acid and 2, 4,-D. It is most effective against broad-leaf vegetation and, because of its low volatility, is used on targets where the spray area boundary is critical. Blue (Phytar 560-G) is a water-based dessicant and kills by drying. It is composed of sodium cacodylate and dimethylarsinic acid and is used primarily for grass-type targets.

2. It should be emphasized that these chemicals are non-toxic, non-corrosive (except for Blue which is slightly corrosive in nature), and generally not harmful to any form of human or animal life. The aircrews are exposed to it daily and, in the U.S., defoliants of this type are used on over 400 million acres annually. Defoliants, in general, have been used for the past 20 years without ill effects and ARVN troops have been exposed to it for the past few years without harm. Defoliants are non-poisonous and food or water may be consumed without fear of resulting effects. Reportably, some RANCH HAND personnel have actually ingested some of the agents during demonstrations to show that there is no danger. The spray does not poison the soil, which may be replanted after irrigation or replowing.

B. Visible Effects of Herbicide Spray

1. The visible effects of the spray vary, depending upon the agent used and types of foliage in the spray area. The first effects of Blue are visible within 24 hours. However, agent Orange is the quickest reacting, killing in four to seven days. White takes about four weeks for visible effects to occur. After six weeks most of the leaves are dead, but it takes up to four months to be able to see through to the ground. Some dense jungle foliage requires two applications of Orange before the upper and lower vegetation is completely defoliated. Grasses, on the other hand, are killed within the first week.

1601

2. Most crops die within a few days. A few types may be salvaged if immediate action is taken by the farmer. Rooted vegetables, such as

[redacted]

carrots and potatoes, are examples. Cabbages can be partially saved if the outer leaves are removed and the cabbage washed. Some trees sprout new shoots within two or three months if the tree had not died as the result of the spray. Bamboo and banana trees have some resistance to certain types of spray, but not to all of the herbicides.

3. The principal food crops on which the VC subsist are rice, manioc, sweet potatoes, and corn. Two of these crops, sweet potato and manioc, are broadleafed and produce edible roots. Both are very susceptible to the 2, 4,-D/2, 4,-5T type herbicides. The other two, corn and rice, are narrow-leaf plants which are also susceptible to the same type of herbicides but require heavier doses. In addition, rice is very susceptible to relatively low rates of cacodylic acid.

4. Sweet potatoes and manioc should be sprayed prior to root formation since killing the aerial portion of the plants will not immediately affect edibility of sweet potato or manioc roots if these are permitted to develop before spray applications.

5. Where the target crop is rice and no other crops are involved, cacodylic acid (Blue) should be used. This herbicide is effective in killing rice or rendering it unproductive at application rates of approximately one pound per acre during approximately 90 days of its growth cycle. However, to insure more positive results, 7 pounds per acre of Blue should be employed operationally. This should be contained in 3 gallons of spray solution (2.3 lbs. Blue/gallon of water).

6. Cacodylic acid (Blue) and to a lesser extent 2,4,-D/2, 4,-5T (Orange) are corrosive to aluminum and brass and caution must therefore be exercised in selecting the proper spray equipment.

C. How Herbicides Kill Plants

1. Herbicides kill plants by interfering with essential physiological processes, such as respiration and photosynthesis, and by inhibiting the synthesis and use of metabolites essential to plant growth. The phenoxy herbicides kill plants by multiple effects including the proliferation of cells, loss of apical dominance, and the conversion of stored carbohydrates such as starch to soluble sugars.

2. The herbicides Orange (2, 4,-D/2, 4,-5 T) and White (Tordon) kill plants by both systemic and contact action. Applied to the foliage of rapidly growing plants, 2, 4,-D and 2, 4, -5T enter the leaves and stems and move downward to the roots, killing the entire plant. Applied to the soil, they are also readily absorbed by plant roots and move to the tops,

1601

[redacted]

resulting in complete kill of the plant. The phenoxy herbicides will also kill plants by contact and systemic action when applied in fine droplets at high rates per acre. When used in this manner they will cause desiccation of foliage which may or may not be accompanied by defoliation depending on the mixture of plant species present and the growing conditions.

3. When Orange or White are applied to the foliage of semi-dormant or dormant plants, their effectiveness in killing vegetation is critically reduced. However, when they are applied to the foliage of rapidly growing vegetation, the Orange or White moves downward into the lower leaves, stems, and roots along with the carbohydrates resulting from photosynthesis in the leaves.

4. Since Orange and White are systemic, translocated herbicides that kill plants by multiple causes, their early effects (1 to 2 weeks) are not as spectacular as the desiccating and burning effects of contact herbicides such as Blue (Phytar). For this reason, and because of their mode of action, it is impossible to evaluate their initial effects on perennial woody vegetation earlier than 30 days after treatment and their full effects in killing the vegetation cannot be completely seen until at least 1 year after treatment.

5. Evergreen forests, mangroves, and tropical scrub are of immediate importance in vegetation control in South Vietnam. The arrangement of the forest canopy and undergrowth in layers; the high density of the total plant cover; the great number of kinds of plants; and the high total volume of plant material are of great importance.

6. Nearly all plants of the Vietnamese forests can be controlled with herbicides in reasonable amounts; some trees require larger amounts than others. Unless applied during active growth, herbicides are much less effective. Active growth corresponds generally to the rainy season.

7. Plants killed by herbicides will be replaced by other kinds of plants unless the soil is cultivated or treatments repeated. Shrubs, tropical grasses, or small bamboos often constitute a very difficult control problem. Repeat treatments, probably annually, will be required to keep an area free of all vegetation.

D. Toxicity of Herbicides to Men and Animals

1. The principal herbicides used in Vietnam have been widely used in the United States for more than 20 years on food crops, range land, and forests. They are considered non-toxic to man and animals. The acute oral LD_{50} for the 2, 4-D type of compound ranges from 375 to 1200 mg/kg, and cacodylic acid has an acute oral LD_{50} for albino rats of 1350 mg/kg*.

*LD_{50} is the amount of material in mg per kg of body weight required to produce 50% mortality in the laboratory animals being used, in this case albino rats.

2. Both materials should be handled with care, should not be ingested, and if spilled on the skin, should be removed with soap and water at the earliest opportunity; however, instances when this has not been done have not resulted in any discernible effects to the men involved.

3. A widely held popular misconception has it that arsenic and arsenical compounds (such as Blue which contains dimethylarsenic acid) are highly cumulative in effect something like lead and mercury, which are indeed cumulative.

4. Arsenic is definitely not cumulative because it is excreted readily and elimination from the tissues is normally completed within a few weeks after removal of arsenic from the diet. This has been clearly demonstrated by Putnam, 1888, in the Boston Medical Surgery Journal 119: 1-4. A lucid statement on the subject from this source follows:

> Arsenic does not accumulate, but is rapidly eliminated. By this is of course, meant that the accumulation does not go beyond a certain limit; for it is evident that a drug which is not wholly eliminated until from one to six weeks after being taken, as is the case with arsenic, must, for a certain time, have been absorbed faster than it could be eliminated.

5. It is seen that the Blue, which although an arsenical compound, is not cumulative in effect and with an LD_{50} of 1350 is perhaps even less toxic than the Orange with an LD_{50} of 1200 and both are clearly harmless to men and animals on the ground in target areas, and to men who handle the materials every day as has been pointed out earlier in this paper.

1601

APPENDIX B

Table 1

PHYSICAL AND CHEMICAL PROPERTIES OF HERBICIDES

rate of 3.0 gallon/acre is normally used

droplet size - 300 microns optimum

UC-123 principal vehicle for dispensing herbicide

ORANGE - 2,4-D/2,4,5-T, Mix	4.2 lbs/gal AE n - butyl ester of 2,4-dichlorophenoxyacetic acid
physical property=light brown liquid, oil soluble	3.7 lbs/gal AE n - butyl ester of 2,4,5-trichlorophenoxyacetic acid
98 to 100% active ingredient as total ester	
8.6 lb/gal acid equivalent	8.9 lbs./gal Acid Equivalent
freezing point 46° F	
BLUE - (PHYTAR 560-G)	27.7% Sodium Cocodylate 4.8% Free cocodylic acid (dimethylarsenic acid)
(PHYTAR)	bal. water, sodium chloride
liquid, water soluble 3.1 lbs/gal acid equivalent	
WHITE - (TORDON 10')	Commercial formulation (Dow Chemical Company) consisting of
liquid, water soluble	Picloram or 4-amino-3,5,6-trichloropicolinic acid, as the potassium salt
	2.0 lbs/gal AE Tri-isopropanolamine salt 2,4-D 0.54 " " " " " salt picloram 2.54 lbs/gal Acid Equivalent

Technical data from ref (a), ref (c), ref (d) and ref (k).

1601

[redacted] [redacted]

APPENDIX C

COMMUNIST PROPAGANDA ON USE OF CHEMICALS IN VIETNAM

A. Local Communist Propaganda in Vietnam

1. Since the early testing period of the herbicide operation, VC propaganda has been increasing in magnitude and hostility. It is usually aimed at the GVN and the U. S. for using chemicals in the war. The propaganda does not seem to differentiate between the use of chemicals for defoliation purposes and that used for crop destruction. It generally attacks the U. S. for the horrible atrocities the spray has caused. Examples of some typical terminology are: "U. S. aggressors have lost all human character", or "behaving like a pack of deranged dogs, like a pack of blood thirsty devils who outdo even the Hitlerite fascists in ferocity."

2. The VC propaganda usually is disseminated by radio broadcasts or by VC cadre meetings in the villages. Both methods exaggerate the effects of the spray and attempt to arouse hatred in the hearts of the people. The radio reports emphasize the effects on animals and small children or old people, claiming all manners and types of illnesses. An example is contained in the following statement of NFLSV Central Committee:

> "In the past few years, thousands of persons were killed and hundreds of thousands of others affected by US toxic chemicals. Recent preliminary investigations by the NFLSV Medical Committee and the Liberation Red Cross showed that in some localities the number of persons killed by US chemi cal poisons had increased 30 percent. Fifty-six percent of the local population got intestinal diseases by eating poisoned food, and 75 percent of them became consumptive. More barbarous still, US poison substances have killed fetuses and seriously affected milk secretion of many mothers and rendered them unable to feed their babies. . . Moreover from 50 to 60 percent of the draught animals lost their vigor and stopped breeding, while the poultry were completely killed."

1601

3. It must be remembered that the chemical spray is non-toxic and has had no effects on aircrews or ARVN regular troops, nor have there been any ill effects reported during the use of these chemicals in the United States. Yet the VC propaganda campaign is vigorous and descriptive. After a defoliation operation in Kien Hoa, a report claimed the following:

[redacted]

"So far, nearly 500,000 people, the bulk of the province population, have been affected more or less seriously. 46,000 of them, mostly women, children, and old folks, are in a grave state, getting itch all over their bodies, nausea and swellings. The body of Mme Khai of Hoa Than Hamlet Two, Luong Hoa village, Giong Trom district, was swollen to the point that she could hardly walk. Mr. Tai's children, two boys and one girl died after eating poisoned fruit. Mrs. Muoi's 3 year old boy, of Long My village, same district, who was playing in his mother's arms, suddenly died after violent throes... In addition, hundred of people seriously affected were sent to hospitals. Toxic chemicals exerted also a damaging effect on domestic animals. Hundreds of head of cattle were killed by eating poisoned grass. Thousands of others were affected. Tens of thousands of poultry, pigs and dogs died also."

4. Much of our knowledge of VC propaganda techniques is derived from interrogation of VC deserters or captured troops and documents. One VC returnee claims that after any defoliation mission, special cadre move into the villages nearby and attempt to arouse feelings of hate and resentment against the U.S. for conducting the defoliation operations and also against the ARVN for permitting "chemical warfare" to be carried out.

5. The propaganda program of the VC is evidence they fear the results of herbicide activity and, almost in desperation, are trying to negate the results of such operations. They are unable to protect the people from the results of the spray and the people associate spray activity with the presence of VC troops in the area. It is realized that repeated crop destruction could cause long range food shortage, thus the people attempt to leave for areas controlled by the GVN. This hurts the VC even more since there are then fewer peasants to produce crops for the troops. Therefore, the propaganda is designed to retain the support of the people by putting the blame for their hardships on the GVN and U.S.

B. Worldwide Communist Propaganda

1. In addition to this local Communist propaganda for and by the Communist leaders and followers in South Vietnam, there is also a worldwide, extensive, and continuing effort to counter the very effective US/GVN herbicide program by use of clever and not so clever propaganda.

1601

2. The following items of enemy propaganda which have been extracted from sources indicated, show what efforts are being made worldwide to cripple or destroy the herbicide program in Vietnam. It will be noted that most of these items which eminated from Cambodia and Moscow, as well as those from Hanoi, were directed at target audiences in both Europe and Asia.

Saigon VIETNAM PRESS in English, 20 March 1963 --S

Item . . . The Liberation Front press agency also said in December that the chemicals had caused the people in Cao Lanh, Kien Phong Province, to break out with rashes all over their bodies. The report said the illness is characterized within 24 hours. Death occurs between the seventh and tenth day. . .

Hanoi VNA in English to Europe and Asia 0533 GMT 16 July 1963 -- B

(Editor's Note: All brackets and ellipses as received)

Item . . . Hanoi, 16 July 1963 (Partial). . . Along with terroristic operations, the United States and the Diem Administration have resorted to a most vicious warfare--the spraying of toxic chemicals over South Vietnam paddy fields in an attempt to starve peasants into joining "strategic hamlets." Up to the end of 1962, the U.S. - Diem air force had carried out about 50 spraying raids over several provinces in Nam Bo and Trung Bo. . .

. . . According to the investigations, analysis, and study conducted by the South Vietnam Liberation Red Cross Society, the United States has used various kinds of chemicals. Besides the 2, 4, -D and 2, 4, -5T used in great doses, it has sprayed in Ben Tre and My Tho the white arsenic alkali, alkali earth, calcic cyanamide, and metal arsenites. It has also used 2, 4 dinitropheno (DNP) and dinitro-orthocresol (DNC). As a matter of fact, the chemicals used by the United States and the Diem administration in South Vietnam are strong chemicals used in great doses, not for production but war purposes . . .

. . . In these conditions, they will of course, entail much more harmful consequences for rice and other crops, animals, and human beings. Ngo Dinh Diem himself has bluntly states: "This is a very effective war weapon." (interview by the Voice of America, 17 March 1963). . .

Hanoi VNA in English to Europe and Asia 0537 GMT 26 June 1963 -- B

1601

Item. . . Hanoi, 26 June 1963 -- In the first days of this month, the U.S. - Diemists again sent aircraft to drop noxious chemicals on many densely populated areas of Ca Mau Province, LIBERATION PRESS AGENCY reported. As a result, hundreds of persons, including many women, children, and old folks were affected. Their skin swelled and was covered with burns and boils. . .

. . . In the spraying of poison on 25 April and 6 May on Phong Binh village five persons were seriously affected, and two children died. . .

(Comment by N. Agayants on a letter sent by the U.S. Embassy in Moscow to KOMSOMOLSKAYA PRAVDA: "Poisonmongers' Advocates")

Item. . . Yesterday an envelope arrived in the editorial office of KOMSOMOLSKAYA PRAVDA. The sender's address was the U.S. Embassy in Moscow. The contents were a sheet from an official Information bulletin. Relying on reports from Saigon, the employees of the American Embassy affirmed that the chemical substances used by the U.S. Armed Forces against the South Vietnam patriots were "absolutely harmless." We decided to reprint the test of the embassy declaration in full, even if its assertions seemed to us rather improbable:

" The herbicides used in the Republic of Vietnam to destroy foliage which serves as a cover for the partisan detachments are harmless to man, animals, the soil, and drinking water. Vietnamese and U.S. officials recently explained this at a press conference. This conference, the purpose of which was to state the truth about the chemicals used for the destruction of foliage, had been convened in connection with false accusations that these herbicides kill people and animals. The herbicides serve to destroy the foliage along the roads and canals which the Vietnamese partisan detachments use as ambush for assaults against Vietnamese troops and rural inhabitants.

"These officials showed the chemical mixture used for the destruction of this foliage. One Vietnamese employee applied this mixture to his skin in order to show that it was harmless. These herbicides are being used on a large scale in the United States, the Soviet Union, and other countries, and are attainable through commerce to farmers throughout the world. The officials stated that this propaganda campaign had been started in order to represent this destruction of foliage as war with the use of poison gas, because these actions had been successful in making the Vietnamese partisans give up their favorite hideouts.

We will not break a lance in the discussion over whether herbicides are harmless or not. But let us turn to facts. Late in March 1963 the American journal NEW REPUBLIC, which probably has also been read by the members of the U.S. Embassy, carried an editorial. It said the following:

"The Pentagon published a determined denial, stating that we have never used poison gas in South Vietnam. This statement is only true if we consider that there is a fundamental difference between poisonous substances and highly toxic substances. The United States used several kinds of liquid chemical substances which destroy weeds and are spread by specially equipped C-128 airplanes belonging to the U.S. Air Force and piloted by American crews."

1601

"The chemicals used are of the same type as the chemicals sold to gardeners and every gardener can confirm that these liquids are highly toxic, which is clearly stated by the instructions on the packages. "Not to be used in closed locations! Keep away from children and domestic animals! Wash those parts of your skin which have come into contact with the liquid!'. These are some of the most usual warnings. However, these chemicals are never used in the same high concentration nor on such a large area as those on which the enormous C-128 transport planes disperse them in the rural areas of Vietnam. It is easy to imagine the influence of this herbicidal rain - not only on the vegetation, but also on the animals and people in the vicinity! ". . .

Hanoi VNA in English to Europe and Asia 1200 GMT 7 December 1962 -- B

Item . . .Hanoi, 7 December. . .The liaison mission of the Vietnam People's Army High Command has sent an emergency message to the International Commission denouncing the U.S.- Diem clique for conducting a large-scale terrorist operation in an area formerly known as "resistance zone D" (northeast of Saigon--VNA). . ."This military operation . . . is not only to terrorize and massacre the population, but also to destroy the crop which is being harvested in this area, in an attempt to deprive the people of their livelihood and starve them into joining the U.S.-Diem "Strategic hamlets."

In execution of this perfidious scheme, U.S.-Diem aircraft have been spraying noxious chemicals on large areas of paddy and other food crops. . .

Hanoi VNA in English to Europe and Asia 1235 GMT 7 December 1962 -- B

Item. . .Hanoi, 7 December--Lawyer Nguyen Thanh Vinh has called on intellectuals of North and South Vietnam and throughout the world to help check the U.S.-Diemists from spreading poisonous chemicals in South Vietnam, which is, he said, an extremely unlawful, uncivilized, and inhuman act.

1601

This member of the DRV Scientific Research Commission writes in HNAN DAN, With the spraying of toxic chemicals, the U.S.-Diemists are poisoning on a large scale the people's bodies. Hundreds of people, mostly women and children, have been seriously affected. Many have suffered hemorrhages or swollen bodies. Others have become paralyzed, blind, or have died. . .

To save their rule, the U.S. aggressors and Diem traitors are using noxious chemicals as a means of saving themselves, but with such criminal acts they will come nearer their last days, the lawyer concludes. . .

[redacted]

[redacted]

Hanoi VNA in English to Europe and Asia 1225 GMT 9 December 1962 -- B

Item . . .Hanoi, 9 December-- The South Vietnam Asian-African People's Solidarity Committee has sent a message to the Asian-African People's Solidarity Council in Cairo denouncing the United States for again using noxious chemicals in South Vietnam.

The message reveals that this aims at destroying crops and killing the people, thus compelling them to quit their villages and live in concentration camps dubbed "stratetic hamlets." It adds that the spreading of toxic chemicals has inflicted heavy losses on the people of South Vietnam, especially in the Ca Mau area, the eastern part of South Vietnam, and the high plateaus. "We call on the Asian-African People's Solidarity Council to help stay the murderers' hands", the message concludes. . .

Hanoi VNA in English to Europe and Asia 0639 GMT 10 December 1962 --B

Item . . .Hanoi, 10 December--The scientific workers of the world are called on to condemn the U.S. Diemists use of toxic chemicals in South Vietnam. Prof. Tran Huu Tuoc in Hanoi . . . says that this product, one kind being dark grey and spread like smoke, and the other white, dropping like mist, causes great damage to crops, trees, and forests, and injures or kills people and animals.

Regarding vegetation, 24 hours after the product is dropped, leaves etiolate and fall, and plants die from the peak to the root. Tubers rot, while trees such as orange, mandarin, and kack, and wild trees become scorched and die.

Persons affected by the chemical are asphyxiated, vomit, faint, or fall sick for 20 hours, and some even four days. Affected children are seriously ill, suffer hemorrhages, or die. Poultry, pigs, dogs, and other animals that drink chemical-poisoned water die, too.

Prof. Tran Huu Tuoc further notes a greater disaster: When forests are ravaged, nature will suffer an imbalance for a long period, and microbiology, zoology, and botany are affected. Land stripped of trees will undergo a change in its biological, physical, and chemical composition. The weather in general is basically changed, thus entailing incalculable consequences both in the present and in the future. . .

1601

Hanoi in Vietnamese to South Vietnam 0400 GMT 6 December 1962 -- S

(Commentary: "The U.S. Imperialists have Resorted to All Cruel and Savage Means to Quench the Patriotic Movement of the Southern People")

[redacted]

[redacted] [redacted]

Item . . . Following the failure of their attacks against the D war zone, the U.S. imperialists, during the autumn-winter mopping-up campaign toward the end of November 1962, also sprayed forests in eastern Nam Bo with poisonous chemical products with the intention of destroying all trees and, as they said, destroying the refuge of our guerrillas, who are clever in concealing themselves. In so doing, they also hoped to destroy crops, thus preventing our peasants from supplying the guerrillas with food. . .

Phnom Penh Domestic Service in Cambodian 0002 GMT 22 May 1963 -- S (OFFICIAL USE ONLY)

(70-minute recorded speech delivered by Prince Sihanouk on May 21 1963 on the occasion of the inauguration of a school building and information hall in Peam Ror, chief town of Banam district, Prey Veng Province)

(Excerpt. . . The Americans have said that it is difficult to find the Viet Cong who hide among the bushes. . . therefore, they have sprayed a powder to destroy trees completely. When the powder falls on trees, it causes the leaves to fall to the ground, thus exposing the Viet Cong. Therefore, you citizens must take care lest your hair also falls, since even the leaves of the trees - which are more solid than our hair--cannot resist the powder . . .

1601