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

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47A

Percent of "Mentions of Food Shortage" among IR's as a function of time

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.

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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

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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)

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)

1601

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.

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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

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

1601

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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. "

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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

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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	416 207	62050 29,945	66 443	13 29 7	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 318,869	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 17 March 1968 as a result of the TET offensive.

** 1 - 24 August 68

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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

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.

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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

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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.

1601

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,

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

1601

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

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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. . .

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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")

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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

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