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VEGETATION CONTROL PROGRAM CY1968 (U)

I. (C) INTRODUCTION

a. BACKGROUND:

1. In 1963, CG I US Corps (GP) proposed the use of herbicides in the DMZ to improve observation and fields of fire and to deny hostile forces the concealment provided by vegetation. A feasibility study was requested and ultimately provided by the U. S. Army Biological Laboratories, Fort Detrick, Maryland. The study recommended that applications of herbicides be made using C-123 aircraft. Due to the possibility of accusations of armistice violations, and a resulting potential propaganda harvest by the Communist world, approval was denied by CINCUNC. However, the then ROK VI Corps Chemical Officer has reported that in late 1963 a small quantity of a commercial herbicide (2,4,D) was used in selected areas such as observation posts and guard posts to clear fields of fire. Lacking specific technical guidance, ROKA forces applied 2,4,D to grassy areas unaware that 2,4,D is specific for broad leaf vegetation and has little or no effect upon annual and perennial grasses.

2. In October 1965, the 2nd U. S. Infantry Division requested that herbicides be investigated for use in controlling growth within the anti-infiltration barrier. It was pointed out that certain chemicals, i.e. Post Engineer R&U herbicides and TO/E equipment were already on-hand and capable of employment. The request was staffed and once again denied due to possible adverse North Korean or third-country reactions.

3. In early 1967, as part of a general review of the DMZ defenses, UNC/USFK found that cover, provided North Korean infiltration or raiding parties by the vegetation within the DMZ and contiguous areas, had grown unencumbered since the Armistice and was an important part of the DMZ defensive problem. Dense uncontrolled growth significantly hampers UNC defensive operations while enemy infiltration operations are enhanced.

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Effective use of night vision devices was affected by dense foliage and frequently movements of UN Forces into defensive positions were being hampered. It was decided to study how best to control vegetation, provide selected cleared areas and yet stay within the Armistice agreement. Various means including hand clearing, mechanical clearing, and use of herbicides were studied with regards to effectiveness, initial and recurring costs, and other pertinent factors to include adverse Communist and third-country reactions. As part of this evaluation, tests of herbicides were conducted in small selected areas near, but South of, the DMZ South tape to establish the parameters for vegetation control in Korea. Based on test results, plans were to be prepared for future full scale application in the area between the DMZ South tape and the Civilian Control Line.

4. The planning for the herbicide testing in Korea revealed the desirability of obtaining State Department approval of the program. This approval was requested by a Country team message. Numerous messages were dispatched during the period May through September 1967. During this period, the political implications were carefully analyzed and the U. S. Mission to the United Nations (USUN) was contacted for comment. Based on USUN support and Country team assurance that political implications were manageable, Secretary of State, in September 1967, authorized discussion of the program with the ROK Government. These discussions provided the acceptance of the program by the ROK Prime Minister and on 20 September 1967, permission for herbicide testing in Korea was granted.

5. As a result of the 20 September 1967 State Department Authority to implement herbicide testing plans, HQ Eighth U. S. Army (EUSA) issued implementing instructions to First ROK Army (FROKA) and I US Corps (GP) to make test applications of available herbicides Monuron (Telvar) and 2,4,D on flat terrain (2nd US Inf Div) and in the mountains (21st ROK Inf Div). Despite the lateness of the growing season, it was decided that these applications were necessary in order to train personnel, evaluate available dispensing equipment, test North Korean, ROK and third-country reactions. A summary of test results is attached as Annex A.

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6. Based on the assumption that Secretaries of State and Defense would approve a herbicide program in Korea and I US Corps (GP) were alerted on 16 January 1968 to initiate planning for a comprehensive vegetation control program.

7. On 4 March 1968, COMUSKOREA was authorized to employ herbicides as part of the vegetation control program in Korea. To preclude the possibility of unfavorable propaganda and to insure that defoliants would be properly employed with a margin of safety, CG EUSA directed that the following restraints be placed on the vegetation control program (Annex B, appendix 1):

(a) Defoliants will not be employed North of the Southern boundary of the DMZ.

(b) During application, care will be taken to insure that there is neither run-off nor spray drift into areas North of the Southern boundary of the DMZ.

(c) Defoliants should not be applied during precipitation or when rain is expected within 12 hours after application.

(d) Extreme caution will be exercised to avoid damage to food crops.

(e) Defoliants will not be dispensed from aircraft of any type.

(f) A KMAG representative will be physically present whenever and wherever defoliants are employed.

8. Planning Conferences were held on 3-4 March 1968 in the Engineer Operations Division EUSA to review FROKA and I US Corps (GP) plans and to coordinate details for anticipated implementation. Action personnel from EUSA G-3, G-4, and Engineer, HQ KMAG, Det L KMAG, HQ FROKA, HQ I US Corps (GP) and HQ 2nd US Inf Division attended the conference.

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As a result of the planning conferences, detailed plans were approved and on 10 March 1968, the EUSA directive for the Vegetation Control Program CY68(U) was released with instructions to implement an order (Annex B, appendix 1).

9. By 20 March 1968, material and equipment began to arrive in the country and in an orderly manner was distributed forward to using units. At this point, confusing information was received from supply agencies in CONUS concerning the soil-applied herbicide, Monuron. The original CIGCOREP requirement requested UROX 22, however, EUSA G-4 was informed that Monuron (Telvar) was being shipped. Since there is a vast difference in the amount of active ingredient in Telvar and UROX 22, different application rates are used; therefore, 250 lbs of UROX 22 per acre as compared with 50 lbs of Telvar per acre. Accordingly, plans and allocations were quickly changed. However, on 8 April 1968, supplies of Monuron arrived in Korea and were confirmed as UROX 22, a pelletized form of Monuron.

10. In mid March, comprehensive briefings on vegetation control including technical information on herbicides, means of application, and expected results were presented to key personnel of HQ I US Corps (GP) and 2nd US Inf Division by Senior Chemical Advisor, Headquarters, KMAG. These briefings specifically presented the restraints and controls directed by JCS and CINC/UNC. The Chemical Advisor, Detachment L, KMAG presented identical briefings in bilingual format to key personnel of HQ FROKA, each ROK Corps HQ, and KMAG Detachments West, Center, and East.

11. On 31 March 1968, CG EUSA ordered implementation of the Vegetation Control Program CY68 to be initiated on or about 15 April 1968 (Annex B, appendix 2).

b. GENERAL:

1a. In March 1967, at the direction of the CG EUSA, a study group was organized for the purpose of conducting a study

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to determine the requirements for clearing vegetation and foliage in areas contiguous to and immediately south of the southern boundary of the DMZ. The EUSA Engineer was assigned responsibility for this task and was assisted as required by representatives from EUSA G-3, G-4, and KMAG. As defoliation was included as a part of the CIGOCOREP plan which was actioned prior to completion of the study groups findings, a formal documented study was never staffed nor published. The decision to employ defoliants overtook the need for staffing the study; however, it has been retained in the Operations Division, EUSA Engineer Section for historical value in two complete copies. It has been used as a reference document in the preparation of certain portions of this report.

1b. Although the EUSA Engineer Study was neither staffed nor published, its primary conclusion was that the use of chemical control of vegetation along the DMZ, in conjunction with manual and mechanical means, is practical, manageable, politically acceptable, and if appropriate chemicals are supplied is within the current capability of EUSA and the Republic of Korea Army. The comparison of techniques and resultant estimated costs in funds and manpower revealed the following comparison: (Annex C, Comparison and Estimated Costing of Clearing Techniques.)

<u>Technique of Clearing</u>	<u>Cost per Acre</u>	<u>Man-hours per Acre</u>
Manual	\$467	227
Mechanical	\$1 60	20
Chemical	\$408	25

2. The planning responsibility for vegetation control was delegated to EUSA Engineers rather than to a staff agency within EUSA headquarters where a staff chemical officer was assigned. However, technical advice and assistance was provided by the Senior Chemical Advisor, KMAG and efforts were closely coordinated between EUSA Engineer, Nuclear-CB Division G-3, and Chemical Advisory Section, Headquarters, KMAG.

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~~CONFIDENTIAL~~**c. WEATHER, VEGETATION, SOIL AND TERRAIN:**

A summary analysis of weather, vegetation, soil and terrain extracted from the EUSA Engineer Study "Clearance of Vegetation and Foliage in the DMZ Area" (U), 31 January 1968 is attached as Annex D.

d. CHARACTERISTICS OF HERBICIDES:

1. In March 1967, representatives of the Plant Sciences Laboratory, U.S. Army Biological Laboratories, Fort Detrick, Maryland visited Korea and inspected typical vegetation growth in selected areas contiguous to the DMZ. Based upon this evaluation, the Plant Sciences Laboratory recommended the use of Agents Orange and Blue and a soil applied herbicide to control general and specific vegetation growth in Korea.

2. Considering both the field evaluation conducted in October 1967 and the recommendation of the Plant Sciences Laboratory, requirements for Agents Orange and Blue, and Monuron were included in the CIGCOREP Plan. A discussion of the technical characteristics of the recommended herbicides is attached as Annex E.

e. EQUIPMENT AND MATERIEL:

1. Requirements for equipment and materiel to support the Vegetation Control Program were established by the CIGCOREP Plan of which portions were approved and funded in early January 1968. A summary of vegetation control equipment and materiel requirements is attached as Annex F.

2. Discussion:

(a) As Monuron UROX 22 is spread by hand or mechanical broadcast, no particular problem was anticipated in its application. 50 Mechanical BORAX weed killer dispensers were received to be used in mechanical broadcast of this agent. A photograph of this dispenser is attached as Figure F-1.

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(b) Both agents Orange and Blue are applied as a liquid spray. In addition, it had been anticipated that Monuron Telvar, which is applied in a liquid suspension, would be used in Korea. Accordingly, a requirement was established for a portable light-weight hyper-type pump spray apparatus with the capability of dispersing a liquid spray and a wettable powder suspension. The actual equipment received were 22 standard gasoline engine-driven insecticide sprayers commonly used in Engineer Entomological Services. Upon test operation of the sprayer, it was determined that it was satisfactory for spraying agents Orange and Blue, but not capable of spraying a wettable powder suspension. Ultimately, this problem was solved by the receipt of pelletized Monuron DROX, rather than Monuron Telvar. A photograph of this sprayer is attached as Figure F-2.

(c) Based on the limited herbicide testing conducted in October 1967, FROKA recommended the use of hand-held insecticide sprayers for small area spraying of liquid agents. 200 of these 2 and 3 gallon sprayers were provided for this purpose. A photograph of these sprayers is attached as Figure F-3.

(d) In addition to the equipment provided by the CIGCOREP Plan, within ROKA and U.S. units there were available several types of TOE and TA equipment which were used for application of liquid defoliants as follows:

(1) ROKA had available 48 ea M8A2 Decontamination Trailers which were used to spray Agents Orange and Blue and to supplement storage and transportation of water for mixing and application. The M8A2 Decontamination Trailer consists of a 200 gallon capacity tank and a 25 HP UED pump unit mounted on a 1 1/2 ton trailer. A single hose reel allows the operator to move approximately 50 feet from the trailer and direct a liquid spray through the adjustable Beam type spray gun at a rate of 20 gallons per minute. A photograph of this equipment is attached at Figure F-4.

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(2) ROKA had available 10 ea M106 "Mitey Mite" dispensers which were used to supplement liquid spray capabilities. The M106 Dispenser is a commercial, back-pack, agricultural duster-sprayer that has been adapted for military use. It consists of a compact two-cycle gasoline engine which powers a blower to disperse liquid or powdered defoliants or riot control agents through a six foot flexible hose. A self contained tank provides the capability of dispersing 3 gallons of liquid agent, total weight of the dispenser is 25 lbs less fuel or agent. A photograph of this dispenser is attached as Figure F-5.

(3) For liquid application of Agents Orange and Blue to small areas, the FROKA Chemical Officer devised a field expedient consisting of crimping a perforated metal cap to the end of a flexible nozzle, then by attaching the flexible nozzle to a 5 gallon "GI" gasoline can, the liquid agent was literally poured over vegetation similar to the manner a garden watering can is used. A photograph of this expedient is attached as Figure F-6.

II. (C) DEFOLIANT OPERATIONS

a. GENERAL

1. Prior to initiation of defoliant operations, a comprehensive briefing was prepared to inform commanders and staffs of the technical aspects of defoliant operations and to specifically delineate controls and restraints pertaining to application of defoliants. The Senior Chemical Advisor, HQ KMAC, assisted by EUSA Engineer Project Officer, briefed the commanders and staff personnel of HQ 2nd U.S. Inf Division and I US Corps (GP) on 21 and 22 March 1968. Senior Chemical Advisor, Detachment L, KMAC presented this same briefing in bi-lingual format to the commanders and staffs of Headquarters FROKA, each ROK Corps, and Detachments East, West, and Center in early April.

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2. To insure a coordinated effort in planning defoliant operations, a series of planning conferences were held in late March 1968 in the EUSA Engineer Operations Division. Those in attendance were representatives of EUSA Engineer, G-3, and G-4, Headquarters and Detachment 1, KMAC, 1 US Corps (GP), 2nd US Inf Div., FROKA and ROKA. For guidance in planning operations, conferees were instructed to prepare plans for defoliant operations along the following guidelines:

(a) Defoliant applications will be made only in the area north of the Civilian Control Line (CCL) and south of the southern boundary of the DMZ (South Tape).

(b) Priorities of applications were established as follows:

(1) Priority 1: A 100 meter strip on each side of the DMZ Security Fence System.

(2) Priority 2: Tactically significant areas in the vicinity of OP's, CP's and other vital areas. In order to preserve natural camouflage, manual clearing would be accomplished first and then defoliants would be applied to improve firing lanes and to deny concealment to would be infiltrators.

(3) Priority 3: A 30 meter strip on each side of tactically significant roads in the forward areas.

(c) Based upon planning guidance, FROKA and 1 US Corps (GP) submitted plans for implementation listing quantities required by priority. See attached Annex G. Plans submitted were based on the planned receipt of Monuron Telvar (80% active ingredient) which required an application rate of 50 pounds per acre. The Eighth Army execution order informed appropriate action officers of the change in type of material and application rate and advised that quantities of Agent Orange and Blue be shifted into Priority 1 requirements to fill in the shortfall of 6,340 acres caused by the change in types of defoliant.

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(d) By 10 April, supplies of defoliants and material for vegetation control were on-hand in forward locations in preparation of planned implementation date of 15 April 1968. A summary of material allocations is attached at Annex H.

b. OBSERVATIONS

1. Defoliant applications were initiated on 15 April 1968 with the application of Monuron in Priority 1 areas (see Annex L for photographic coverage). No particular difficulties were found in dispensing Monuron as it is spread by hand similar to the manner by which Korean farmers spread seeds or fertilizer. The usual technique involved was that an area selected for Monuron application was divided into several lanes and each man walked along his assigned lane spreading Monuron by hand or the mechanical spreader along approximately 5 meters on each side of his marked lane. Supplies of Monuron were spotted throughout the area to facilitate individual resupply along assigned lanes.

2. As of 28 April 1968, Monuron applications were completed in I US Corps (GP) area. In I US Corps (GP) area, the terrain is generally flat with some rolling hills along the DMZ Security Fence System and is relatively accessible by vehicular traffic; however, in the FROKA area the terrain becomes increasingly difficult moving eastward from the CHORWON Valley. In the extreme eastern area of the DMZ in the III ROK Corps area, some application sites were a four hour foot march from the nearest road. Work in these inaccessible areas progressed very slowly but improved when materiel and men were flown in by helicopter when available.

3. The action of Monuron is dependent upon rainfall to soak the active ingredient into the soil and penetrate the plant root zone. Almost coincidental with the application of Monuron, there was a minor drought in most of the areas which resulted in an unusually delayed response time to the defoliant. Once absorbed into the plants, the initial response to Monuron is very

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similar to reaction to fertilizer and very little visible evidence is exhibited except a slight yellowing is apparent and then slowly foliage begins to turn brown and eventually defoliates completely as if the vegetation had been struck by a killing frost. In those areas where annual and perennial grasses appear, most vegetation did not even emerge leaving a strip almost devoid of all plants.

4. As Monuron is an all-purpose defoliant rather than a selective defoliant it effectively kills annual and perennial grasses which may lead to soil erosion problems in future years in those areas where it was applied along the DMZ Security System Trace. To counter this problem a 'soil erosion program' has been planned in which sheep fescue and white dutch clover will be planted in susceptible areas to prevent serious erosion problem. This plan is being carefully coordinated at the working level to insure that seed and fertilizer will not be applied to areas that have been previously treated with Monuron. In this respect, it would appear that in future defoliant programs the use of a selective defoliant to control broadleaf vegetation and not affect grasses has merit. There are several off the shelf commercial herbicides that are specific for use against broadleaf vegetation but do not affect grasses. Agent WHITE, known commercially as TORDON 101, has been used in Vietnam for specific problem areas in which it was desired to preserve grasses. The use of liquid WHITE or pelletized formulation such as Tordon 10K along the DMZ Security System Trace should be more satisfactory than the use of Monuron in that annual and perennial grasses would not be affected and once the bushy woody growth is reduced grasses would remain to prevent serious erosion problems. The remaining grasses could then be controlled through manual or mechanical means utilizing the jeep and tractor drawn mowers and other equipment provided by the CIGCOREP Plan.

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5. Application of the liquid Agents Blue and Orange began in mid May 1968 upon the emergence of foliage.

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(a) Agent Orange:

(1) Agent Orange was mixed with diesel oil at a ratio of 3 gallons of Orange to 50 gallons of diesel which was recommended as the application rate per acre to preclude regrowth of resistant vegetation. The only significant problem area involved was the lack of adequate spray equipment. Most application areas were relatively inaccessible to vehicular traffic which precluded the use of the M8A2 Decontamination Trailer. As only 22 liquid defoliant spray sets were available, expedient means of applying Orange were devised. Generally speaking, the expedient devices to apply liquid defoliants were ineffective, in that they resulted in a waste of material as there is no way, other than by visual estimation, of accurately measuring an application rate per acre. In applying liquid defoliants, the most critical factor is liquid particle size. In aerial application, as employed in Vietnam, undiluted Agent Orange is sprayed from aircraft through specifically designed equipment to produce an aerial spray of the optimum particle size to facilitate absorption through the leaf surfaces of foliage. There is no visible evidence of plant damage for a period of several weeks as the agent is being translocated throughout the plant. Then, dramatically and vividly, the systemic herbicide exhibits its effect of defoliation and killing of the plant. Both methods of liquid dissemination used in Korea produced large droplets of liquid, in fact, the expedient methods of Orange application resulting in literally pouring the agent/oil mixture on foliage. The high concentration of diesel oil in the mixture immediately caused a browning of foliage which, in most cases, prevented the absorption of Agent Orange and its subsequent translocation. As a result of this "drenching" vegetation was defoliated and most of it eventually died; however, in some cases where controlled burning was not used to clear defoliated areas, there was some regrowth by mid July. In the opinion of Dr. James W. Brown, Plant Sciences Laboratory, U. S. Army Biological Laboratories, Fort Detrick, Maryland, the diesel oil was primarily responsible for defoliation and retarded growth rather than the Agent Orange. In an attempt to achieve optimum particle size from ground spraying operations, units were

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advised to spray Orange in a fine mist and to direct the spray high into the air allowing the mist to settle on foliage. Although this procedure increased the risk of undesired spray drift, the effectiveness of Orange was increased. In regard to spray drift, it was realized that under certain conditions when the windspeed exceeds 5 knots per hour, that there was the possibility of spray being carried downwind and damaging sensitive vegetation. In the 2nd US Infantry Division area, the "fine spray" technique was employed successfully between the Imjin River and the South Tape where no farming is allowed. This technique was used only when distance and wind speed and direction precluded drift into the DMZ, and it was noted that sensitive foliage (primarily locust trees) within 100 to 200 meters downwind of the application area were frequently effected by spray drift.

(2) Although in advisory visits and briefings to key ROKA personnel, it was stressed that Agent Orange is a specific systemic herbicide for broadleaf plants and is ineffective against most annual and perennial grasses, a large quantity of Agent Orange was applied to grassy areas with the result that the growth of grass was retarded by the effect of diesel oil and within two to three weeks the grass began to grow again. This procedure in effect was a waste of time, manpower, and material in that although the application sites were tactically important, vegetation could have best been controlled by manual clearance or controlled burning.

(3) Used properly, Agent Orange produces excellent results and in those areas covered with woody growth, broad leaved plants, vines, and trees, produced good results within a minimum period of time and required less effort than would be required by manual methods.

(4) There were no serious problem areas in maintaining the equipment used to apply Agent Orange. Spray equipment was thoroughly cleaned and flushed at the end of each day's operations; therefore, deterioration of rubber components, as expected, from the Orange/oil mixture was minimized. There were some cases reported of checking and

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cracking of rubber gaskets in the 2 or 3 gallon hand-held insecticide sprayer. In some instances, the 180 GPH Insecticide Sprayers were damaged by rough handling in which the pressure value indicator glass was broken and the carrying frame bent. In mid June, 3 of the 22 sprayers were deadlined because of engine failure and there were no repair parts available in Korea. Five new engine assemblies were procured from CONUS and direct exchange of engines was performed by 2nd S&T Battalion, 2nd U. S. Infantry Division. For future operations, a supply of repair parts and direct exchange parts should be stocked in-country to facilitate maintenance.

(b) Agent Blue:

(1) Agent Blue was mixed with water at the ratio of three gallons of Blue to 50 gallons of water for spray application. The majority of locations sprayed with Agent Blue were located along roadsides and areas easily reached by vehicles; consequently, the M8A2 Decontamination Trailers were used extensively for spraying Blue. As Agent Blue is particularly effective against rice and other cereal grain crops, precautions were taken to avoid damaging adjacent crop areas.

(2) Agent Blue was particularly effective against wild rice and a tall grass commonly referred to as "Buffalo Grass" which grows in abundance in abandoned rice paddies and along rivers and streams. It was highly effective in drying out these grasses with a high water content and preparing them for controlled burning. In general, Agent Blue causes desiccation of broad leaf and narrow leaf vegetation ultimately causing effective defoliation, but it does not necessarily cause plant kill in all cases. In those areas where applications of Blue were followed up by controlled burning, vegetation clearance was complete; in those areas not burned off, there has been considerable regrowth.

6. (a) Not all plant species react similarly to defoliants. The differential susceptibility may be a function of time of treatment, nature of the leaf surface, variable capacity for

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absorption and translocation of the defoliant, plant chemistry, or the nature of the defoliant itself. Thus one can expect different reactions of vegetative types, some will be easily defoliated and killed while others will be comparatively resistant to the defoliant. Locust trees and scrub oak appeared to be extremely sensitive to Agent Orange. However, some grasses exhibited regrowth after the initial application of Agent Blue requiring a second application of the agent by mid summer.

(b) In general, all three defoliants produced the expected results with the exception that regrowth following Blue and Orange application was greater than anticipated. In measuring the overall tactical effectiveness of the defoliation project, one must consider the priorities that were directed by higher headquarters. Application of all three agents along the DMZ Security System fence line (Priority one) was tactically the most sound as it provided a clear area for observation and fields of fire and to a certain degree improved the effectiveness of night vision devices by producing an area of high contrast. When applied in Priority 2 areas around OP's and CP's, frequently an entire area was cleared thus exposing these installations to enemy observation. Applications in Priority 3 areas were not too effective because the width of the area covered was usually less than 30 meters on each side of the road. This distance is not adequate to afford protection from ambush.

7. There were no serious major accidents or incidents as a result of defoliant application nor were there any safety problems in handling any of the material. The most serious accident occurred immediately prior to the application phase of the program when the Chemical Officer, 6th ROK Infantry Div was accidentally killed by a booby trap as he was returning from a reconnaissance of planned application areas.

(a) There were several minor incidents in which ROKA personnel detonated uncharted mines and booby traps, but no serious injuries were sustained.

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(b) There were no problems encountered in the handling, storage or application of defoliant materials. It had been anticipated that some of the defoliants could possibly cause eye, nose, throat, and skin irritation; however, this effect was minimized by the wearing of gauze masks and gloves when handling the material and by washing upon completion of application.

8. Ground application of defoliants requires extensive manpower and time. In addition to manpower actively employed in application, overhead is required to provide security and to provide mixing, filling and transportation of defoliant material to application sites. Use of relatively unsophisticated spray equipment results in estimated application rates. Further, Agent Orange applied by ground spray means is not as effective as it could be. Use of an aerial spray system such as the AGRINAUTIC system developed for the UH-1 series helicopter would result in a more efficient plant response, require less time in application, and require considerably less manpower support than ground application means. The AGRINAUTIC spray apparatus is not limited to liquid spray but can also be used to disperse pelletized solid herbicides such as Monuron UROX 22, BROMACIL, and TORDON 10 K which are soil-applied defoliants. The average application rate for ground applied liquid agents was approximately 200 acres per week depending upon the ruggedness of the terrain. By contrast, one UH-1 helicopter equipped with the AGRINAUTIC sprayer, flying at a height varying from 12 feet to 50 feet at 90 knots per hour, could spray a swath 100 feet wide with Agent Blue at an application rate of 3 gallons per acre for a total area coverage of 65 acres in approximately 2 1/2 minutes in one sortie. A minimum of four sorties per working day would thus yield an area coverage of 250 acres which would require more than seven working days by ground application means. Swath width can be adjusted by varying the flight heights and more positive control of spray drift can be accomplished by flying at low altitudes but at a reduced swath width. Nozzles can be calibrated and adjusted to spray optimum particle sizes. The AGRINAUTIC sprayer is designed for rapid installation in the UH-1 B/D helicopter and can easily

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be removed in the field within a minimum of time should the helicopter be required for another type of mission. A technical description of the AGRINAUTICS, Model 3090, is attached as Annex I.

9. The Chemical Officer, FROKA, monitored the entire program in the FROKA area in an outstanding professional manner. The corps and division Chemical Officers, along with the regimental Chemical Officers, actively supervised defoliant applications. The overall staff planning and the initial plans submitted were complete and thorough in every detail. Initially, all commanders including corps, division and regimental displayed a great deal of interest and enthusiasm in the program; unfortunately, this enthusiasm was the result of the concept that defoliants would be applied in those areas considered to be most tactically significant, i. e. north of the South Tape within the DMZ. In initial plans for application, FROKA had planned to apply defoliants to extensive areas within the DMZ and adjacent to the MDL. The FROKA Chemical Officer was repeatedly briefed on the restraints and controls directed by CG EUSA but his efforts to prepare plans based on application only in the area between the South Tape and the Civilian Control Line were thwarted by the fact that the corps and division commanders involved in the project chose to make their own interpretation of directives. Thus, from the outset of planning, the division Chemical Officers prepared their plans based on guidelines received from the division commander which were contrary to the published guidelines. At this point, it was detected that corps commanders were exerting pressure and using personal influence to FROKA and ROKA Headquarters to lift the restrictions. It was only after positive statements were made by the CG FROKA to the effect that he was a soldier and was duty-bound to obey directives from higher headquarters and that he expected the same from his subordinate commanders that it became apparent to all commanders that violations would be reported and appropriate command action taken. Once commanders accepted the fact that they were bound to obey the restraints and control, planning proceeded in an orderly manner in accordance with Eighth U. S. Army guidance. However, it was readily apparent that once the commanders were finally convinced that

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restrictions on the use of defoliants within the DMZ would not be relaxed, they lost all interest in the program and shifted their interest to projects which they considered more important. In an advisory visit to a ROK Corps headquarters, the commander openly stated to the Senior Chemical Advisor, KMAC that he could not understand why the United States would spend such a large amount of money for expensive defoliants and then waste them by not allowing him to use them in the DMZ where they were needed and desired. However, in almost the same breath, he stated he was impressed with the results of Monuron and desired to use additional quantities of Monuron in future defoliant operations.

10. (a) In spite of the apparent loss of interest by commanders, the Chemical Officers in the field were highly motivated and enthusiastic concerning the use of defoliants. For them it was an opportunity to prove that a technical service was capable of providing operational support in a tactical mission. During the planning period, an outstanding training program was conducted on the use of defoliants and the equipment provided for the operation. Personnel turbulence during the five month application phase necessitated repetition of training, consequently, all ROKA personnel who participated in the project were well trained and prepared.

(b) Initially, the main battle area (MBA) divisions experienced difficulty in defoliant application in that a lack of organization was evident. This was no doubt due to last minute changes in the plans, the lack of command interest when it was finally realized the defoliants could not be utilized as desired, and a reluctance on the part of lower unit commanders to detail their troops to this project when they had so many other high priority projects confronting them. However, within a short period following the initial shaky start, the operation was adequately organized and, in general, followed the planned schedule in an orderly manner.

(c) The physical stamina of the individual Korean soldier was remarkably demonstrated by the tedious and hard labor performed by troops in applying defoliants. Working in

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difficult terrain for long hours, and transporting their equipment and material on their backs, they diligently performed their job in the face of many dangers such as uncharted minefields and even friendly booby traps literally under the noses of observing North Korean troops.

c. **OPERATIONAL CONSIDERATIONS**

1. **Command, Control, and Coordination:**

(a) **General**

(1) Chief, KMAG was assigned responsibility for technical assistance and supervision of the vegetation control program by CG EUSA. This responsibility required KMAG to assume an operational mission, yet it is organized and staffed only to provide an advisory mission. As of April 1968, there were only four Chemical Corps Officers assigned to KMAG, two in the Chemical Advisory Section, HQ KMAG, one assigned to Det L, KMAG and one assigned to Det F, KMAG. The Chemical Advisory Det F KMAG is assigned specific logistical advisory duties and due to distance and travel limitations did not participate in the mission.

(2) As stated previously, responsibility for planning defoliant operations was delegated to the Engineer EUSA since that section had been originally tasked to make the feasibility study. At the time that the CG EUSA authorized the application of defoliants and stipulated that ROKA troops apply defoliants, the decision was made to task KMAG with supervision of the program. This was done for several reasons; BG James H. Batte, Senior Logistics Advisor, KMAG, as a Chemical Corps Officer, has had extensive experience in many technical fields of chemical operations; further, KMAG is a subordinate element of Eighth U. S. Army, thus reducing administratively the span of control. Execution orders and implementing instructions of a directive nature were released by P&P Div., G-3 EUSA. Other matters of an informative nature were released through Senior Chemical Advisor, HQ KMAG for the Chief, KMAG.

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~~CONFIDENTIAL~~**(b) KMAG Supervision**

(1) Guidance from C1 EUSA directed that whenever and wherever ROKA troops applied defoliants, a KMAG representative would be physically present to provide technical assistance and guidance. KMAG supervisory responsibilities were discharged in the following manner:

a. In the I US Corps (GP), direct supervision of ROKA working teams was provided by Chemical Corps Officers and enlisted personnel assigned to the U. S. 54th CBRE Detachment and the Chemical Section, 2d U. S. Infantry Division. The Deputy Chemical Advisor, HQ KMAG was placed on TDY to HQ I US Corps (GP) and maintained daily contact with working teams applying defoliants.

b. In the FROKA area, KMAG supervisors were detailed from advisory personnel assigned to the subordinate detachments of Detachment L, Detachments East, West, and Center.

(2) To provide guidance for KMAG personnel assigned supervision duties in defoliant application and to provide further guidance to ROKA application teams, a comprehensive Standing Operating Procedure for vegetation control was published in bi-lingual format and distributed in sufficient quantities to be issued to working personnel. A copy of the SOP is attached as Annex J.

(3) There were some problem areas concerning KMAG supervision at the onset of defoliant applications which can be attributed to last minute changes in plans and the fact that U. S. personnel monitoring a ROKA operation was not entirely palatable to ROKA commanders. Initially when it was learned by ROKA commanders that KMAG supervision would be present throughout the entire operation, a considerable number of questions were tactfully asked by ROKA personnel as to why. When it was finally realized that the KMAG personnel were assigned by higher headquarters to assist and guide the defoliation

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program, they were quickly accepted as members of the defoliation team and excellent relationships were developed at the working level. This, plus the fact that there was no serious injuries, accidents or incidents involving KMAG supervisors, indicates that the supervisory role of the operation was a success.

(4) As a parallel it was equally unpalatable to U. S. personnel in I US Corps that ROKA personnel only would make actual application of defoliants, a mission that U. S. Chemical Corps personnel are trained in and fully qualified to perform. However, as with ROKA personnel, when it was realized that this was a mandatory requirement it was accepted as such. Only one significant problem developed. In the 2d U. S. Inf Div area defoliant application was conducted by personnel of the 98th ROK Regimental Combat Team. Administrative delays due to clearance and access into areas north of the Imjin River plus the time consumed traveling to and from application areas significantly increased the time required to complete operations in the division area. Use of U. S. troops whose compounds are located north of the Imjin River could have reduced the time required to apply defoliants.

(5) The task of KMAG supervision did, however, exert its toll on the overall advisory function of Detachment L, KMAG. During the height of the defoliant operations, 15 June through 1 July when a massive effort was mounted to apply defoliants prior to the beginning of the rainy season, it was estimated by Detachment L, that its advisory function was reduced by 70% in order to accomplish its supervisory mission over FROKA defoliant operations.

2. Intelligence Implications:

(a) It has been assumed that the North Koreans would use any vegetation control program in or adjacent to the DMZ as the basis on which to charge the UNC with violating the Armistice Agreement and further would probably charge that the use of defoliants would be either "chemical" or "germ" warfare similar to charges by North Vietnam resulting from

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the employment of defoliants in Vietnam. On 12 January 1968, news releases originating from the ROK Ministry of National Defense openly indicated the ROK Government's intention to employ defoliants in the DMZ area (Fig II-1). Though not acknowledged by the United Nations Command, these releases provided a factual test of ROK, North Korean, and third-country reaction. As of this date, the only reaction that has been registered was at a meeting of the Military Armistice Commission as discussed in the 22 January 1968 Stars and Stripes news release (Fig II-2).

(b) Within ROKA, all information concerning defoliation plans and operations were classified as "SECRET" with a limited distribution on a need-to-know basis. Defoliant application teams employed deceptive measures in those areas under observation from North Korean outposts by labeling equipment and supplies with the code words "CORN" for Monuron, "RICE" for Agent Blue, and "BEANS" for Agent Orange to give the impression that the working teams were planting crops.

(c) In mid-July, one EM of a FROKA unit that had been assigned to a defoliant application team defected to North Korea, however, there has been no information which would indicate that he revealed defoliation plans to the North Koreans.

(d) As of this date, there has been no reported indication that North Korea is aware of the testing and subsequent application of defoliants. Present indications are that the North Koreans have not exploited the use of defoliants in the vicinity of the DMZ by UNC personnel.

3. Coverage Accomplished (see Annex K): Although the total requirement of priority application totaled 24,115 acres. The quantities of defoliant materials received provided a coverage capability of only 19,984 acres. Based on reports submitted from I US Corps (GP) and FROKA, a total of 18,150 acres were reported covered which reflects a shortfall of 1,834 acres. This discrepancy in reported coverage can be explained by several considerations as follow:

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(a) Field expedient methods of mixing and applying defoliants resulted in rough approximation. For example, in FROKA it appears that the average actual application rate varied for each agent as follows:

<u>Agent</u>	<u>Recommended Application Rate</u>	<u>Average Application Rate</u>
Monuron	250 lbs per acre	95 lbs per acre
Orange	3 gallons per acre	3.3 gallons per acre
Blue	3 gallons per acre	5.5 gallons per acre

(b) Areas treated with defoliants were not measured or approximated as acre plots but were visually estimated as 100 meter or 30 meter wide strips based on the priority designation of the area.

(c) In the case of Monuron applications, the low average application rate could be responsible along with the lack of rain for the delayed response time seen in Monuron treated areas. In the case of Orange and Blue, it appears that there were slightly heavy applications which may account for the extremely rapid responses gained from these agents.

4. Cost Estimation and Comparison on Techniques:

(a) Cost estimates of defoliation operations were developed from statistics obtained in actual defoliant applications in a 44 day period in which 3,345 ROKA personnel were engaged in applying defoliants over an area of 1,658 acres.

(b) Cost estimates of manual clearing were developed from data obtained by FROKA from manual clearing operations in the summer of 1967 in which 425 square kilometers were cleared at the expense of approximately 600,000 man days over a 30 day period.

(c) Estimates of both funded and unfunded costs indicate that clearing vegetation by the application of defoliants can be accomplished at a total cost of \$165 per acre. If the cost of troop labor is funded on the assumption that the labor force

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is always available, and will be used as the requirement dictates, then the average cost of defoliants is estimated as \$63 and 710 manhours per acre.

(d) A comparison of techniques and resultant costs and manpower per acre reveal the following comparison (See Annex M).

(1) Funded and unfunded cost estimates:

<u>Technique</u>	<u>Cost Per Acre</u>	<u>Man Hours Expended</u>
Manual	\$0.12 (105, 019 acres)	4, 800, 000
Defoliants	\$163 (1, 658 acres)	1, 177, 440

(2) Funded Costs Only:

<u>Technique</u>	<u>Cost Per Acre</u>	<u>Man Hours Per Acre</u>
Manual	None	4.6
Defoliants	\$63 (average)	710

(e) Regardless of which method of vegetation clearance is employed, the most critical factor is the use of manpower rather than costs in that ROKA Forces are faced with many high priority projects such as Main Battle Area construction and hardening of defensive positions which require a staggering amount of manpower to accomplish; consequently, the use of military labor results in a significant decrease in military operations due to the impact of committing troop labor to such tasks.

(f) The conditions in Korea pertaining to accessibility, working hazards (due to minefields, and obstacles), vegetation and practicability (due to cost, labor and management) appear to dictate that no one method of clearing vegetation is best. A proper amalgamation of three methods: manual, mechanical and defoliants appear to be the best technique of vegetation clearance.

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~~CONFIDENTIAL~~**III. (C) FINDINGS:**

a. That cleared areas to improve visibility, increase contrast for night vision devices, and the reduction of cover and concealment for infiltration are an essential requirement in the DMZ Security System.

b. Monuron applications in the vicinity of the DMZ Security System fence contributed significantly to the strengthening of the defensive capability along the fence line. However, removal of vegetation cover may cause erosion problems in the future.

c. That the effects of Agents Blue and Orange were negated by regrowth of vegetation in those areas that defoliation was not followed up by controlled burning. The application of these agents in areas other than the DMZ fence trace was of doubtful tactical value. In addition, the drenching of vegetation with Agent Orange/oil mixture and the use of Orange on grassy areas were a waste of time and effort.

d. That the use of defoliants was a costly program of marginal success because:

1. Restraints and controls precluded the application of defoliants north of the southern boundary of the DMZ along the most logical approach routes and clearly the most desirable location for their use from the tactical point of view. As a result, a resource that could have had a very favorable impact from a tactical viewpoint was expended at considerable time and effort in far less critical areas.

2. The political value of the project was negated when, after providing the defoliants and selling the program to ROKA, the use of defoliants was restricted to the point where commanders lost interest in the project and turned their support and interest to other priority projects. Additionally, U. S. military personnel were used to monitor and report on the activities of the ROKA Forces. Although it is felt that the rapport of the advisor-counterpart relationship did not suffer under this arrangement, there were some minor feelings of mistrust at times.

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That due to a last minute change in the type of defoliant allocated, there exists a requirement to continue control of vegetation by the use of a soil applied defoliant to the remaining 6,240 acres along the DMZ Security System trace.

f. That KMAG supervision of the defoliation program severely tasked the overall advisory mission to the point that the Detachment L advisory effort was reduced by 70% during the peak of the operation.

g. That the ground application of defoliants requires a massive amount of manpower and time. In addition, in the case of Agents Orange and Blue, the dilution, mixing, and liquid spray reduced the overall effectiveness of the defoliants and led to significant regrowth of vegetation.

h. That there has been no reported indication that North Korea is aware of the use of defoliants and there have been no attempts by North Korea to make a political harvest of propaganda by accusing the UNC of Armistice violations or the accusations of employing "chemical" or "biological" warfare as was anticipated.

i. That the aerial application of defoliants, particularly pelletized defoliants, is feasible and desirable for use in those areas adjacent to the DMZ Security System fence under carefully controlled conditions and under the proper meteorological conditions.

j. That the estimated cost of defoliant operations is \$63 and 710 man hours per acre.

k. That insofar as a combination of practicability and costs are concerned, neither clearing by the use of defoliants nor the clearing by manual means can stand alone due to the consideration of weather, terrain, vegetation, and enemy and friendly capabilities. A careful combination of the two methods using the best one for specific problem areas appear to be practical, reasonably expensive, yet within the current capability of the United Nations Command in man and equipment.

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l. That the stipulation that ROKA Armed Forces only could make actual application of defoliants considerably slowed down application progress in the U. S. 2nd Infantry Div. area.

m. That supervision and monitoring of the operational aspects of defoliant applications should be conducted by a headquarters adequately staffed to perform an operational mission with the technical guidance of qualified staff chemical officers.

IV. (C) CONCLUSIONS:

a. There is a need to continue the control of vegetation along the DMZ Security System fence and to extend this control beyond the southern boundary to include the most logical approach routes and other locations within the DMZ to deny enemy infiltrators the use of vegetation for cover and concealment.

b. The use of defoliants in conjunction with manual and mechanical clearing means in practicable, manageable and politically acceptable and if appropriate defoliant materials are again provided, is within the current capability of this command.

c. The use of Monuron significantly contributed to the strengthening of defensive capabilities along the DMZ Security System trace.

d. The use of Agents Orange and Blue in areas other than the DMZ fence line located to the rear of the South tape contributed very little to improving defensive positions.

e. The application of defoliants by ground means is difficult, expensive and requires a staggering amount of manpower. Carefully controlled aerial application would reduce the time and manpower required and in the case of Agents Orange and Blue would result in a more effective response.

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e. That action be initiated to procure three each **AGRI NAUTICS Aerial Spray Systems (FSN 3740-866-4481)**. Equipment should be delivered ASAP so that necessary training can be conducted prior to actual application operations. It is further recommended that spray equipment be allocated on the following basis:

FROKA - 1 Unit

I US Corps (Gp) - 1 Unit

Reserve - 1 Unit

f. That future defoliation projects be supervised by a headquarters staffed to support an operational mission with the guidance of staff chemical personnel.

g. That ROKA units be authorized to apply defoliant without the direct supervision of U. S. personnel and that U. S. units be allowed to make applications as required. (b) (6)

(b) (6)



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ANNEX B: Technical Characteristics of Herbicides (U)

1. (U) Chemical control of vegetation and foliage has been an accepted agricultural practice for a number of years. The various chemical herbicides that are commonly used for this purpose are classified according to their effects as follows:

a. Desiccants are chemicals which rapidly dry up foliage causing the leaves to fall off of treated vegetation. Desiccation can be effectively used to prepare vegetation for controlled burning during the growing season.

b. Herbicides are chemicals which are absorbed into the plant inhibiting growth and eventually killing the plant. Initial plant response is that the leaves and stems of the plant begin to die first causing the plant to be "defoliated". The second response is the eventual death of the plant which may occur two to three weeks later.

c. Soil applied herbicides are chemicals that are placed into the soil and are absorbed through the plant root system and then translocated throughout the plant causing defoliation and eventual killing of the plant.

2. (U) As a common meaningful designation and to prevent confusion the term "defoliant" rather than the term desiccant, herbicide, etc has been used throughout all briefings, correspondence and directives pertaining to the Vegetation Control Program OY 1968.

3. (U) Spraying defoliants as a means of improving both horizontal and vertical visibility where vegetation is dense has become an accepted practice in military operations in Vietnam. Research, which has been conducted for more than 20 years at the US Army Biological Laboratories, Fort Detrick, Maryland, has been confirmed for its use on a large scale, for certain defoliants by their successful use during the past six years in Vietnam. In Vietnam the military worth of herbicides as a new military weapon has been proven. The improvement of air-to-ground and ground-to-ground visibility has uncovered enemy positions, permitted observation of his movements and has been a primary factor in reducing the incidence of ambushes with a resultant saving of lives of allied military personnel.

4. (U) The defoliants that have been used in Korea have been in use in the United States for over 20 years. They are available commercially in the United States under a variety of trade names at most seed stores, garden shops and farm supply stores. In the summer of 1967 a commercial variety of 2,4 D was sold in the YONGSAN PX Garden Shop. Although the use of defoliants is recognized and is taught at agricultural colleges in Korea they are not generally used in agriculture in Korea due to the relative expense of the active ingredients and the plethora of cheap manual labor.

5. (U) In order to avoid misunderstandings on what can be accomplished, by the use of defoliants on vegetation, it should be borne in mind that the ultimate effect of the chemicals will be to provide a vegetation condition similar to that of winter. With certain chemicals, the vegetation growth is completely stopped. While with others it may be temporarily defoliated and later re-leaf. In any case the chemicals do not cause the vegetation to vanish. The trunks and branches of trees, for example, remain in place until removed by man or nature. In any case the chemicals do not cause the vegetation to vanish. The trunks and branches of trees, for example, remain in place until removed by man or nature. In Vietnam, it has been noted that when trees 50 to 100 feet high were defoliated by aerial spray, there was an increase of approximately 80% in vertical visibility and horizontal visibility was improved 50%.

6. (U) As a result of tests and data obtained from defoliant operations in Vietnam and field evaluation in Korea as well as recommendations from the US Army Biological Laboratories, Fort Detrick, Maryland the following defoliants were selected for use in Korea:

a. Agent Orange: A 50:50 mixture of normal butyl esters of 2,4-diphenoxyacetic acid (2,4-D) and 2,4,5-triphenoxyacetic acid (2,4,5T). It is a systemic plant poison which when absorbed into the plant through foliage and translocated throughout the plant causes a rapid withering followed by death of the plant within 2 to 3 weeks. It is specific for broad leaf plants and is effective against most trees and woody brush including evergreens, locust and scrub oak. Generally speaking narrow leaf plants which include most grasses are not affected by Agent Orange. Effective defoliation and death of most susceptible vegetation can be expected from an application rate of three gallons of active agent per acre. Agent Orange was applied as a liquid spray and was mixed with No 1 diesel oil at a rate of 3 gallons of Orange to 50 gallons oil for spray of a one acre area. Agent Orange is relatively non toxic and no danger exists to warm blooded animals in connection with its handling and application. Figure E-1 illustrate the vegetation cover along a road near the DMZ. Figure E-2 illustrate the same area after treatment with Agent Orange.

b. Agent Blue: A liquid formulation of cacodylic acid known commercially as PHYTAR 560G. It is used for the rapid desiccation, or drying out, of the leaves of woody and grassy growth, particularly narrow leaf growth such as annual and perennial grasses. It has an extremely fast response time of 3 to 5 days for this type of vegetation and is especially effective in preparing vegetation of a high water content for controlled burning. Rice and other cereal grain crops belonging to the narrow leaf family of plants are extremely sensitive to this agent, in fact Blue has been used in Vietnam as a specific agent to destroy Viet Cong rice crops. Agent Blue is applied as a liquid spray and is mixed with water at a ratio of 3 gallons of Blue to 50 gallons of water application to a one acre area. Figure E-3 shown

a possible ambush area adjacent to a tactical road Figure E-4 is the same area following application of Agent Blue.

c. Monuron UROX 22: This agent is a palletized solid containing 22% Monuron trichloroacetic acid and is an all purpose semi-permanent soil applied herbicide. It is effective for the long term control of perennial and annual grasses, vines, broadleaf weeds, trees and woody plants. This agent is spread by hand or mechanical broadcast in the same fashion as palletized fertilizer and is applied to the soil immediately prior to or at the beginning of the growing season. Once applied to the soil Monuron slowly dissolves and is absorbed into the soil where it is absorbed into the root systems of plants and is further translocated throughout the plant causing defoliation and eventual killing of the plant. Rainfall is required to dissolve the pellets and cause absorption into the soil; therefore, two to three months may be required before a visible effect of the agent may be observed. Once applied to the soil Monuron is expected to be effective for up to two growing seasons. It is comparatively non-toxic and no danger exists to man or animals in handling and application. To illustrate the effect of Monuron UROX the tree in Figure E-5 was treated with a basal application on 10 April 1968. Figure E-6 shows that as of 3 July 1968 the leaves were browning and the tree was beginning to die in contrast to the fully developed foliage of adjacent untreated vegetation.

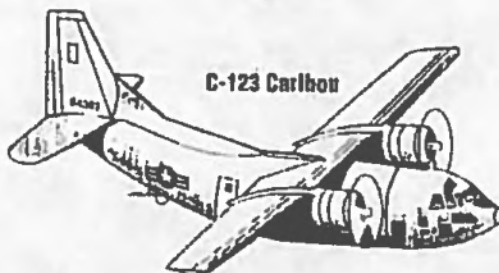
The story of Agent Orange

Agent Orange was sprayed in Vietnam from 1965-71 to remove leaves from trees and to destroy crops. Many Americans exposed to dioxin, Agent Orange's cancer-causing byproduct, suffer health problems. The Veterans Administration will release new regulations for damage suits this fall. Here is a look at the Agent Orange story.

■ Black areas on map show where Agent Orange was sprayed

How much Agent Orange was used

The Air Force's Operation Ranch Hand sprayed 11.3 million gallons of Agent Orange from 1965-71. The Army, Navy and Marines also sprayed an undetermined amount of Agent Orange.



C-123 Caribou



Others methods of spraying



Vehicles



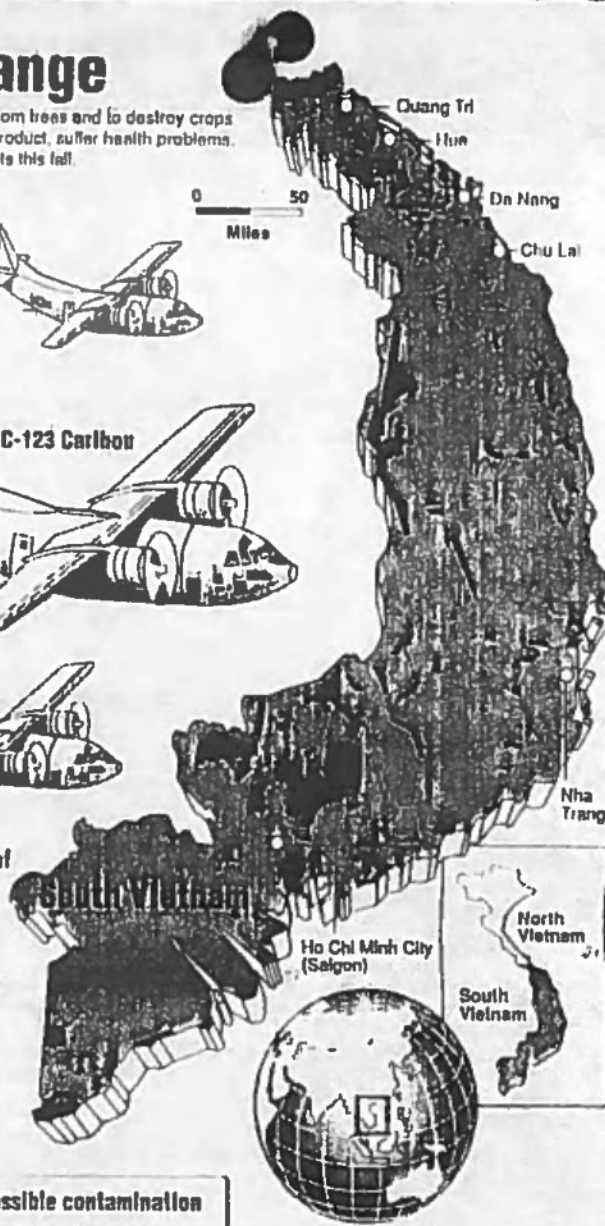
Helicopter



Troops



Miles

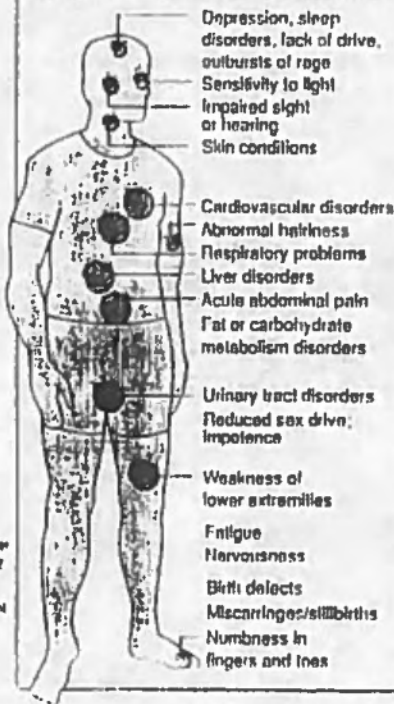


Agent Orange timeline

Major events over the last 27 years.

- 1962** U.S. military test sprays Agents Pink and Purple in Vietnam
- 1965** U.S. military begins spraying Agents Orange, White and Blue
- 1966** U.S. troops told Agent Orange is non-toxic
- 1968** U.S. military sprays 12,000 gallons of Agent Orange in Korea
- 1977** Vietnam veteran sues manufacturers of Agent Orange; stockpile burned over the Pacific Ocean
- 1978** TV program discusses Agent Orange
- 1979** Environmental Protection Agency bans dioxin; Congress begins hearings on involuntary exposure; bill passed to design Agent Orange study
- 1980** VA starts Exposure Validation Study
- 1981** President signs bill expanding VA study to include other environmental hazards in Vietnam
- 1982** Centers for Disease Control (CDC) start Vietnam Experience Study on health
- 1983** VA transfers Exposure Validation Study to CDC; President signs \$54 million funding bill; Air Force releases report on spraying missions
- 1984** Dioxin manufacturers settle out of court; \$180 million fund created for veterans
- 1987** CDC cancels Exposure Validation Study after spending \$43 million
- 1988** CDC completes Vietnam Experience Study
- 1989** Congress investigates CDC's cancelling Exposure Validation Study

Symptoms of possible contamination



Depression, sleep disorders, lack of drive, outbursts of rage
Sensitivity to light
Impaired sight or hearing
Skin conditions

Cardiovascular disorders
Abnormal hairiness
Respiratory problems
Liver disorders
Acute abdominal pain
Fat or carbohydrate metabolism disorders

Urinary tract disorders
Reduced sex drive, impotence

Weakness of lower extremities

Fatigue

Nervousness

Birth defects

Miscarriages/stillbirths

Numbness in fingers and toes

Herbicides used

- Agent Pink
- Agent Purple
- Agent Green
- Dioxol
- Trinoxol
- Diquat
- Bromacil
- Tandex
- Monuron
- Duxon
- Dalapon
- Agent Orange
- Agent White
- Agent Blue

Phased testing

- 1962-64: 11 chemicals tested in Corps IV
- 1965-68: Tactic for warfare
- 1968-71: Used in war zones, not population centers

Vietnam veteran facts

- 2.5 million exposed to dioxin
- 255,000 filed damage claims against Agent Orange manufacturers
- 230,000 requested the VA to examine them for dioxin poisoning
- 35,000 filed claims with the VA, citing Agent Orange

Did you know?

- FDA banned hexachlorophene in soaps and deodorants in 1972 because it contained dioxin
- Agent Orange was sprayed along the U.S.-Canadian border until 1977
- High levels of dioxin are in the food chain in South Vietnam.

Source: H. H. Congress, Veterans Administration, White House, Air Force, Department of the Interior, U.S. Army, U.S. Navy, U.S. Air Force, U.S. Marine Corps, U.S. Coast Guard, Environmental Support Group, Surgeon General, U.S. Environmental Protection Agency, U.S. Department of Health and Human Services, U.S. Department of Energy, U.S. Department of Agriculture, Vietnam Veterans of America, Vietnam Veterans Affairs, U.S. Environmental Defense Fund, University & ...

Vet who served in Korea says Agent Orange did harm there to

The chemical was sprayed in Korea's DMZ by its troops.

By Peter Wehrwein
Staff Writer

MISKAYUNA — When Bill Mahoney beat non-Hodgkin's lymphoma a decade ago, he beat some very long and extremely grim oncological odds.

His cancer was classified as the "stage 4" case, and stage 4 cases are not supposed to live very long. Now the 41-year-old resident of

this town is in the middle of another uphill fight. The stakes are not cancer's life-and-death wager, but Mahoney is still facing formidable opposition: government bureaucracy combined with considerable historical and medical uncertainty.

Mahoney is a Vietnam-era Army vet who believes his cancer was caused by exposure to Agent Orange, the dioxin-laced chemical that Americans used to defoliate the

jungle. His claim may not seem so remarkable. As of Jan. 1, some 36,250 veterans had filed claims for government coverage for service-connected disabilities caused by Agent Orange. Coverage has been granted to 22,675 of them, according to Linda Stalvey, a spokeswoman for the Department of Veterans Affairs in Washington.

But Mahoney never so much as set an Army boot in Vietnam.

He and a cadre of other veterans from across the country believe their bodies were assaulted chemi-

cally by Agent Orange over a thousand miles away in Korea. Agent Orange was used to rid the hills of the demilitarized zone between North and South Korea, they contend.

Mahoney said the DMZ was a "free-fire zone" and his unit was told several times not to shoot at friendly troops spruading the chemical.

"We were living where they sprayed," said Mahoney, whose job as a forward observer was to guide artillery fire in case the North Koreans ever attacked.

Denver Combs, director of a veterans center in Dayton, Ohio, has been a dogged advocate for Mahoney and other vets. Combs and Rick Morrow, a DMZ vet of the Vietnam War vintage who used to live in the Dayton area, bombarded the Pentagon with freedom of information requests.

The records trickled out. "I don't think they wanted to open up another can of worms," Combs said.

Still, he believes the final result is solid proof that up to 12,000 American soldiers might have been exposed to Agent Orange between 1968 and 1974, when it was used in Korea.

Now for the Catch-22s.

Until recently, only "in country" Vietnam vets were considered eligible for any kind of Agent Orange benefit. "If you had one hour in Vietnam, you were covered," said Mahoney, who has a thick file of correspondence that dead ends in rejections.

But President Bush signed a new law earlier this year that extended disability benefits to veterans with conditions related to Agent Orange. The way Combs and others read it, the Korean DMZ vets are covered.

"As of now, they are being considered just like they are Vietnam vets," said Combs.

But Stalvey the VA spokeswoman, said the proposed rule changes stemming from that law treat non-Vietnam vets quite differently.

For one thing, the burden of proof is on the DMZ vets to show that they were exposed, she said.

The list of covered conditions is also different, according to Stalvey. Only Vietnam vets can get service-connected coverage for soft-tissue sarcomas, non-Hodgkin's lymphoma and chloracne.

Because the scientific links to Agent Orange are more tenuous, non-Vietnam veterans suffering from non-Hodgkin's lymphoma and chloracne will not be eligible for the



Times Union photo by Luciano M. KOREAN MEMENTO — Bill Mahoney of Miskeyuna, a veteran argues a stint in Korea gave him an Agent Orange-induced cancer.

Agent Orange disability benefits, she said.

Besides, it is "rather unlikely" American soldiers suffered significant Agent Orange exposure in Korea, Stalvey said. Korean troops spread the herbicide.

Told of Stalvey's opinion, Mahoney was smug. "So because I wasn't administering it, I was not affected by what I was living in?" he said.

Mahoney has been "healthy as horse" since his successful chemotherapy

crappy treatments 10 years ago gets a salary of about \$40,000 as a personnel administrator for the Department of Civil Service.

He is not pursuing this case for the money, he said. He thinks it might result in some early diagnosis and treatment for thousands of veterans.

"What I am worried about," Mahoney added, "is that there might be a lot of other guys who don't know about this."

Early test results show no firehouse air problem

By Yvonne Ray

Times Union Staff Writer



Ex-Daytonian helps pass Agent Orange act

Richard Morrow was one of many Army privates stationed in Korea in 1974.

The former Daytonian remembers looking out over the Korean countryside near the demilitarized zone. Green leafy trees were on the horizon. Where he was standing the foliage was dead or dying.

He said the trees and plants in Korea were killed by Agent Orange, a powerful herbicide used by the military in Vietnam. He also said he suffers one of the classic ailments linked to Agent Orange poisoning.

The Army said it didn't use defoliants in Korea.

When Morrow, then transplanted to Michigan, was refused an examination by Veteran's Administration doctors for Agent Orange problems he found out otherwise.

The efforts of Morrow, U.S. Congressman Tony Hall, D-Dayton, and Montgomery County Veteran Services Center Director Denver Combs paid off recently with legislation that could make veterans stationed outside of Vietnam during the same era eligible for Agent Orange benefits.

Hall and the others helped insert a paragraph into the Agent Orange Act of 1991 that allows those stationed outside Vietnam to apply for VA disability benefits that Combs said can run from \$70 to \$1,700 per month.

Morrow said once he was rejected for the exams he contacted his congressman in Michigan. He said he got no help, so he turned to his former congressman, Hall, who enlisted the aid of Combs.

Morrow wrote the Pentagon asking for information on defoliants used in Korea. He was startled when he received a 30-page "Vegetation Control Plan" that had been declassified in return.

That plan said Agent Orange was used in Korea beginning as early as 1967 and at least 18,000 acres were treated near where Morrow's 2nd Infantry Division was stationed at the DMZ.

Morrow said that information gave the ammunition needed to pass the legislation.

Combs said veterans wanting more information may call the Veteran's Service Center at 256-4702.

OKs liquor-store bill

Chemical sprayed in Korea

WASHINGTON (AP) — Newly declassified Pentagon records show that Agent Orange, the herbicide under investigation as a health hazard to GIs exposed to it in Vietnam, also was sprayed in Korea.

~~How the records were obtained is not clear. The records were obtained from the Pentagon by a Freedom of Information Act request. The records show that Agent Orange was sprayed in Korea in 1969. The records also show that Agent Orange was sprayed in Korea in 1970. The records also show that Agent Orange was sprayed in Korea in 1971. The records also show that Agent Orange was sprayed in Korea in 1972. The records also show that Agent Orange was sprayed in Korea in 1973. The records also show that Agent Orange was sprayed in Korea in 1974. The records also show that Agent Orange was sprayed in Korea in 1975. The records also show that Agent Orange was sprayed in Korea in 1976. The records also show that Agent Orange was sprayed in Korea in 1977. The records also show that Agent Orange was sprayed in Korea in 1978. The records also show that Agent Orange was sprayed in Korea in 1979. The records also show that Agent Orange was sprayed in Korea in 1980. The records also show that Agent Orange was sprayed in Korea in 1981. The records also show that Agent Orange was sprayed in Korea in 1982. The records also show that Agent Orange was sprayed in Korea in 1983. The records also show that Agent Orange was sprayed in Korea in 1984. The records also show that Agent Orange was sprayed in Korea in 1985. The records also show that Agent Orange was sprayed in Korea in 1986. The records also show that Agent Orange was sprayed in Korea in 1987. The records also show that Agent Orange was sprayed in Korea in 1988. The records also show that Agent Orange was sprayed in Korea in 1989. The records also show that Agent Orange was sprayed in Korea in 1990. The records also show that Agent Orange was sprayed in Korea in 1991. The records also show that Agent Orange was sprayed in Korea in 1992. The records also show that Agent Orange was sprayed in Korea in 1993. The records also show that Agent Orange was sprayed in Korea in 1994. The records also show that Agent Orange was sprayed in Korea in 1995. The records also show that Agent Orange was sprayed in Korea in 1996. The records also show that Agent Orange was sprayed in Korea in 1997. The records also show that Agent Orange was sprayed in Korea in 1998. The records also show that Agent Orange was sprayed in Korea in 1999. The records also show that Agent Orange was sprayed in Korea in 2000. The records also show that Agent Orange was sprayed in Korea in 2001. The records also show that Agent Orange was sprayed in Korea in 2002. The records also show that Agent Orange was sprayed in Korea in 2003. The records also show that Agent Orange was sprayed in Korea in 2004. The records also show that Agent Orange was sprayed in Korea in 2005. The records also show that Agent Orange was sprayed in Korea in 2006. The records also show that Agent Orange was sprayed in Korea in 2007. The records also show that Agent Orange was sprayed in Korea in 2008. The records also show that Agent Orange was sprayed in Korea in 2009. The records also show that Agent Orange was sprayed in Korea in 2010. The records also show that Agent Orange was sprayed in Korea in 2011. The records also show that Agent Orange was sprayed in Korea in 2012. The records also show that Agent Orange was sprayed in Korea in 2013. The records also show that Agent Orange was sprayed in Korea in 2014. The records also show that Agent Orange was sprayed in Korea in 2015. The records also show that Agent Orange was sprayed in Korea in 2016. The records also show that Agent Orange was sprayed in Korea in 2017. The records also show that Agent Orange was sprayed in Korea in 2018. The records also show that Agent Orange was sprayed in Korea in 2019. The records also show that Agent Orange was sprayed in Korea in 2020. The records also show that Agent Orange was sprayed in Korea in 2021. The records also show that Agent Orange was sprayed in Korea in 2022. The records also show that Agent Orange was sprayed in Korea in 2023. The records also show that Agent Orange was sprayed in Korea in 2024. The records also show that Agent Orange was sprayed in Korea in 2025. The records also show that Agent Orange was sprayed in Korea in 2026. The records also show that Agent Orange was sprayed in Korea in 2027. The records also show that Agent Orange was sprayed in Korea in 2028. The records also show that Agent Orange was sprayed in Korea in 2029. The records also show that Agent Orange was sprayed in Korea in 2030.~~
The purpose was to discourage infiltration from North Korea, DeYoung said. This was the first acknowledgment by the military that Agent Orange was widely sprayed in places other than Vietnam.

~~agent orange~~

COMPARISON OF HERBICIDE EFFECTS

<u>AGENT:</u>	<u>ORANGE</u>	<u>BLUE</u>	<u>MONURON UROK 22</u>
<u>CLASSIFICATION:</u>	HERBICIDE	DEPOLIANT (DESSICANT)	SOIL APPLIED HERBICIDE
<u>CHEMICAL COMPOSITION:</u>	50:50 MIXTURE 2,4D AND 2, 4, 5T	CACODYLIC ACID (PHYTAR 560G)	COMMERCIAL PREPARATION (ALLIED CHEMICAL CO.)
<u>EFFECTED VEGETATION:</u>	WOODY GROWTH, TREES BROAD LEAF WEEDS	WOODY AND GRASSY	WEEDS, TREES, WOODY PLANTS AND PERENNIAL GRASSES
<u>METHOD OF DISSEMINATION:</u>	LIQUID SPRAY (OIL BASE)	LIQUID SPRAY (WATER BASE)	HAND OR MECHANICAL BROADCAST
<u>DURATION OF EFFECTIVENESS:</u>	ONE GROWING SEASON	MAXIMUM DEPOLIATION IN 2 TO 3 WEEKS	TWO GROWING SEASONS 4E
<u>RESPONSE TIME:</u>	2 TO 3 WEEKS	3 TO 5 DAYS	2 TO 3 MONTHS
<u>TOXICITY:</u>	NO EFFECT ON WARM BLOODED ANIMALS	LOW (COMPARABLE TO ASPIRIN)	NON-TOXIC