FN: 97-266 - ORIG. REQUEST
&
FN: 97-303 - APPEAL
continued

DEPARTMENT OF THE ARMY
HEADQUARTERS, U.S. ARMY MEDICAL COMMAND
2050 WORTH ROAD
FORT SAM HOUSTON, TEXAS 78234-6000

REPLY TO
ATTENTION OF

MCIM (25-55j) 3 July 1997

MEMORANDUM FOR Director, Office of the Secretary of Defense, The Army General Counsel (Ms. Suzanne Council), Room 2E725, 104 Army Pentagon, Washington, DC 20310-0104

SUBJECT: Appeal of Agency's Decision to Partially Withhold Records Considered to be Classified

1. References:

a. Letter (Appeal), dated 24 June 1997 (Encl 1).

b. Letter (Original Request), dated 7 February 1997, as sent to U.S. Army Chemical & Biological Defense Command, AMSCB-CIF, Aberdeen Proving Ground, MD (Encl 2).

c. Referral to this command from DAMO-ZXA, 400 Army Pentagon, Washington, DC, dated 15 May 1997 (Encl 3).

d. Letter (Initial Denial), Headquarters, U.S. Army Medical Command, dated 11 June 1997 (Encl 4).

e. Letter (Acknowledgment of Appeal), Headquarters, U.S. Army, dated July 2, 1997 (Encl 5).

f. Copy of sanitized document provided to requester (Encl 6).

g. Report Documentation Page and Distribution List (Encl 7).

h. Supporting documentation dated 11 March 1997 referring request to Cdr., U.S. Army Dugway Proving Ground (IM-A), Dugway, UT (Encl 8).

i. Memorandum dated 25 March 1997 indicating the requested document is classified Secret and recommending that only a sanitized version (which STEDP-JA provides), be released (Encl 9).

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MCIM
SUBJECT: Appeal of Agency's Decision to Partially Withhold Records Considered to be Classified

j. Letter dated March 25, 1996 to Mr. Kirby in which he is provided two documents and informed that the third document (BIG ITCH) is classified and has been referred to the IDA for review and release determination (Encl 10).

2. This forwards the appeal of Mr. Kirby.

3. In his appeal, Mr. Kirby gives no valid reason for his appeal other than to state that he takes exception to the withholding of certain paragraphs within Section 8, "Appendices (U)", 8.1 "Literature Cites", pp 61-64 of the document and from what appears to be evident to him, this entire section is unclassified.

4. After further review we remain firm in the belief that we have acted in good faith concerning our previous response to Mr. Kirby. We have reviewed the document and provided all portions of the document considered releasable. We feel that our initial response was both prudent and correct.

FOR THE COMMANDER:

10 Encls

VERNON L. GROEBER
LTC, MS
Acting Deputy Chief of Staff
for Information Management

24 June 1997

(b.) (6)

Mr Charles Bowers
FOIA/PA Officer
US Army Medical Command
Attn: MCIM
Ft Sam Houston TX 78234-6013

Re: FOIA Appeal

Reference is made to your commands review and partial denial of my request as stated in the attached letter.

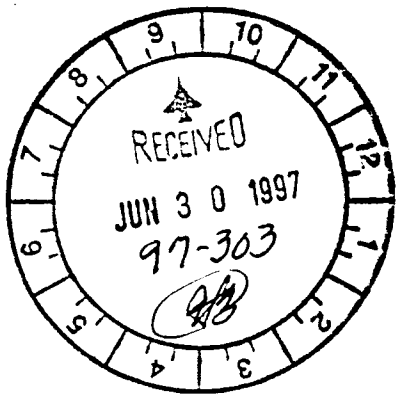
I thank your activity for their careful review of the document "An Evaluation of Entomological Warfare as a Potential Danger to the United States and European NATO Nations", and concur that exception (b) (1) of 5 USC 552, Freedom of Information Act, was probably appropriate for the majority of this document as most of this document appeared to be a survey of literature, and several sources were inferred to still be classified.

However, I take particular exception to the denials within Section 8 "Appendices (U)", 8.1 "Literature Cited", pp 61 - 64 of this document, and therefore request an appeal of the partial denial to my request in regards to these pages. From what is evident of the released information, this entire section is unclassified.

I look forward to your response, and thank you for considering this appeal request.

Sincerely,

Reid Kirby
(b.) (6)



February 7, 1997

Reid Kirby

(b.) (6)

Ms Cheryl Fields
US Army Chemical & Biological Defense Command
Attn: AMSCB-CIF
Building E5183
Aberdeen Proving Grounds MD 21010-5423

Re: FOIA Request

I am requesting information on US efforts to weaponize fleas for the biological warefare program. Specifically I am interested in what agent-vector combinations were considered during the 1950's. Along with information of entomological field test BIG ITCH, which was conducted during 1954. This involved test of the E-14 munition, which was intended to disseminate fleas. It would also be helpful in fulfilling this request to provide a discription of the E-14 munition that is suitable for historical discussion.

I believe that release of this information is in the public's interest, and would not jeopardize national defense. If I should be assessed any fees for this request, I am willing to pay all fees up to a maximum of $50.00. If you estimate that the fees will exceed this limit, or have any questions regarding my request, please contact me.

Thank you for considering my request,

Reid Kirby

(b.) (6)

SECRET

DEPARTMENT OF THE ARMY
OFFICE OF THE DEPUTY CHIEF OF STAFF FOR OPERATIONS AND PLANS
400 ARMY PENTAGON
WASHINGTON DC 20310-0400

REPLY TO
ATTENTION OF

DAMO-ZXA

15 May 1997

MEMORANDUM FOR U.S. ARMY MEDICAL COMMAND, DEPUTY CHIEF OF STAFF FOR INFORMATION MANAGEMENT, ATTN: MCIM, FT. SAM HOUSTON, TX 78234-6013

SUBJECT: Freedom of Information Act (FOIA) Referral

1. The enclosed FOIA request was forwarded to this office for action as Initial Denial Authority. Upon review, it was noted the document pertains to entomological which falls within your purview. As such, the request is forwarded herewith for direct response to requester.

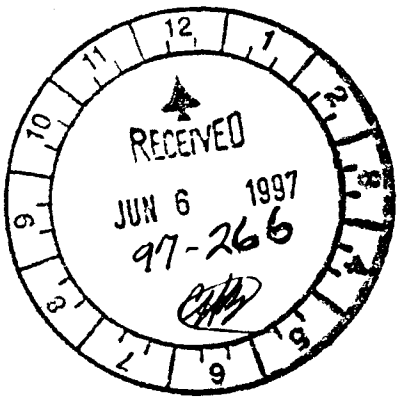
2. The requester has been notified of this referral.

3. POC is Mrs. Phillips, DSN 224-2011/COMMERCIAL (703) 614-2011.

FOR THE DEPUTY CHIEF OF STAFF FOR OPERATIONS AND PLANS:

Encl

JOHN C. BEDNAR
LTC, GS
Administrative Executive



REGRADED UNCLASSIFIED
WHEN SEPARATED
CLASSIFIED ENCLOSURE

SECRET

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DEPARTMENT OF THE ARMY
HEADQUARTERS, U.S. ARMY MEDICAL COMMAND
2050 WORTH ROAD
FORT SAM HOUSTON, TEXAS 78234-6000

REPLY TO
ATTENTION OF

June 11, 1997

Information Management

Mr. Reid Kirby

Dear Mr. Kirby:

This is in further response to your inquiry dated February 7, 1997 to the U.S. Army Chemical & Biological Defense Command, Aberdeen Proving Ground, MD in which you request documents relating to a field test called "Big Itch."

Your inquiry, along with one document, still classified, titled "An Evaluation of Entomological Warfare as a Potential Danger to the United States and European NATO Nations", which is responsive to your request, has been referred to this command for review, release determination and direct response to you. This referral was received on June 6, 1997 and has been processed in accordance with both the Freedom of Information Act (FOIA), 5 United States Code (U.S.C.) 552 and the Privacy Act (PA), 5 U.S.C. 552a.

As you were previously notified, the aforementioned document is still classified and was referred to the Initial Denial Authority for additional review. After careful consideration it has been determined that a partial denial of this information is warranted. This partial denial is made on behalf of Lieutenant General Ronald Blanck, The Surgeon General, who, as the Initial Denial Authority under the FOIA, is authorized to make such determinations involving medical records, and is based on exemptions provided by 5 U.S.C. 552 of the FOIA and Army Regulation 25-55, paragraph 3-200, Number 1.

You are advised of your right to appeal this initial partial denial. Should you desire to do so, you should submit your appeal, stating the basis for your disagreement, to

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Mr. Charles Bowers, FOIA/PA Officer, Office of the Deputy Chief of Staff for Information Management within 60 days of the date of this letter.

Sincerely,

for Vernon L. Groeber
Lieutenant Colonel, U.S. Army
Acting Deputy Chief of Staff
for Information Management

Enclosure

DEPARTMENT OF THE ARMY
HEADQUARTERS, U.S. ARMY MEDICAL COMMAND
2050 WORTH ROAD
FORT SAM HOUSTON, TEXAS 78234-6000

REPLY TO
ATTENTION OF

July 3, 1997

Information Management

Mr. Reid Kirby

D./(D

Dear Mr. Kirby:

This responds to your letter dated June 24, 1997 in which you appeal this agency's response concerning your request for access to additional portions of a classified government document (BIG ITCH). Your appeal was received on June 30, 1997 and has been processed in accordance with both the Freedom of Information Act, 5 United States Code (U.S.C.) and the Privacy Act, 5 U.S.C. 552a.

After further review we have submitted your appeal, along with our recommendation to the Army General Counsel, 104 Army Pentagon, Washington, DC, for additional review and direct response to you.

You may expect to hear directly from that agency regarding your appeal.

Sincerely,

for: Vernon L. Groeber
Lieutenant Colonel, U.S. Army
Acting Deputy Chief of Staff
for Information Management

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AD _____

RDTE Project No. 1L162706A553-TA3-7

TECOM Project No. 8-CO-513-FBT-023

DPG Document No. DPG-S-445A

first 30 pages provided to requester

AN EVALUATION OF ENTOMOLOGICAL WARFARE AS A POTENTIAL DANGER TO THE UNITED STATES AND EUROPEAN NATO NATIONS (U)

By

William H. Rose

March 1981

U.S. ARMY DUGWAY PROVING GROUND
Dugway, Utah 84022

[redacted]

ASSIFIED BY: Multiple Sources
VIEW ON: 31 March 1997

DPG 81-41
Copy 60 of 69 Copies

FOREWORD

The author gratefully acknowledges the valuable assistance of Dr. Robert Elbel of the University of Utah, Entomology Department and Mr. George Crane of Dugway Proving Ground.

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SECTION 4. HISTORY OF EW FIELD TESTING IN THE US

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SECTION 7. CONCLUSIONS AND RECOMMENDED DEFENSIVE MEASURES

SECTION 8. APPENDICES

LIST OF TABLES

SECTION 1. EXECUTIVE SUMMARY (U)

1.1 PURPOSE

(U) This report assesses the current potential threat and probability of use of various entomological warfare (EW) agents against the US and European NATO nations by a foreign power or dissident organization. It also makes recommendations to combat or negate this potential danger.

1.2 INTELLIGENCE INFORMATION

(U) The following intelligence information is indicative of possible development of EW by the Warsaw Pact Nations.

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(U) Several exotic viruses, many of which are not problems in the Soviet Union but which are potential EW disease agents are being studied in the USSR. One of these, African swine fever, has been under study since the early 1960s. This disease, which is almost 100 percent fatal to infected swine, is not endemic in the Soviet Union (4).

(U) The Soviets have conducted a significant amount of research with foot and mouth disease (FMD) virus. This virus infects cattle, sheep, and hogs. It is not endemic in the US but if introduced could cause tremendous economic damage (4).

(b)(1)...

(b)(1)...

Table 1. (U) Resource Cost Summary for an *F. tularensis* Aerosol Attack on a Battalion.

Item	Cost (1976 $)
Planning	8,750
Agent Production	10,000
Munition Acquisition	9,897
Weapon Employment	5,700
TOTAL:	34,347

1.5.1.2 (U) Attack with Yellow Fever Infected Mosquitoes. The cost of attacking a 7.5-km^2 area (battalion) with yellow fever-infected mosquitoes was estimated. Where possible, costs of equipment were taken from 1976 catalogues to make the cost comparison with the aerosol attack as valid as possible. The feasibility of area coverage with *A. aegypti* mosquitoes was based on the Avon Park, Florida mosquito trials described in Section 4 (11,12). Approximately 225,000 infected female *A. aegypti* are required for this hypothetical attack. The mosquitoes would be released from a helicopter 610 m upwind of the target area. Table 2 contains the resource cost summary for this attack. See Table 6 page 46 for the estimated cost of munition items for the *F. tularensis* attack and Table 7 page 49 for the estimated cost of items to raise 225,000 yellow fever infected mosquitoes.

Table 2. (U) Resource Cost Summary for a Yellow Fever-Infected Mosquito Attack on a Battalion.

Item	Cost (1976 $)
Planning	8,750
Agent Production	9,066
Munition Acquisition	2,150
Weapon Employment	6,700
TOTAL:	26,666

(U) Tables 1 and 2 demonstrate the probable cost differential for an aerosol versus EW attack when considering a given limited area such as that occupied by a mechanized battalion in the field. In actuality, an EW attack of this type on a military unit would probably not be attempted because complete control of the airways would be necessary and the attack would not be covert. The same would be true for a pathogen aerosol attack attempted this close to the target area.

1.5.2 City Attack.

1.5.2.1 (U) Attack with Yellow Fever-Infected Mosquitoes. The cost of attacking an urban area covertly with yellow fever-infected mosquitoes was estimated. It was assumed the cost of planning a city attack with yellow fever-infected mosquitoes is comparable with the cost of planning an aerosol attack on Washington, DC (scenario 7 of reference 10). In the present hypothetical attack, 16 simultaneous attacks were planned at a total planning cost of $8,750. The cost of one attack would be $547.00 ($8,750 ÷ 16).

(U) Agent production would involve producing 225,000 yellow fever-infected female *A. aegypti*. This is the same number used in the hypothetical battalion attack so the cost would be the same ($9,066).

(U) Munition acquisition was estimated to be $500.00 and weapon employment (truck rental and wages of two semi-skilled people for eight hours) was estimated to be $360.00. These costs are summarized in Table 3.

Table 3. (U) Resource Cost Summary for a Yellow Fever-Infected Mosquito Attack on a City.

Item	Cost (1976 $)
Planning	547
Agent Production	9,066
Munition Acquisition	500
Weapon Employment	360
TOTAL:	10,473

THIS TABLE IS UNCLASSIFIED

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(U) The costs of agent production, munition acquisition, and weapon employment were also taken from scenario 7 of reference 10. The one exception to this was for weapon employment. Scenario 7 included the travel and per diem costs of foreign agents traveling to the US to conduct the attack. In the presently described scenario, people to conduct the attack were considered to be already in the US. This makes the costs comparable to those for the yellow fever mosquito attack on a

city where attack personnel were considered to be already in the US. The costs are summarized in Table 4.

Table 4. (U) Resource Cost Summary for an *F. tularensis* Aerosol Attack on a City.

Item	Cost (1976 $)
Planning	547
Agent Production	174,000
Munition Acquisition	1,435
Weapon Employment	3,250
TOTAL:	179,232

THIS TABLE IS UNCLASSIFIED

1.5.3 Cost Comparison Summary.

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(U) The closeness of agent and agent vector release in these two types of attacks (610 m upwind of the target area) would preclude the advantage of covertness. Therefore, personnel having access to protective masks during an *F. tularensis* aerosol attack would probably have the opportunity to take advantage of this method of protection.

(b)(1)...

(U) It has been estimated that between 50 and 90 percent of a nonimmune population bitten by infected yellow fever mosquitoes will become infected and 30 to 40 percent of the victims will die (12). Thus >50 percent of the personnel in the battalion would likely become incapacitated and a large number would die.

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Table 5. (U) Various Estimates of Cost per Death for an *F. tularensis* Aerosol Attack on a City.

Percent Deaths	Number of Deaths	Cost Per Death (1976 $)
5	62,500	2.86
10	125,000	1.43
20	250,000	0.72
30	375,000	0.48
40	500,000	0.36
50	625,000	0.29

THIS TABLE IS UNCLASSIFIED

[1]Streptomycin, kanamycin, and chloramphenicol are also effective against *F. tularensis*, although some strains of *F. tularensis* are resistant to streptomycin.

death for various death ratios in the tularemia attack depicted. This table indicates that a death rate of 20 percent per casualty would have to be achieved before the cost rate per death would be less than that estimated in a similar yellow fever-infected mosquito attack.

(b)(1)...

1.6 CONCLUSIONS

(U) Intelligence information dealing with the Warsaw Pact countries has indicated that in the past they have attempted to produce an EW capability. Presently, indirect evidence indicates activity in EW. The evidence includes mass rearing of potential insect vectors and working with microbiological agents compatible with EW agents that are not a problem in these countries. The Warsaw Pact nations certainly have the capability to conduct EW.

(U) The *A. aegypti* yellow fever virus system is estimated to be the most likely antipersonnel EW system that could be used by the Warsaw Pact Countries against the US or the European NATO nations. FMD virus is a likely animal EW agent that could be effectively spread by *M. domestica* with a resultant great economic loss.

(b)(1)...

(U) EW systems are not likely to be used on military units because the agent vectors must be released too close to the target area. This would make a covert attack on a military unit difficult to achieve. In addition troops in the field are normally spaced further apart than people in cities which would make EW warfare less effective.

1.7 RECOMMENDED DEFENSIVE MEASURES

(U) When an EW attack on a city is suspected or when a large population of mosquitoes or other insects unexpectedly appears in an abnormal way, reaction must be swift. Insecticide spray operations should be

initiated as soon as possible. At the same time, the general population must be warned by radio, television, and newspapers. If the insects are mosquitoes, the warning should include advice to stay indoors and to keep unscreened doors and windows closed at all times. Those who must venture outside should be protected as much as possible. Suggested protection should include wearing mosquito netting over the face and neck and the use of mosquito repellant. Long-sleeved shirts with gloves tightly fastened around the wrists should be worn. Pants should be fastened tightly around the ankles and two pair of socks worn. Hats should be worn to protect the tops of heads.

(b)(1)...

SECTION 2. INTRODUCTION (U)

2.1 PURPOSE

(U) The spread of disease-causing microorganisms for the purpose of inflicting casualties on enemy personnel, animals, or crops has been termed biological warfare (BW). The use of insect vectors to accomplish this task has been termed entomological warfare (EW). The purposes of this paper are to (1) assess the current potential threat and probability of a foreign power or dissident organization using various EW diseases against the US and European NATO nations and (2) make recommendations to combat or negate this potential danger.

2.2 METHODS

(U) The purpose of this report has been accomplished by:

a. (U) Listing the available foreign intelligence information which indicates Warsaw Pact interest in EW,

b. (U) Summarizing the history of US EW testing,

c. (U) Obtaining the facts relative to the more probable EW diseases that could be used against the US or European NATO nations,

d. (U) Giving the reasons why these diseases might or might not be employed and how they might be used,

e. (U) Comparing the cost of conducting EW to the cost of the aerosol mode of BW, and

f. (U) Delineating some of the defensive measures that could be used to negate an EW attack.

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(b)(1)...

SECTION 3. INTELLIGENCE INFORMATION (U)

(U) Since World War II several reports have indicated the Soviet Union has an interest in EW.

3.1 HIRSCH REPORT

(b)(1)...

(U) The prisoners, reportedly in chains, were placed in an eight-man tent which had a number of plague-infected rats and fleas under wire nets on the floor. Most of the prisoners developed bubonic plague after being bitten by the fleas. Ground squirrels and other rodents were reported to have been used in similar experiments and proved to be efficient intermediary hosts. The escape of a prisoner infected with bubonic plague started a great epidemic among the Mongols in the summer of 1941. Three to five thousand Mongols were reported to have died in this epidemic and were disposed of by burning or burying with disinfectants.

(U) Ticks were also reported to have been used to transfer tick-borne encephalitis to prisoners. In addition, infected fleas and other insect vectors were dropped from aircraft in paper containers.

3.2 MASS PRODUCTION OF *AEDES AEGYPTI*

(b)(1)...

3.4 FOOT AND MOUTH DISEASE (FMD)

(U) FMD is an economically important disease in livestock, especially cattle, because of losses arising from its occurrence. At present the disease is not a problem in the US. Previous outbreaks have been controlled by eradication of the sick and/or infected animals. The results of Soviet research efforts to develop an effective vaccine have been largely inconclusive. Other areas investigated in the USSR include growth of the causative virus in cell culture, resistance of the virus to the environment, inactivation by ultraviolet rays, and disinfection of foodstuffs. Because of the susceptibility of livestock populations in the United States, this acute, rapidly-spreading virus has considerable potential as a BW agent (4). The virus could be spread by insect vectors.

3.5 OTHER DISEASES

(U) Several more exotic viruses are also being examined in the Soviet Union. Since the early 1960s, the Soviets have conducted research on African swine fever. This disease, which is not endemic in the Soviet Union, is almost 100 percent fatal to infected swine. Early work with this virus demonstrated that dried blood infected with it was capable of causing the disease after nearly three years of cold storage (4). This virus could also be spread by insect vectors.

3.6 INSECT MASS REARING

(b)(1)...

SECTION 4. HISTORY OF EW FIELD TESTING IN THE US (U)

4.1 OPERATION BIG ITCH (8,12)

(U) In 1954 a series of trials was conducted using *Xenopsylla cheopis* (fleas) in E-14 munitions with cardboard and sponge inserts. The insects were dropped from altitudes of 305 and 610 m over US Army Dugway Proving Ground (DPG), Utah to: (1) investigate the suitability of the munition components for dissemination of these arthropod vectors; (2) determine survival and host acquisition ability of *X. cheopis* disseminated from these devices; (3) plot carrier patterns produced by E-14 munitions filled with the special carriers.

(U) The fleas were successfully reared to the appropriate stage, then dropped on the target with little or no die-off. After release, the insects were successful in acquiring hosts but were not active longer than 24 hours. The sponge carriers were the most widely distributed, as indicated by carrier patterns.

(U) No calculations of effects were attempted in this report.

4.2 OPERATION BIG BUZZ (12,14)

(U) In May 1955 a field test was conducted in Georgia to (1) demonstrate the feasibility of mass-producing, storing, loading into munitions, and disseminating mosquitoes from aircraft, and (2) to determine if the mosquitoes would survive the airdrop and take blood meals from humans.

(U) More than one million uninfected *A. aegypti* were produced and stored for nearly two weeks. About one third of these mosquitoes were placed in E-14 munitions (containing "aircomb waffles" and "loop tubes") and in 0.76 m rocket-shaped ground release munitions, and dropped, without mortality, from aircraft. The remaining mosquitoes were used in munition loading and storage tests. Mosquitoes were released from E-14 munitions when they were 91 m above the ground. The mosquitoes were dispersed by the wind and their own flight and were collected as far as 610 m downwind from the target release site. The female mosquitoes were active in seeking blood meals from humans and guinea pigs.

4.3 OPERATION DROP KICK (12,15)

(b)(1)...

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4.5 OPERATION MAY DAY (12,17)

(U) Operation MAY DAY consisted of studies of *A. aegypti* activity and dispersion in an urban area (Savannah, Georgia) from April to November 1956.

(U) The tests were designed to give information on the dispersal of *A. aegypti* from a ground level point-source release in a short period of time. Results were based primarily on mosquito recoveries obtained in dry-ice baited traps. In these tests a small fraction (0.5 percent to 7.75 percent) of the total number of mosquitoes

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(U) There were no [redacted] in the test area before the release of the test mosquitoes; however, a number of native species of mosquitoes were recovered by traps and by human collectors.

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(U) The time of maximum biting of this species outdoors was early in the morning and late in the evening during twilight and during inversions when wind velocity was at a minimum. Outdoor collections were made during these periods. Indoors, this species of mosquito bites at any time when there is any light (natural or artificial). Biting mosquitoes were collected in buildings from 0630 to 1930 (even later at night in lighted buildings).

(U) The biting activity was relatively independent of temperature except that early morning biting activity outdoors and in unheated buildings was limited at temperatures below 16°C. At this temperature and above the mosquitoes were very active and bit ferociously.

(b)(1)...

4.7 MUNITION DISSEMINATION TESTS (12,18)

(U) A 1957 report titled "Studies Relating to the Munition Dissemination of Insects for BW" discusses the munition dissemination of insects. Munition loading with selected insects using aspiration of insects was accomplished and insect survival was studied under different environmental conditions.

(U) Field tests were carried out with mosquitoes to determine the optimum release height between ground level and 305 m. In field tests, mosquitoes and houseflies dispersed up to 2.4 and 6.4 km respectively. A minimum of five infected mosquitoes, five houseflies, and 30 fleas or ticks per person is the preliminary estimate of the numbers of insects required for effective coverage of a target area.

4.8 OPERATION QUICKHENRY (7)

(U) A 1960 report discusses field trials involving uninfected female *A. aegypti* mosquitoes.

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4.9 BELLWETHER I (19)

(U) Bellwether I reported on a series of 52 field trials conducted at DPG between 1 September and 9 October 1959. The basic trial design of this test series consisted of three 4.6 m radius circles, located 0.8 km apart on a crosswind line. Ten human volunteers were located equidistantly around the perimeter of one circle, and ten traps with guinea pigs or ten empty traps were placed around the perimeters of the other two circles. Ten volunteers all remained seated in these trials. One hundred mosquitoes were released in the center of each circle and sampling was conducted for 30 minutes. A mobile meteorological station was located 0.4 km upwind of the center circle.

(U) The primary objective of this test was to determine the effects of major meteorological parameters on the biting rates of starved, virgin female *A. aegypti* mosquitoes on troops in the open. Other objectives were (a) to find out if this domesticated, house-loving tropical mosquito could be effectively tested in hot, open, temperate desert terrain and (b) to determine if traps could replace human samplers.

(U) For uninfected, virgin *A. aegypti* mosquitoes, the results obtained in these trials indicate that:

a, (U) It is feasible to test this mosquito under hot, dry desert conditions.

b. (U) Although many of these trials produced erratic and unpredictable results, analysis of these data indicates that each of the meteorological variables studied (wind speed, temperature, relative humidity, and solar radiation) exert a significant influence on the biting activity of the *A. aegypti* mosquito. All variables would have to be considered important parameters in any model designed to predict biting activity. However, the effects of the latter three factors were manifested only in terms of interaction with wind speed and with each other; wind speed alone had a direct effect upon biting activity.

c. (U) An increase of 1.6 km/hr in the ambient wind speed was associated with a decrease of approximately six bites in a 4.6 m radius circle with 10 volunteers during a 30-minute time interval.

d. (U) The data suggest that the previously determined lower temperature limit of 15°C for vector biting activity of the non-cold-resistant strain is placed too high. However, at these lower temperatures some other factors (at present unknown) produce erratic results.

4.10 BELLWETHER II (20)

(U) In Bellwether II, 14 field trials were conducted at DPG from 6 September to 20 October 1960 (12). Up to 100 assigned military personnel were used as samplers in each trial. Grid arrays involved in Bellwether I were incorporated into this test design.

(U) The objective of Bellwether II, using release of uninfected, starved virgin female *A. aegypti* mosquitoes, were, in part:

a. (U) To evaluate the effects of varying the host distance, the host concentration, and the vector/host ratio,

b. (U) To determine the effect of the presence or absence of overt movement of the human samplers upon the outdoor biting rate, and

c. (U) To investigate methods of placement of human samplers in open terrain and within built-up areas.

(U) Development and improvement of a basic entomological field test technology were the major goals throughout the test.

(U) For the specific conditions encountered, it is concluded that:

a. (U) In a 30-minute sampling period, there was no significant difference in vector biting activity at distances up to 30 m from the release point, but maximum biting activity occurred at distances of <61 m.

b. (U) Intervening hosts did not interfere with the vectors' outward spread or biting activity.

c. (U) No conclusive findings were generated regarding the effect of host concentration.

d. (U) When the number of vectors was increased by a factor of 10, approximately 10 times as many bites were received and the proportion of hosts bitten increased an average of 36 percent.

e. (U) Vector biting activity tended to be highest when the hosts were alternately in motion and then motionless for recurring 5-minute periods. Biting was lowest when the hosts moved continuously.

f. (U) Hosts located near buildings were subjected to significantly greater vector biting activity than were hosts located in open areas.

g. (U) Vectors did not tend to distribute themselves evenly throughout an isolated built-up area. Also, they did not tend to redistribute themselves evenly during the interims between host occupations.

h. (U) No conclusive findings were generated regarding optimum sampling duration.

i. (U) No evidence of twilight hours biting preference was obtained in these trials.

j. (U) There were no conclusive findings concerning the average longevity of *A. aegypti* exposed to ambient desert conditions.

4.11 BELLWETHER IV (21)

(U) Bellwether IV was conducted at DPG and published in 1962. The objective of this report was to compare the Rockefeller (R) strain of *A. aegypti* with the Fort Detrick (CD) strain for biting propensity (Phases A, B, and C), dispersal (Phases B and C), and building penetration (Phase C) in a desert environment. Bellwether IV Phases A, B, and C consisted of 17 trials; Phase A, nine trials; Phase B, five trials; and Phase C, three trials.

(U) The results of Phase A trials indicated that the biting propensity of strains R and CD did not differ. During Phase B trials, more bites were recorded for strain CD than for strain R. However, this difference may not have been statistically significant. The dispersion of the two strains was considered to be comparable.

(U) Conflicting results were obtained during Phase C. Many more mosquito bites were obtained on Trials C-2 and C-3 than on Trial C-1. Trial C-1 was conducted with strain CD, and Trials C-2 and C-3 were