TECHNICAL BULLETIN

OCCUPATIONAL AND ENVIRONMENTAL HEALTH PEST SURVEILLANCE

HEADQUARTERS, DEPARTMENT OF THE ARMY
JUNE 1992

TECHNICAL BULLETIN
NO. MED 561

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, DC, *1 June 1992*

OCCUPATIONAL AND ENVIRONMENTAL HEALTH PEST SURVEILLANCE

You can help improve this bulletin. If you find any mistakes or if you know a way to improve procedures, please let us know. Mail your memorandum or DA Form 2028 (Recommended Changes to Publications and Blank Forms) to HQDA (SGPS-PSP), 5109 Leesburg Pike, Falls Church, VA 22401-3528. A reply will be furnished to you.

Approved for public release; distribution is unlimited.

Tables

Illustrations

CHAPTER 1

INTRODUCTION

1–1. Purpose

This bulletin—

a. Outlines the basic principles and standard surveillance techniques to help installation preventive medicine (PVNTMED) personnel—

(1) Establish a pest surveillance program.

(2) Conduct surveillance of medically important pests.

b. Includes survey, collection, preservation, and shipment techniques and control recommendations for medically important pests that require regular surveillance by PVNTMED personnel to protect the health and welfare of the installation population.

c. Addresses the establishment and operation of installation (garrison) pest surveillance programs. The actual surveillance procedures apply equally to field situations. In addition, FM 8–250 provides guidance on surveillance of medical pests in a field environment.

1–2. References

Appendix A lists the publications, forms, and selected bibliography.

1–3. Explanation of abbreviations and terms

The glossary explains the abbreviations and terms used in this bulletin.

NOTE

Use of trademarked names does not imply endorsement by the U.S. Army but is intended only to assist in identification of a specific product.

1–4. Introduction

a. To fulfill the medical authority's responsibilities outlined in AR 420–76, the installation medical authority (IMA) conducts surveillance of medically important pest populations (that is, vectors and pests affecting the health and welfare of the Army community).

b. The installation PVNTMED personnel, being that part of the IMA that conducts pest surveillance—

(1) Maintains a written standing operating procedure (SOP) for the surveillance of each pest.

(*a*) Updates each SOP annually.

(*b*) Ensures that SOPs are included in the installation pest management plan (IPMP).

(*c*) Provides copies of SOPs to the installation pest management coordinator (IPMC) to be used in preparing the pest control workload definition worksheets in the IPMP.

(2) Conducts routine and comprehensive surveillance for medically important pests including—

(*a*) Mosquitoes.

(*b*) Cockroaches.

(*c*) Filth flies.

(*d* Ticks.

(*e*) Commensal rodents.

(3) Conducts surveillance for other pests as required or when requested by the installation commander, facilities engineer, or Headquarters, U.S. Army Health Services Command (HQ USAHSC).

(4) Reports surveillance results to the IPMC for use in determining appropriate control measures. Include recommendations for appropriate integrated pest management (IPM) measures when surveillance data indicates a need for control.

(5) Reports time and labor expended in surveillance activities on a monthly basis to the IPMC for inclusion on DD Form 1532 (Pest Management Report (DD–M(A&AR)1080)(AR 420–76).

(6) Maintains records of surveillance activities and pest management recommendations to provide documentation and permit short- and long-term assessments of the effectiveness and environmental consequences of the installation pest management program.

c. The supporting activities of the U.S. Army Environmental Hygiene Agency (USAEHA) Pest Management Program provide—

(1) Pest identification services to support IMA pest surveillance.

(2) Professional telephonic consultation to support IMA pest surveillance.

(3) Special on-site investigative services, on request, in the identification and assessment of pest surveillance problems.

1–5. Policy

a. Department of the Army (DA) policy prohibits the—

(1) Use of preventive or scheduled periodic pesticide treatments unless approved by the major command pest management consultant and based on surveillance data or past pest problems.

(2) Use of chemical control measures before nonchemical control methods have been fully explored and have been found inadequate to control the pest population.

(3) Application of pesticides in a food handling facility or other sensitive area such as a medical

treatment facility without current surveillance data documenting a pest infestation.

b. Pest surveillance is an essential aspect of an installation pest management program. Pest surveillance, as part of a health and environment program, is necessary to protect the Army community from medically important vectors and pests by—

(1) Identifying the presence of medically important pests.

(2) Showing when and where control should be initiated or ended.

(3) Documenting success of control measures.

c. IMA pest surveillance programs include examination of conditions that are conducive for infestation, not just presence or absence of the pest, for pesticide application.

d. Consistent, regular pest surveillance is essential to compare the abundance of the pest at different times, seasons, and years. Maintain records of surveillance activities and survey results for permanent documentation to ensure continuity of the pest surveillance effort.

1–6. Installation pest surveillance program guidelines

a. Surveillance activities enhance the planning, operation, and evaluation of the arthropod and rodent pest management program. This is true whether the pest management effort is designed to prevent and control disease agents carried by these pests, or to reduce pest populations to lessen the discomfort to personnel.

b. An effective pest surveillance program involves five elements—

(1) Conducting surveys to identify presence and size of pest populations and identifying conditions that favor breeding.

(2) Monitoring pest populations and conditions that favor breeding.

(3) Evaluating survey results.

(4) Notifying the IPMC when established thresholds have been surpassed.

(5) Surveying to determine the success of the control measures taken.

c. The surveillance program should be documented in PVNTMED SOPs and as part of pest control workload definition worksheets in the IPMP. The SOP for surveillance of each pest, as a minimum, contains—

(1) Who will do the surveillance. Specify the responsible organizations or officials.

(2) How the surveillance is to be conducted. List the techniques and procedures to be used.

(3) Where are the surveillance locations. Clearly identify all locations on map and floor plans.

(4) When the surveillance will be conducted. Include rationale for the frequency of collections and when complaints are evaluated.

(5) What the criteria are for initiating control measures. Identify thresholds to be used and the recommended control measures.

d. An effective surveillance program must have a way to determine the need for pest control measures. The presence of a pest does not automatically mean a recommendation to the IPMC for control. Thresholds are established to help predict when control measures are needed.

(1) The threshold value itself is an index calculated from pest surveillance data. Continuous surveillance over several years may be required to establish reliable threshold values.

(2) The threshold value is used to protect personnel or property from the pest by initiating control measures just before a pest problem occurs.

(*a*) For example, at a particular installation it has been established that mosquito annoyance complaints are received when the trap index exceeds 20. In this case, the threshold would be established at 20 so that control measures are initiated at the same time (and hopefully before) the mosquito population reaches a level that causes annoyance (and resulting complaints).

(*b*) Establish thresholds to prevent confirmed cases of a particular disease, disease transmission, complaints, and damage.

(*c*) Threshold values will vary at each installation depending on factors, such as species, area involved, habitat, collection technique, number of complaints, and disease potential.

(3) Use caution. Thresholds are only indicators and therefore should not be the only factor used in the decision to recommend control measures.

1–7. Shipping instructions

Appendix B provides—

a. Specific shipping instructions for adult, larval, and egg collections for mosquitoes.

b. General shipping instructions for other arthropods.

c. A list of items commonly used for shipment of specimens.

1–8. Technical assistance

a. Per AR 40–5, chapter 1, commanders, IMAs, and installation PVNTMED personnel may request technical assistance through command channels.

b. See appendix C for a listing of activities that provide support services for surveillance programs.

CHAPTER 2

MOSQUITOES

Section I
Mosquito Surveillance

2–1. General information

a. Mosquitoes are probably the most important arthropod pest encountered by PVNTMED personnel. Mosquitoes are vectors of serious diseases such as malaria, yellow fever, dengue, and encephalitis. Although mosquito-borne diseases are not common in the continental United States (CONUS) and other developed countries, the vectors are abundant; therefore, the danger of a disease outbreak is always present.

b. The annoyance to humans caused by high mosquito populations is an equally important factor. Biting mosquitoes can make training and recreation areas unusable, and generally interfere with the morale and productivity of an installation population.

c. Mosquito annoyance alone, independent of the disease potential, has often been used to justify control efforts. Therefore, with only a few exceptions, such as a desert environment, an installation PVNTMED service should conduct routine mosquito surveillance. The frequency and type of mosquito surveillance, however, must be tailored to each installation's needs.

d. The purpose of mosquito surveillance is to—

(1) Determine the presence of pest and vector species.

(2) Monitor population numbers to determine when thresholds are passed and when to initiate control measures.

(3) Estimate the effectiveness of control measures.

2–2. How to establish mosquito surveillance

PVNTMED personnel—

a. Conduct a comprehensive larval survey by—

(1) Starting early in the mosquito season when breeding sites are generally most abundant.

(2) Obtaining installation range and training maps (that is, topographic with grid overprint).

(3) Conducting a map reconnaissance for orientation and location of potential breeding sites before going to the field.

(4) Visiting every conceivable potential mosquito breeding site (such as swamps, ponds, streams, tire yards, and sewage treatment plants) within and near populated areas.

(5) Identifying and mapping those locations that prove to be active or probable breeding sites.

b. Meet with the IPMC or the contract quality assurance evaluator to—

(1) Discuss what is being done or planned for mosquito control at the installation.

(2) Determine what criteria (such as surveillance data, schedule, service order, or complaints) are used to initiate control measures.

c. Contact adjacent community activities, such as the State and local Public Health Department or mosquito control district, which may be conducting mosquito surveillance. This may be a valuable source of information on mosquito species and their life histories, population densities, mosquito-borne diseases present in the region surrounding the installation, and control techniques employed by health authorities in the adjacent communities.

d. Contact USAEHA (app C) to obtain historical information on mosquito species found on the installation.

e. Select methods and locations for sampling that are appropriate to monitor the mosquito species of concern.

(1) Ways to sample a mosquito population include—

(*a*) Adult collections (light traps, resting stations, landing counts).

(*b*) Larval collections (dipping).

(*c*) Egg collections (ovitraps).

Section II describes these methods. The most desirable collection method(s) will vary greatly depending on the target species.

(2) Entomologists on the staff at USAEHA can provide assistance and guidance on appropriate surveillance techniques.

f. Determine the frequency of sampling appropriate for the species and installation.

(1) Collect mosquitoes throughout the mosquito breeding season. Mosquito breeding may be continuous at installations in southern CONUS and in tropical areas of the world. In northern parts of CONUS, the breeding season may be 6 months or less in length.

(2) The frequency of mosquito collections may vary from installation to installation depending on such factors as—

(*a*) Seasonal abundance.

(*b*) Species of pest and vector mosquitoes.

(*c*) Potential mosquito-borne diseases in the area.

(*d* Size of the human population at risk.

(*e*) Type of control measures available.

g. Submit collected mosquitoes to the appropriate USAEHA activity for identification.

h. Develop thresholds and control options (include nonchemical measures).

i. Write an SOP. See USAEHA technical guide number (TG No.) 176 for guidance.

(1) Include a map pinpointing all mosquito sampling locations.

(2) Provide a copy of the SOP to the IPMC to be included in the IPMP.

2–3. How to update established mosquito surveillance

PVNTMED personnel—

a. Conduct a comprehensive larval survey at least once a year during the breeding season to identify and map any changes since the past year in active and potential mosquito breeding sites.

b. Reestablish liaison with local activities to share data and other information relating to mosquito surveillance and control.

c. Review identifications of mosquitoes submitted to the USAEHA during the last breeding season.

d. Visit all sampling sites, review frequency of collections, and review data obtained.

e. Replace sampling sites that are no longer breeding mosquitoes or have not been providing valuable data.

f. Review thresholds and control options. See paragraph 1–6*d* for a discussion of thresholds.

g. Update the SOP and map to reflect changes.

2–4. Mosquito surveillance maps

a. Good maps are essential in planning and conducting mosquito surveillance. They are used for orientation and location of larval breeding sites and adult sampling stations in relation to the living and working areas to be protected. Obtain topographic maps (that is, contour maps that show streets, roads, railroads, buildings, rivers, small streams, lakes, waterways, and other standing water) that have the grid system overprint. Figure 2–1 illustrates the type of information plotted on a mosquito surveillance map.

b. Plot the location of all collection sites on two maps.

(1) Keep one copy at PVNTMED service.

(2) The IPMC keeps the second copy for use in coordinating effective control operations.

(3) Map sections covering small areas are recommended for field use while master maps remain permanently mounted at the office.

c. Consecutively number the routine collection stations (for example, light traps—T1, T2, T3, T4; landing count stations—L1, L2, L3, L4; resting stations—R1, R2, R3, R4; larval dipping stations—D1, D2, D3, D4; egg sampling stations—E1, E2, E3, E4).

(1) If a station is eliminated, discontinue that number.

(2) If a new station is established, use a new number. Example (assuming four traps): if the location of light trap number 1 is moved to a new location, the old number (T1) should be retired and the new location given the next available number (T5 in this example).

(3) Update maps to show the changes in trap locations.

d. Prepare a listing of all collection sites on DA Form 8010–R (Mosquito Collection Sites) and document in the SOP a brief description of the locations. Keep the DA Form 8010–R listing and the map of the collection sites together. Examples are given in figures 2–2 through 2–6. DA Form 8010–R will be reproduced locally on 8 1/2- by 11-inch paper. A copy for reproduction purposes is located at the back of this bulletin.

Section II
Collection Methods

2–5. Adult collections

a. Introduction.

(1) Adult collections are frequently the primary means of mosquito surveillance because the adult female mosquito carries disease pathogens and causes annoyance through biting. Adult mosquitoes are usually easier to survey, collect, and identify than the immature stages of the insect.

(2) Light traps are limited to gathering data on the density and species makeup of nocturnal adult mosquito species that are attracted to light. Wide differences in capture efficiency have been noted between species due to differences in their reactions to light. Some species are caught in great numbers while others are rarely taken even though they may be plentiful in the vicinity. Because of these behavioral differences, other types of adult mosquito collection methods, including resting stations and landing counts, are needed to obtain a valid index of the total population.

(3) An installation with a large population at risk, as in the case of troops continuously training in the field or a large residential population, history of mosquito-borne disease, and presence of vector species should have adult mosquito surveillance conducted on a regular schedule (two or more times a week).

(4) An installation without a population at risk, no history of mosquito-borne disease, or a

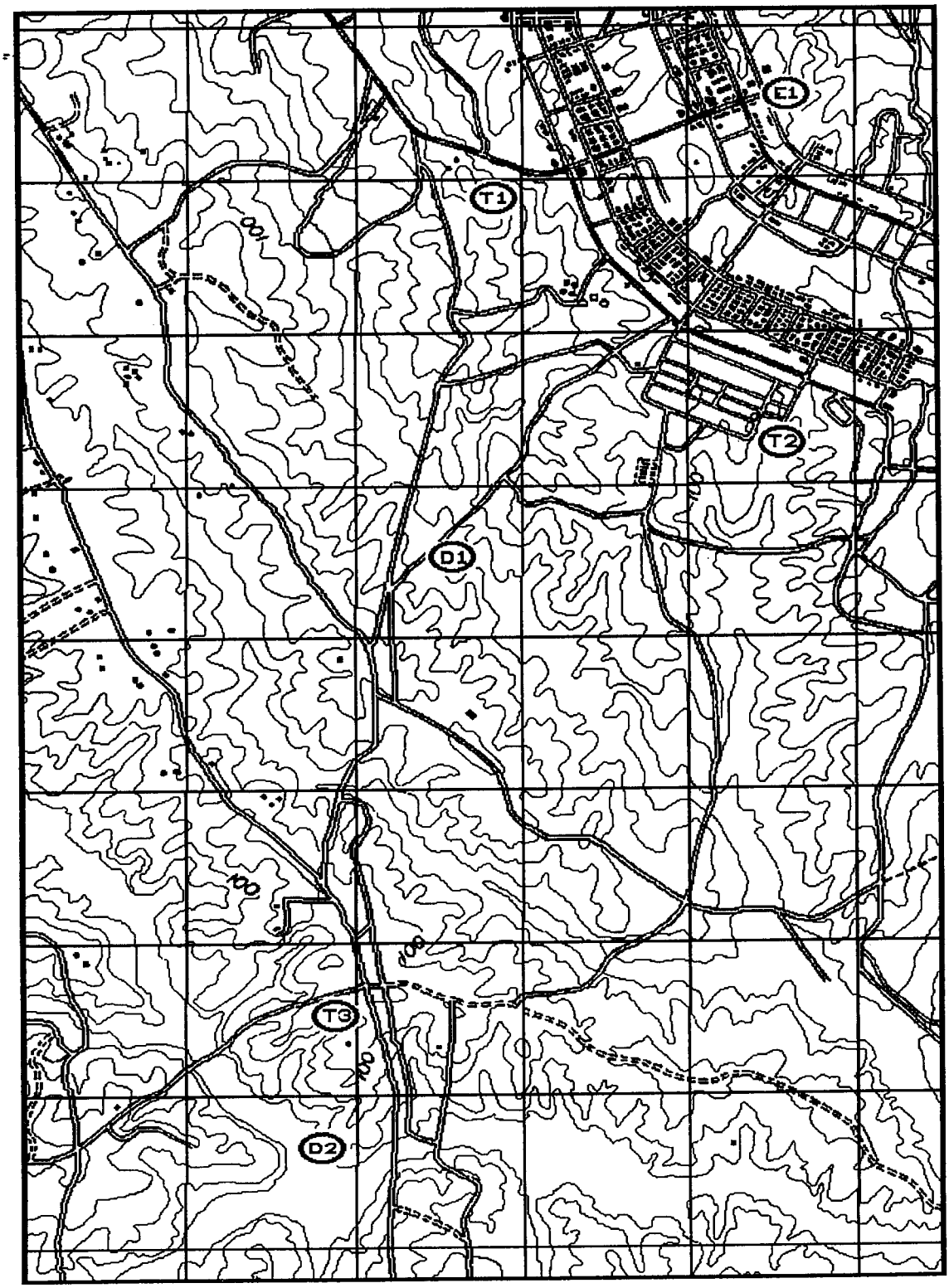

Figure 2–1. Example of an installation map with mosquito collection sites identified.

MOSQUITO COLLECTION SITES

For use of this form, see TB MED 561; the proponent agency is OTSG

COLLECTION METHOD: LARVAL DIPPING

SITE NUMBER *a*	GRID *b*	DESCRIPTION *c*
D1	365624	Horse drinking water containers at stable
D2	803300	Edge of swampy pond at corner of X & Y Streets
D3	912665	North side of road at Firing Point 43

SAMPLE

DA FORM 8010-R, DEC 91

Figure 2–2. Example of a filled-in listing of mosquito collection sites form using the larval dipping collection method.

MOSQUITO COLLECTION SITES

For use of this form, see TB MED 561; the proponent agency is OTSG

COLLECTION METHOD: LIGHT TRAP

SITE NUMBER *a*	GRID *b*	DESCRIPTION *c*
T1	799900	Clump of trees 20 yds south of Godman pool
T2	369605	Tree line behind stadium
T3	436321	50 yds north of latrine at picnic area

SAMPLE

DA FORM 8010-R, DEC 91

Figure 2–3. Example of a filled-in listing of mosquito collection sites form using the light trap collection method.

MOSQUITO COLLECTION SITES

For use of this form, see TB MED 561; the proponent agency is OTSG

COLLECTION METHOD: RESTING STATION

SITE NUMBER *a*	GRID *b*	DESCRIPTION *c*
R1	803300	Culvert at corner of X & Y Streets
R2	436322	Latrine at picnic area

SAMPLE

DA FORM 8010-R, DEC 91

Figure 2–4. Example of a filled-in listing of mosquito collection sites form using the resting station collection method.

MOSQUITO COLLECTION SITES

For use of this form, see TB MED 561; the proponent agency is OTSG

COLLECTION METHOD: LANDING COUNT

SITE NUMBER *a*	GRID *b*	DESCRIPTION *c*
L1	566800	Next to creek 10 yds from road intersection
L2	436322	Picnic area

SAMPLE

DA FORM 8010-R, DEC 91

Figure 2–5. Example of a filled-in listing of mosquito collection sites form using the landing count collection method.

MOSQUITO COLLECTION SITES

For use of this form, see TB MED 561; the proponent agency is OTSG

COLLECTION METHOD: EGG COLLECTION

SITE NUMBER *a*	GRID *b*	DESCRIPTION *c*
E1	389734	DRMO tire yard
E2	601996	Behind storage shed

SAMPLE

DA FORM 8010-R, DEC 91

Figure 2–6. Example of a filled-in listing of mosquito collection sites form using the egg collection method.

lack of vector species has limited mosquito surveillance needs. Initiate adult surveillance when local conditions of rainfall and temperature become optimum for mosquito breeding or when the presence of nuisance species are expected based on historical surveillance records.

(5) The facilities engineers provide and maintain light traps. The number of traps needed depends on the IMA's need to acquire information on mosquito populations. Direct coordination with the directorate of engineering and housing (DEH) is needed. The PVNTMED service is authorized to purchase mosquito light traps.

b. Light traps.

(1) *General.*

(*a*) Identify each trap with a visible sign or label that identifies the trap, its purpose, killing jar contents, and a "POISON" label. Provide the telephone number and name of the organization responsible for equipment operations.

(*b*) Insects that have been removed from a light trap after a night's operation should be processed immediately. Separate and count female mosquitoes in each trap and report to IPMC (provide control recommendations if the threshold is exceeded), then forward specimens to USAEHA (app C) for identification.

(*c*) Notify the military police concerning the appearance and exact locations of the installed light traps.

(2) *Light trap operation.*

(*a*) Use a minimum of three light traps.

(*b*) Operate the light traps on a regular schedule.

(*c*) Operate the light traps between 2 and 7 nights per week from dusk to dawn, depending on mosquito populations and risk of mosquito-borne diseases.

(3) *Light trap placement.*

(*a*) Several traps should be placed between larval habitat(s) and the area(s) to be protected, such as troop billets, housing areas, and bivouac areas.

(*b*) Determine the specific location of traps after conducting a larval survey of the area. As a guide, the survey area should extend out in a 2-mile radius surrounding the area(s) to be protected. Place additional traps in the area surrounding bivouac and training sites.

(*c*) Sites being considered for locating mosquito light traps should include the following favorable attributes:

1 Source of permanent electrical current.

2 Low shrubbery and some shade in vicinity.

3 Woods and swamp margins are very desirable.

4 Secluded or semi-secluded area away from traffic.

5 Accessibility.

(*d*) Avoid the following locations when locating mosquito light traps:

1 Near competing sources of artificial light.

2 Areas exposed to strong winds.

3 Near buildings housing animals.

4 Open water or open pastures.

5 Areas where the trap is exposed to vandalism.

6 Near obstacles that block the trap's light.

7 Unreliable electrical supply.

(*e*) Suspend the trap so the light is about 5 to 6 feet above the ground. This is the most effective height for collection of mosquito species attracted to light.

(*f*) Put the trap where the light is visible in all directions.

(4) *Mosquito light trap, New Jersey Type.* This trap—

(*a*) Was developed to meet the requirements of the military services.

(*b*) Has been standardized and is listed as Trap, Mosquito, Light, national stock number (NSN) 3740–00–607–0337.

(*c*) Is operated with 110-volt, 50/60-cycle AC.

(*d*) Uses a white light as an attractant (that is, 25-watt, 110-volt, white frosted bulb).

(*e*) Has an automatic 24-hour timing device. If using 50-cycle AC to operate the trap, be sure the timer is also 50-cycle AC.

(*f*) Is the light trap most commonly used for routine surveillance operations on installations. If using another type of light trap in an emergency, record the type used in the remarks section of each sample data form.

(*g*) Is virtually indestructible; however, spare parts are not available as standard items. Get spare parts or timers from companies such as Hausherr's Machine Works, Old Freehold Road, Toms River, New Jersey 08753.

(*h*) Must be used with killing jars.

(5) *Killing jars.* Killing jars may be made by using cut up dichlorvos (DDVP) resin strips (NSN 6840–00–142–9438) in a 1-pint plastic jar with screw-cap neck.

WARNING

Do not use glass jars and do not use cyanide as the killing agent.

To make a killing jar using the DDVP resin strips—

(*a*) Cut the strips in a well ventilated area. Wear rubber gloves while handling the resin strips. Do not contaminate work surfaces.

(*b*) Cut a one-half inch section of a resin strip and place it in the bottom of the plastic 1-pint collecting jar.

(*c*) Place a waxed paper cup, perforated on the sides and bottom, inside the killing jar over the DDVP strip (fig 2–7). The cup should be large enough that the rolled lip of the cup will catch on the mouth of the jar preventing it from going through. Mosquitoes collected in the waxed paper cup can then be easily removed from the killing jar.

(*d*) Replace the resin strip every 2 to 3 months or sooner if the mosquitoes collected are not being effectively killed.

(*e*) Plainly mark all killing jars "POISON."

(*f*) Keep jars clean and dry. Control moisture by placing a few strips of soft paper (toilet or facial tissue) in the jars beneath the waxed paper cup.

(6) *Solid state Army miniature (SSAM) light trap.* This trap is—

(*a*) Listed under NSN 3740–01–106–0091.

(*b*) Known as the CDC (Centers for Disease Control) light trap.

(*c*) A lightweight, portable unit for collecting insects attracted to light.

(*d*) Intended for use by medical personnel in the field for viral isolation and determination of the need and adequacy of mosquito control measures.

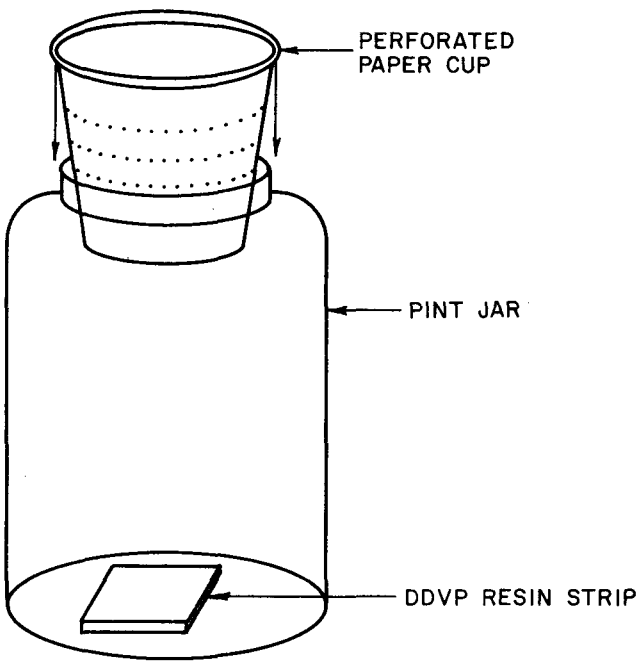

Figure 2–7. Light trap killing jar using DDVP resin strips with perforated paper cup to collect mosquitoes.

(*e*) Designed to require servicing only once a day.

1 Electronic circuitry allows the trap to be set up anytime during the daylight. SSAM light traps can be used for routine surveillance when New Jersey traps or AC power are not available.

2 Keep the trap in a resting mode until dusk.

3 At dusk, the photocell activates the lamp and motor.

4 At dawn, the lamp is automatically turned off while the motor continues to run.

5 The trap is stopped and electronic circuit recycled by disconnecting the trap from the power source.

(*f*) Not used for routine surveillance operations on installations.

(*g*) Used during mosquito-borne disease outbreaks or where intensive trapping in remote areas is required. For this, use carbon dioxide (CO_2) gas or dry ice to attract greater species diversity.

(*h*) Powered for operation by either a 6-volt DC dry cell or rechargeable battery. Rechargeable batteries are available from the Federal supply system (Battery, Storage, NSN 6140–00–432–0490). The batteries are commercially available from Johnson Control, Dynasty Battery, JC6C5, 6-volt, 6.5 ampere-hours.

c. Resting stations.

(1) *General.*

(*a*) Many species of adult mosquitoes rest during the daylight hours in dark, cool, humid places. This is especially true of some of the *Anopheles* and *Culex* mosquitoes. A careful inspection of such places usually reveals resting mosquitoes and helps in estimating population density.

(*b*) A minimum of five stations per installation is suggested, either natural or artificial, with collections made 2 days per week. Make these collections at the same time of day (preferably during the morning).

(2) *Natural resting stations.* Natural resting stations are places already present in a given area such as culverts, caves, houses, stables, privies, etc. Two techniques that may be used are—

(*a*) In larger dwellings, examine areas near the ceiling and floors and collect mosquitoes using an aspirator.

(*b*) In smaller dwellings, lay a white sheet on the floor to collect mosquitoes knocked down with an aerosol pesticide.

(3) *Artificial resting stations.*

(*a*) When suitable natural resting stations are unavailable, construct artificial resting boxes that are designed to attract mosquitoes.

(*b*) Construct artificial resting stations by using five wooden squares to form a box measuring approximately 1 cubic foot (outside dimension). One side remains open. Cut a single, circular drain hole 4 inches in diameter on that side of the resting box that will be placed on the ground. This drain, covered with a fine mesh screen, allows moisture or rainwater that may accumulate in the box to drain. Paint the outside of the box black and the inside of the box red. Attach a cover cloth to the top of the open side. Quickly drop the cloth over the opening to prevent the escape of adult mosquitoes.

(*c*) Place the boxes in shaded, humid areas that are protected from the wind. As a general rule, placement of the boxes with the opening facing to the west will ensure a shady, humid environment that will attract adult mosquitoes.

(4) *Collection.*

(*a*) Collect mosquitoes from resting stations using a mechanical or mouth aspirator and a killing tube. Use a flashlight in dark areas. Aim the beam of light at a 15-degree angle to the surface and the mosquitoes can be readily seen without disturbing them.

(*b*) If using artificial resting stations, invert the box and spray an aerosol insecticide or chloroform into the box through the screen drainage hole. After a short time, open the box and dump the contents out onto a white sheet.

d. Landing counts.

(1) Landing counts on humans are useful for determining population densities of mosquitoes not attracted to light traps and for rapid checks of mosquito populations. Use this method when complaints or suspicions do not reflect light trap collections.

CAUTION

This technique may increase the exposure of survey personnel to disease. Therefore, during a mosquito-borne disease outbreak use personal protective measures such as wearing headnets and rolling down sleeves, but do not use repellents.

(2) This survey technique establishes an index or landing rate by counting the number of mosquitoes landing on the investigator during a specific period of time.

(3) Conduct landing counts at three stations once every 1 to 2 weeks (minimum requirements). As with the resting station collections, make the landing counts at the same time of day (dawn, dusk, or other time depending on the peak biting activity) to ensure uniformity. Use a flashlight when collecting mosquitoes, but in order to prevent disturbing them, do not shine too much light on them.

(4) The technique used depends on the mosquitoes' biting habits. For some mosquitoes, such as the salt marsh *Aedes*, 1 minute of collections is sufficient; however, since some mosquitoes are more cautious than others, 10 to 15 minutes may be required. Take two or more counts at each station to obtain greater accuracy in estimating population size.

(5) One person can perform landing counts. Two persons are preferred for safety and effectiveness. Sit on a box or stool at the selected location with trouser legs rolled to the knees and socks rolled to the ankles. Collect the mosquitoes that land on the exposed skin during the established time period. For consistency of results, the same person or persons should perform landing counts.

e. Collection equipment. Collection equipment includes a flashlight, killing jar, and an aspirator.

(1) *Killing jar.*

(*a*) Killing jars are commonly made using chloroform or ethyl acetate as the killing agent. Ethyl acetate is favored over chloroform as a killing agent. It keeps specimens relaxed and is less hazardous to use. In addition, chloroform is a suspected human carcinogen. Consult the Materiel Safety Data Sheet before using either of these chemicals. Safer killing methods such as freezing should also be considered.

WARNING

Chloroform and ethyl acetate are toxic to humans as well as to arthropods. Clearly label the tubes DANGER, DO NOT BREATHE FUMES.

(*b*) Precautions to take when using a killing jar—

1 Use by, or only under the supervision of, experienced personnel.

2 Do not smell or sniff the contents of any killing jar to detect the presence of a killing agent.

3 Keep the lid tightly closed when the jar is not in use.

4 When the jar is opened, breathe shallowly until the lid is closed and the vapors have diffused.

(*c*) To make an ethyl acetate killing tube (fig 2–8)—

1 Pour about 1 to 1.5 inches of plaster of Paris in the bottom of a large glass test tube (that is, 1-inch diameter by 7 inches long) or small jar.

2 When the plaster is thoroughly dry, saturate it with ethyl acetate.

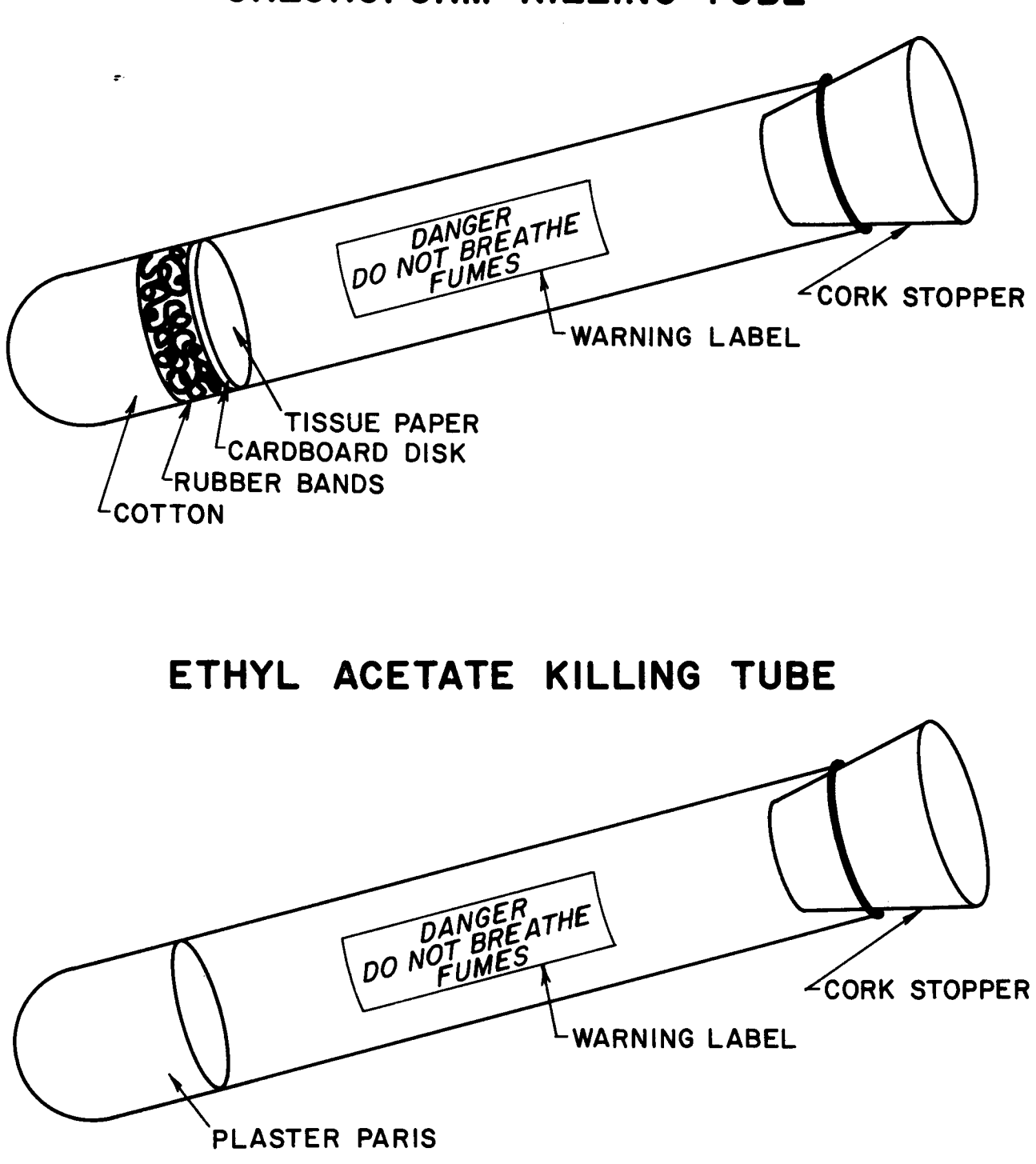

Figure 2–8. Ethyl acetate and chloroform killing tube or jar.

3 Recharge by resaturating the plaster with ethyl acetate when the tube loses effectiveness.

(*d*) A chloroform killing tube may be made from a large glass test tube or a small jar (fig 2–8).

1 Place wads of cotton on the bottom of the jar or tube.

2 Place small pieces of rubber (cut-up rubber bands) on top of the cotton.

3 Add chloroform until the rubber is covered and completely saturated.

4 Place a cardboard disk cut to fit the tube or jar on top of rubber pieces to keep them in place.

5 Add tissue paper to help keep specimens dry and prevent breakage.

6 Use a cork stopper (never rubber) to keep the jar airtight.

7 Recharge by pouring a sufficient amount of chloroform into the jar to saturate the rubber.

8 Wrap the killing tube with tape to prevent or reduce breakage of the jar.

(*e*) A killing tube remains effective for months if kept tightly closed. Jars require frequent recharging when used extensively. They operate most effectively when vapor is sufficient to knock down a mosquito instantly.

(2) *Aspirator.*

(*a*) An aspirator for collection of mosquitoes is easily constructed from a glass or plastic tube, rubber tubing, and a piece of gauze.

1 Select a glass or plastic tube about 12 inches in length, with an inside diameter of 1/4 inch.

2 If using a glass tube, flame polish the ends; this constricts the opening slightly and polishes the edge of the tube.

3 Secure a small piece of gauze over the opposite end of the tube by forcing the rubber tubing over the gauze and onto the end of the tube about 1 inch. The gauze serves as a screen, keeping specimens out of the mouth when they are sucked into the tube.

(*b*) When using an aspirator—

1 Hold the rubber tubing in the mouth.

2 Hold the glass or plastic tube next to the mosquito specimen.

3 Suck the specimen into the tube.

4 Expel the specimen from the aspirator into a killing jar by blowing gently.

5 Never suck the specimen from the killing jar.

(*c*) Practice in order to learn the proper technique for using an aspirator.

(*d*) Battery powered aspirators are available from companies such as Hausherr's Machine Works, Old Freehold Road, Toms River, NJ 08753. These aspirators accelerate the collection process without the danger and discomfort of inhaling dust and insect scales. However, mosquito mortality and damage is generally greater with mechanical aspirators than with mouth aspirators.

2–6. Larval collections

a. Introduction.

(1) Larval collections are an important part of the installation mosquito surveillance effort. Not only can larval collections be used to determine requirements for control operations, but they may also detect the presence of important species that are not attracted to light traps as adults.

(2) Control efforts based on larval surveillance are preferred because significant populations can be eliminated before the mosquitoes become an annoyance as adults. In addition, pesticide applications can be pinpointed to only those areas where mosquito populations are known to exist, thus minimizing the environmental hazard.

(3) The number of larval collection sites depends on the number of breeding sites identified with a 2-mile radius of the area to be protected. A representative number (10 to 20 percent—three stations minimum) of the breeding sites identified during the initial larval survey should be selected for weekly collections. Periodically check for breeding, especially following heavy rains, other locations positive for mosquito breeding in the initial survey.

(4) If areas outside military property are included as collection sites, conduct collections in coordination with local public health officials or the mosquito control district. Get permission from the property owner.

(5) An installation with a large population at risk (for example, troops continuously training in the field or a large residential population, history of mosquito-borne disease, and presence of vector species) should have active regular larval mosquito surveillance. Monitor larval sites for mosquito breeding at least once a week during the breeding season.

(6) An installation without a population at risk, no history of mosquito-borne disease, or a lack of vector species has limited larval mosquito surveillance needs. Monitor previously selected larval sites following heavy rainfall, and continue monitoring while breeding exists.

b. Collection procedures.

(1) The primary collection method for larval mosquitoes is dipping, using a white enameled or plastic dipper.

(*a*) The most likely places to find mosquito larvae are near vegetation, debris, or at the water's edge. Larvae are more abundant in shaded than in sunlit areas.

(*b*) When dipping for *Culicine* species, employ a quick, intercepting movement in the water, since disturbed larvae quickly swim away, dive, or hide. When the bottom is disturbed, the water may become turbid, making it difficult to see the larvae. The collector's shadow also disturbs the larvae as they move across the water.

(*c*) To dip for *Anopheline* mosquitoes—

1 Skim the dipper along the surface of the water in places where vegetation or floating debris offers protection for the larvae.

2 Place the dipper near emergent vegetation and slowly lower the dipper into the water allowing the in-rushing surface water to carry larvae into the dipper.

(*d*) Conduct dipping in a uniform manner because the abundance of larvae at different times and in different areas will be compared. Uniformly distribute the dips taken over the breeding site in order to obtain a representative sample of the mosquito population.

(*e*) At each collection site, record the number of larvae in each dip, the number of dips, and the date.

(2) Several species of mosquitoes breed only in treeholes that contain water. Any cavity in wood that retains water for a lengthy period of time is a potential mosquito breeding area. Use a turkey baster or a modified aspirator to extract mosquito larvae from treeholes and similar breeding sites. A length of rubber tubing attached to a rubber suction bulb makes a good siphoning apparatus.

(3) Some mosquito species also breed in tin cans, rubber tires, rain gutters, and many other artificial containers. Routinely check water troughs at horse stables, in buckets and barrels for fire protection, and in other containers for the presence of mosquito larvae. Routinely check landfills and outdoor storage of excess property by the Defense Reutilization and Marketing Office (DRMO) to see if breeding is occurring in artificial containers, especially used tires.

(4) The larvae of some mosquitoes (the genera *Mansonia* and *Coquillettidia*) do not float freely in the water but attach to underwater plants by means of their specialized siphons. These groups cannot be collected by dipping but require that the plants be rapidly pulled from the water and held over appropriate containers. Specific guidance on collecting these species is available from entomologists at USAEHA. Due to the extra effort involved in collecting these larvae, use this procedure only when adult collections or historical records indicate that these species may be a problem.

c. Collection equipment.

(1) Use a white enamel or plastic dipper to collect larvae. A broom handle or similar stick is often inserted into the hollow end of the handle to extend the reach of the collector.

(2) A larval concentrator is useful if large numbers of mosquitoes are collected. To construct a simple concentrator (fig 2–9)—

(*a*) Cut the top off a one-half- or one-gallon heavy duty plastic jug. Antifreeze and bleach jugs work well, but do not use milk jugs.

(*b*) Cut rectangular holes approximately 1x3 inches long in the jug, about 2 inches from the bottom.

(*c*) Cover the hole with 60-mesh screen wire secured with a water resistant adhesive, such as silicon glue.

(*d*) To filter plant debris or other organic matter, a coarse, (8-mesh galvanized hardware cloth) strainer may be placed over the top of the concentrator.

2–7. Egg collections

a. Introduction.

(1) Egg collections using ovitraps are a very effective means of monitoring mosquito populations and can be more efficient than larval surveys. Until recently, egg collections were limited to monitoring *Aedes aegypti* populations in the southern areas of CONUS.

(2) *Aedes albopictus*, which was recently discovered in CONUS, is also effectively monitored by egg collections. *Aedes albopictus*, however, has the potential to become much more widespread than *Aedes aegypti* because of this species' ability to survive in colder climates. Therefore, egg collection will become a required part of mosquito surveillance as the range of *Aedes albopictus* expands.

(3) Set up collection sites in at least three separate areas of the installation (up to 10). Include property disposal yards and areas where tires are stored as well as residential areas.

(4) Normally only one trap is placed at each collection site.

b. Ovitrap placement.

(1) Place ovitraps—

(*a*) Where they will be in full or partial shade most of the day.

(*b*) Near walls, fences, hedges, shrubs, used tires, piles of junk, or other sheltered areas to be near potential resting sites and for protection from the sun and wind.

(*c*) Near or at ground level with at least 12 inches of open space above the trap.

(*d*) Where they are inconspicuous to children or animals, yet can be easily reached to be serviced.

(2) Do not place ovitraps—

(*a*) Near garden and lawn sprinklers or where rain run-off might fill or flood the trap.

(*b*) In direct sunlight and fully exposed areas.

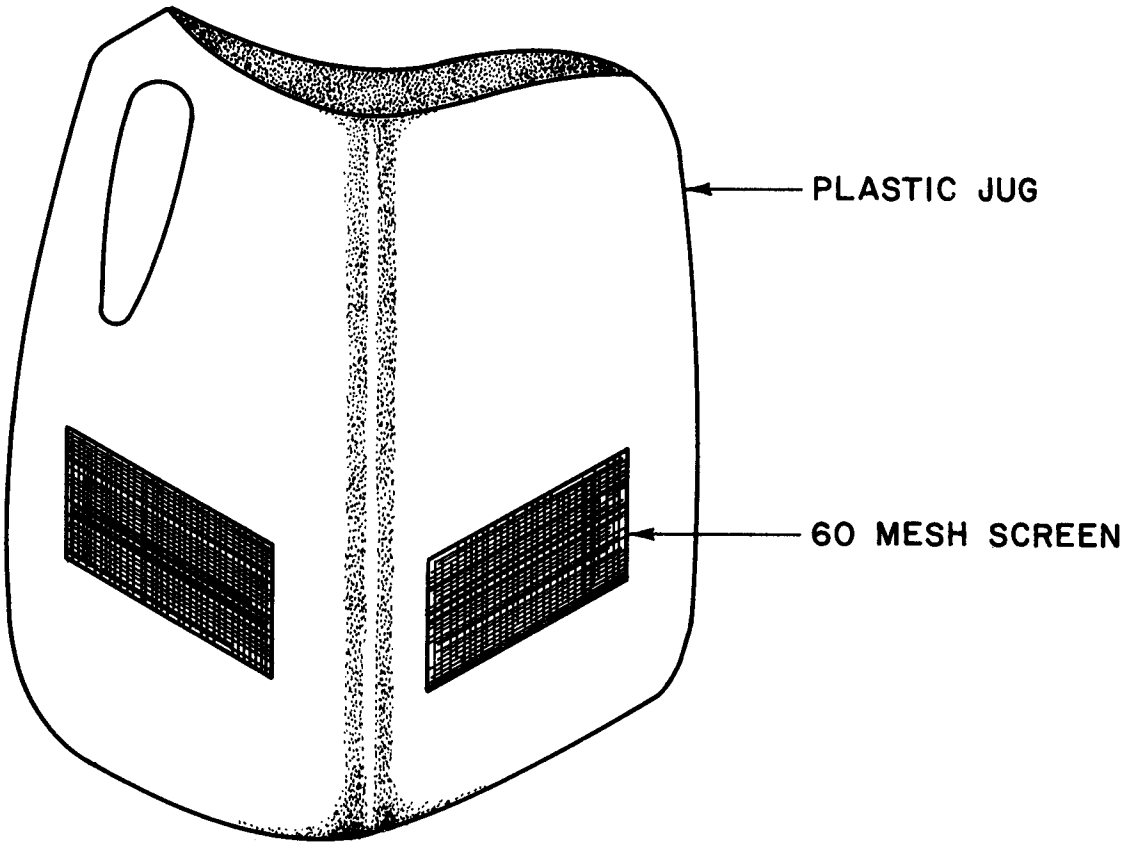

Figure 2–9. Simple larval concentrator made from a plastic jug.

c. Ovitrap setup.

(1) Add 1 to 2 inches of water to a jar. Do not use chlorinated water. See paragraph *e*(1) below for instructions on making an ovitrap jar.

(2) Clip the egg collection strip to the side of the container with a large paper clip with the rough surface of the strip facing the center of the container. See paragraphs *e*(2) and (3) below for instructions on making an egg collection strip.

(3) Label the egg collection strip with identifying information, in pencil, on the smooth side before being clipped in the trap.

(4) Tip the container to wet the strip before putting the container at its site.

d. Ovitrap inspection.

(1) Inspect ovitraps at least weekly (eggs may hatch if a longer collection cycle is used) and inspect all ovitraps on the same day. Some mosquitoes, which are not being surveyed by this method, will lay eggs in rafts on the surface of the water. These eggs may hatch in 2 or 3 days.

(2) Eggs are usually deposited just above the water line on the exposed rough side of the strip.

(3) Place collected strips in an insulated box that is lined with dry paper towels to return to the laboratory. Be sure to protect the rough or egg side of the strips to avoid dislodging or crushing the eggs.

(4) Clean the trap inside and out to maintain its smooth shiny appearance each time egg strips are collected.

e. Collection equipment.

(1) An ovitrap is made by painting a one pint capacity jar (3 inches diameter by 5 inches high) glossy black on the outside. Black plastic cups (16 oz), available from USAEHA, also make suitable ovitraps.

(2) Egg collection strips are made out of velour paper cut into strips 1 inch wide by 5 inches long. Velour paper is effective in collecting eggs.

(3) If velour paper is not available, make egg collection strips out of interior grade hardboard with smooth and rough surfaces. Cut the hardboard into strips 3/4 inch wide by 5 inches long.

Section III
Surveillance Data, Control Recommendations, and Important Species

2–8. Recording surveillance data

a. Compare the abundance of mosquitoes with historical data to determine the need for and to

document the effectiveness of control measures. Record and maintain the data from mosquito surveillance activities (such as surveys and collections) for permanent documentation to ensure continuity of the mosquito surveillance effort.

b. Maintain the following data on DA Form 8011–R (Mosquito Surveillance Light Trap Collections) and DA Form 8012–R (Mosquito Surveillance Larval Collections) (figs 2–10 and 2–11):

(1) Number, sex, species, and date collected at each site and trap.

(2) Weather data, such as daily high and low temperature, rainfall, and wind speed and direction.

(3) Pesticide treatment data, such as date, pesticide used, rate, method of application, and area(s) treated. DA Form 8011–R and DA Form 8012–R will be reproduced locally on 8 1/2- by 11-inch paper. Copies for reproduction purposes are located at the back of this bulletin.

c. An adult mosquito index is usually calculated to average several collection sites or traps to provide a composite index for a particular area or installation. One index commonly used for light trap collections is—

$$\text{Adult Female Mosquito Index} = \frac{\text{Number of Female Mosquitoes}}{\text{Number of Traps} \times \text{Number of Nights}}$$

Similar indices can be calculated for other collection methods.

d. Plot the data as a graph to help visualize changes in the mosquito population and detect long-term trends (fig 2–12). This plot can show the effect of rainfall and temperature on mosquito populations and the effectiveness of pesticide applications.

2–9. General information on control

a. The PVNTMED service is responsible for mosquito surveillance. When results of these surveys indicate that control is required, PVNTMED personnel notify the appropriate installation activity, usually the IPMC. The recommendation for mosquito control is usually made when an index for one or more surveillance techniques exceeds the threshold level. Mosquito control may also be deemed appropriate by other indicators (for example, human or animal disease outbreaks, potential disease outbreaks, and complaints).

b. See paragraph 1–6*d* for a discussion of threshold levels.

c. Installations should not rely exclusively on pesticide application for mosquito control. Make recommendations to the IPMC for nonchemical measures such as the following:

(1) Improve natural drainage in ditches, streams, and borrow pits.

(2) Improve natural drainage in areas that flood during heavy rains.

(3) Eliminate artificial containers.

(4) Control aquatic vegetation.

(5) Clear blocked culverts.

d. In areas where control is impractical or prohibited, PVNTMED personnel initiate or intensify training of personnel concerning protective measures when thresholds and other mosquito population indicators are surpassed. These measures include—

(1) Limiting exposure of skin by wearing a long-sleeved shirt with sleeves worn rolled down.

(2) Wearing a hat.

(3) Blousing trousers into boot tops.

(4) Wearing headnets.

(5) Using repellents.

(6) Using bednets.

2–10. Bionomics of important species

The life history and habits of medically important vector and pest species of mosquitoes (common in CONUS) can be used as a guide for determining where, when, and techniques to collect a particular species.

a. Genus Aedes.

(1) Many *Aedes* mosquitoes are vicious biters and, therefore, can be a serious pest. They feed during the day and evening hours.

(2) Members of the *Aedes* species lay their eggs singly on the ground or above the waterline in tree holes or containers. The eggs can survive long periods of drying and can hatch after flooding. Some species have several generations per year while the eggs of others will not hatch until subjected to periods of drying or coldness.

(3) In general, *Aedes* species breed in temporary pools formed by rain, snowfall, or unusually high tides in coastal salt marshes. Some breed in tree holes, rock pools, and artificial containers. *Aedes* mosquitoes can be separated by larval habitat into characteristic groups.

(*a*) Salt marsh *Aedes* mosquitoes breed primarily in coastal saline waters.

(*b*) Flood water *Aedes* mosquitoes breed in temporary pools formed by flooding and water accumulation from irrigation and seepage.

(*c*) Tree hole and artificial container *Aedes* mosquitoes breed in water accumulation in tree holes and manmade containers.

(*d*) Table 2–1 shows the biological data on important *Aedes* species.

b. Genus Anopheles.

(1) The eggs of *Anopheles* mosquitoes are always laid singly on the water surface. Breeding is

MOSQUITO SURVEILLANCE LIGHT TRAP COLLECTIONS

For use of this form, see TB MED 561; the proponent agency is OTSG

1. DATE TRAP(S) SET	2. DATE SPECIMENS COLLECTED	3. COLLECTOR
3 June	4 June	SP Special

4. WEATHER DATA

HIGH a	LOW b	RAINFALL c	WIND SPEED d	WIND DIRECTION e
95	73	Ø	10-15	NW

5 TRAP NUMBER	6. NUMBER				7. COMMENTS
	MALES a	FEMALES b	NIGHTS c	FEMALES/NIGHT d	
T1	25	30	1	30	
T2	5	10	1	10	
T3	50	10	1	10	
T4	15	26	1	26	

SPECIMENS SENT TO USAEHA FOR ID

8. DATE	9. SPECIES
5 June	Aedes vexans, Culex pipiens

10. PESTICIDE TREATMENT DATA

DATE a	PESTICIDE b	RATE c
30 May	Malathion	

11. METHOD OF APPLICATION

ULV

12. AREA(S) TREATED

Cantonment Area

SAMPLE

DA FORM 8011-R, DEC 91

Figure 2–10. Example of a filled-in mosquito surveillance light trap collections form.

MOSQUITO SURVEILLANCE LARVAL COLLECTIONS

For use of this form, see TB MED 561; the proponent agency is OTSG

1. DATE	2. COLLECTOR
3 June	SP Special

3. WEATHER DATA

HIGH a	LOW b	RAINFALL c
95	73	∅

4. SITE NUMBER	5. NUMBER			6. COMMENTS
	DIPS a	LARVAE b	LARVAE/DIP C	
D1	10	65	6.5	
D2	3	15	5	
D3	8	64	8	
D4	5	45	6	

SPECIMENS SENT TO USAEHA FOR ID

7. DATE	8.
4 June	SPECIES Culex pipiens, Aedes sp.

9. PESTICIDE TREATMENT DATA

DATE a	PESTICIDE b	RATE c
30 May	chlorpyrifos	.05 lb/ac

10. METHOD OF APPLICATION

broadcast – granular

SAMPLE

11. AREA(S) TREATED

50 acres - Training Area 23

DA FORM 8012-R, DEC 91

Figure 2–11. Example of a filled-in mosquito surveillance larval collections form.

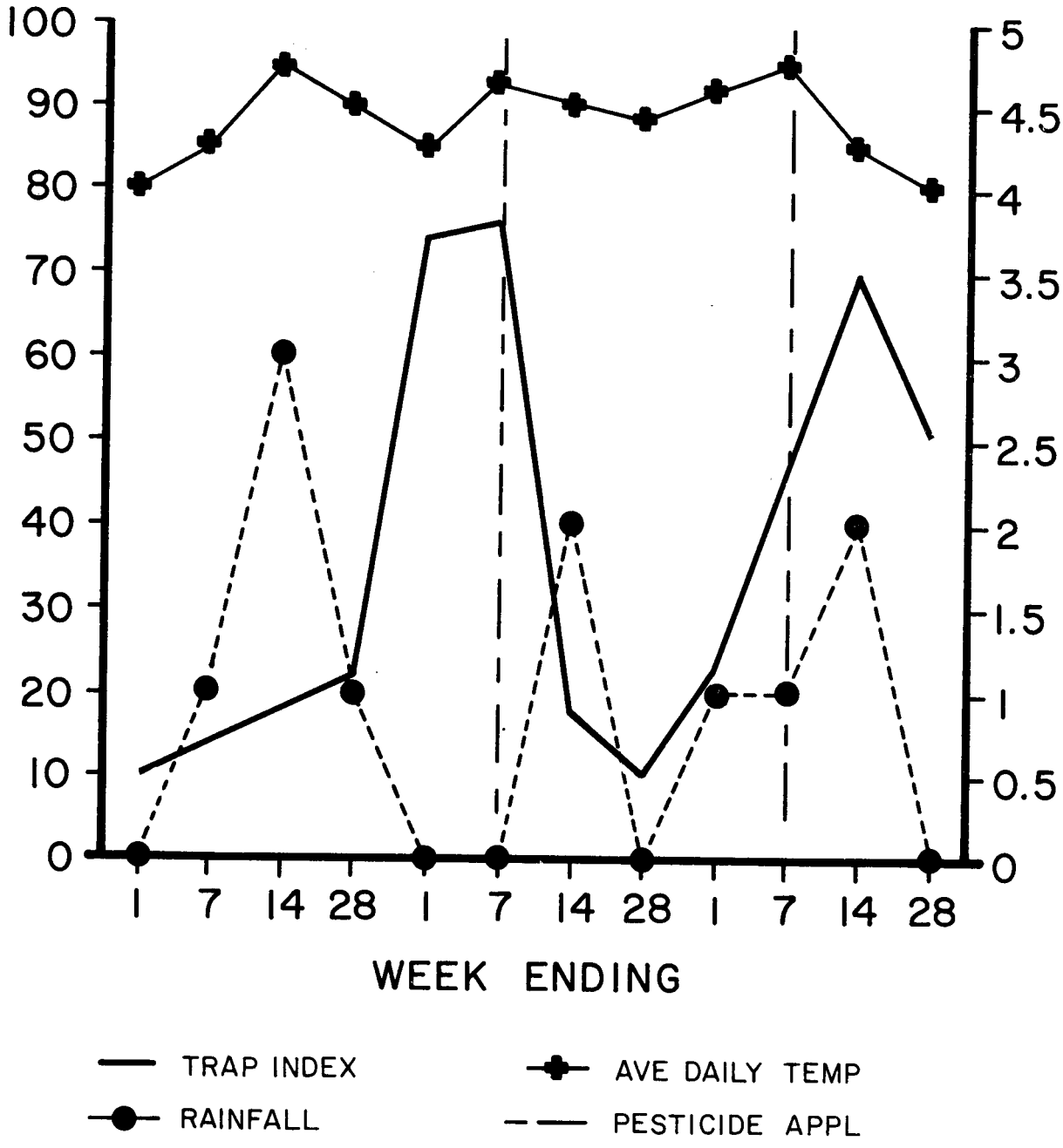

Figure 2–12. Example of mosquito surveillance data graph.

uninterrupted during the warm season. Inseminated adult females normally overwinter.

(2) *Anopheles* mosquitoes usually breed in large permanent bodies of clear fresh water that are partially shaded with some vegetation or debris. Table 2–2 shows the biological data on important *Anopheles* mosquitoes.

c. Genus Culex.

(1) The eggs of *Culex* mosquitoes are deposited in raft like masses of 100 or more on the surface of the water. Breeding is uninterrupted throughout the warm season. Inseminated adult females normally overwinter.

(2) *Culex* mosquitoes breed in quiet waters from artificial containers to large bodies of permanent water. Water with considerable organic mate-

rial including sewage is favored for breeding. Table 2–3 shows the biological data on important *Culex* mosquitoes.

d. Genus Culiseta. Members of this genus seldom bite humans but are important vectors in the transmission of encephalitides in the reservoir bird populations.

e. Genus Psorophora and Mansonia. Members of these genera are not generally considered common vectors of human disease but are vicious biters and can be severe pests. *Psorophora* mosquitoes are found breeding in habitats similar to flood water *Aedes* mosquitoes and are commonly found associated with rice fields. *Mansonia* larval and pupal mosquitoes are attached below the water surface to stems of aquatic vegetation for air which makes a larvicide ineffective.

Table 2–1
Biological data on important Aedes mosquitoes

Species	Habitat	Feeding habits	Important diseases	Flight range	Remarks
1. Salt marsh *Aedes*					
a. *Aedes taeniorhynchus*	American coastal plains and inland saline waters.	Vicious biter that feeds primarily at night.	California encephalitis.	5–20 miles	Breeds throughout the summer.
b. *Aedes sollicitans*	Atlantic and Gulf coastal plains.	Feeds at night but attacks in the daytime if disturbed.	Eastern encephalitis.	5–20 miles	Is a severe pest.
c. *Aedes dorsalis*	Pacific coast.	Vicious biter that feeds in early morning.		2–5 miles	Is a severe pest.
2. Flood water *Aedes*					
a. *Aedes vexans*	Throughout CONUS on river flood plains and other water accumulations.	Vicious biter that feeds at dusk and at night.	Eastern encephalitis.	5–20 miles	Multiple broods develop from repeated flooding.
b. *Aedes dorsalis*	Fresh water.				Associated with *Aedes vexans.*
c. *Aedes nigromaculis*	Western and central plains.	Painful biter that feeds in the evening but will attack in the daytime.		5–20 miles	Is a severe pest.
3. Tree hole/artificial container *Aedes*					
a. *Aedes triseriatus*	Widespread east of Rockies.	Severe biter that feeds in the daytime.	California encephalitis complex in Midwest.	.5–1 mile	
b. *Aedes aegypti*	Southern and southeastern states.	Feeds in early morning and late afternoon.	Yellow fever and dengue.	1 block	
c. *Aedes albopictus*	Eastern half of CONUS associated with tire piles.	Severe biter that attacks in daytime if disturbed.	Dengue, Dog heartworm.	1 block	Is an introduced species.

Table 2–2
Biological data on important Anopheles mosquitoes

Species	Habitat	Feeding Habits	Important diseases	Flight range	Remarks
1. *Anopheles quadrimaculatus*	East of the Rockies.	Feeds primarily at night.	Malaria	1–2 miles	Not ordinarily taken in light traps.
2. *Anopheles freeborni*	West of the Rockies.	Feeds at night.	Malaria	1–2 miles or more	
3. *Anopheles punctipennis*	Throughout CONUS.	Vicious biter that feeds primarily at night.	Dog heartworm	1 mile	Breeds in a variety of aquatic situations.

Table 2–3
Biological data on important Culex mosquitoes

Species	Habitat	Feeding habits	Important diseases	Flight range	Remarks
1. *Culex pipiens*	Throughout CONUS.	Feeds only at night.	St. Louis encephalitis and western encephalitis.	1 mile or more	
2. *Culex tarsalis*	West of Mississipppi River.	Feeds from dusk to dawn.	Western equine encephalitis and St. Louis encephalitis.	2–10 miles	Breeds in all types of water but prefers polluted water.

CHAPTER 3

COCKROACHES

Section I
Cockroach Surveillance

3–1. General information

a. Cockroaches are the most common arthropod pests encountered by PVNTMED personnel. On many installations, more than half of all pest control efforts and pesticide applications are directed against cockroaches.

b. Cockroaches are an important menace to public health.

(1) Cockroaches have been shown to carry organisms that cause salmonellosis, dysentery, and typhoid fever. Therefore, although never proven, they may be involved in the mechanical transmission of disease during epidemics. When lax sanitary conditions persist, large cockroach populations are usually found.

(2) Recent research has shown that many people suffer from cockroach allergies. Eight to 25 percent of the general population and 70 percent of the asthmatic population is allergic to cockroaches. Some studies show that 80 percent of asthmatic children in low income housing develop allergies to cockroaches (Burns, 1987).

(3) Do not underestimate the psychological impact of a cockroach infestation.

(*a*) The effect of large and persistent cockroach populations has a negative effect on the quality of life perception of installation residents and can affect the retention of trained military personnel.

(*b*) A study by Wood et al., 1981, on the relative importance of a cockroach infestation, demonstrated that cockroaches have a very negative impact on people.

1 When asked which is more disturbing, cockroaches, a leaky faucet, or a broken window, the majority of people interviewed selected cockroaches.

2 When asked which is worse, cockroaches or a broken toilet, 43 percent felt cockroaches were worse and 13 percent felt the problems were of equal magnitude.

c. Historically, at many U.S. Army installations, it has been common practice to apply pesticides for cockroach control on a routine, scheduled and preventive basis.

(1) Department of the Army policy prohibits the use of preventive or scheduled periodic pesticide treatments unless approved by the pest management consultant and based upon surveillance data or past pest problems.

(2) In addition, the practice of routine application of pesticide in the absence of cockroaches has several drawbacks—

(*a*) Consumes time and money.

(*b*) Encourages building managers to rely on chemical control methods instead of emphasizing good sanitation and harborage elimination.

(*c*) Promotes the development of resistance.

d. The pesticides used for cockroach control are applied to sensitive areas, such as food handling facilities, homes, barracks, offices, and other areas where personnel spend a lot of time. Personnel will be needlessly exposed to the hazards of pesticide if unnecessary applications are made in these sensitive areas.

(1) Department of the Army policy prohibits application of pesticides in a sensitive area without current surveillance data documenting a pest infestation.

(2) The role of PVNTMED personnel in cockroach control should be to help limit the unnecessary application of pesticide in these sensitive areas by—

(*a*) Conducting cockroach surveillance and notifying the appropriate organization for action when problems are encountered. For example, notify the IPMC or work order desk, as appropriate, that a harborage area needs repair.

(*b*) Enforcing sanitary standards. Emphasize the importance of good sanitation for effective cockroach control to managers and employees of food handling facilities.

(*c*) Emphasizing the importance of self-help pest control.

3–2. How to establish cockroach surveillance

PVNTMED personnel—

a. Develop a listing of all potential cockroach infestation sites. A listing of facilities that receive sanitation inspections is a good place to begin. Since family housing does not receive routine cockroach surveillance, it should not be included on this list.

b. Conduct a preliminary survey using sticky traps at all the potential cockroach infestation sites listed. The purpose of this survey is to identify existing cockroach infestations.

c. Contact installation activities that are concerned with cockroach control. On most installa-

tions cockroach surveillance and control are conducted by personnel from different organizational elements, therefore, a successful cockroach control effort requires close coordination with all personnel involved. Each person must be aware of the objectives of the surveillance program and their role in it.

(1) Meet with the IPMC to discuss—

(*a*) What is being done for cockroach control at the installation.

(*b*) How to integrate efforts.

(*c*) What criteria are used to initiate control measures; such as—

1 Surveillance data.

2 Schedule.

3 Service order.

4 Complaints.

(*d*) What facilities are or have been particular problems for cockroach control.

(2) Meet with the Army and Air Force Exchange Service (AAFES) and club managers (and their supervisors), the family housing officer, and, of course, the building occupants. Cooperation of these personnel is necessary for a successful cockroach control effort.

d. Select a method(s) and frequency for sampling the cockroach population appropriate to the species and installation. The use of sticky traps once a month is recommended for routine surveillance of German cockroaches, supplemented with nighttime surveys when problems are encountered. Entomologists are on the staff at USAEHA (app C) and can provide assistance and guidance on appropriate surveillance techniques.

e. Initiate cockroach surveillance that includes collection of cockroaches and evaluation of facilities for conditions that are conducive to cockroach infestation. Survey personnel should look for conditions, such as—

(1) Lack of general sanitation.

(2) Food debris in equipment (in food handling facilities).

(3) Food debris or trash in hard to reach areas.

(4) Cracks, crevices, or holes that provide harborage or access to harborage for cockroaches.

(5) Practices that aid cockroach infestations, such as leaving food and dirty dishes out overnight.

f. Develop thresholds and discuss control options with the IPMC. See paragraph 1–6*d* for a discussion of thresholds.

g. Coordinate with the IPMC and develop a policy for dealing with complaints from building occupants, such as family housing, barracks, and offices. This policy must be consistent with DEH's self-help policy. If self-help is ineffective, professional pest management help may be needed.

h. Write an SOP. See USAEHA TG No. 176 for guidance.

(1) Document all aspects of cockroach surveillance in the SOP.

(2) Include floor plans of food handling facilities to show cockroach trap locations.

3–3. How to update established cockroach surveillance

PVNTMED personnel—

a. Annually review the list of facilities receiving routine cockroach surveillance to identify any changes during the past year.

b. Reestablish contact, if necessary, with other installation activities that are concerned with cockroach control.

c. Visit all sampling sites and review frequency of collections. Replace those sampling sites that are no longer appropriate.

d. Review data, thresholds, and control options. Are the thresholds and control options still appropriate?

e. Update the SOP to reflect changes.

3–4. Cockroach surveillance floor plans

a. Good floor plans are essential to conduct cockroach surveillance. The number of cockroaches collected can vary greatly from one location to another. Therefore, to obtain data that is comparable over a period of time, the repeated collections must be from the same location.

b. These floor plans can be an effective way to communicate the location of harborage areas or infestation foci to pest control and maintenance personnel.

c. The location of all collection stations should be plotted on floor plans of facilities in which cockroach surveillance is conducted. Figures 3–1 and 3–2 illustrate the type of information plotted on a cockroach surveillance floor plan in quarters and in a food handling facility, respectively.

(1) Routine collection stations should be numbered consecutively (for example, sticky traps—T1, T2, T3).

(2) If a collection station is eliminated, the number will be discarded.

(3) Use a new number when establishing a new trapping station.

d. The SOP should include a floor plan of each type of facility and housing unit with collection sites plotted. A listing of all collection sites with a brief description of the location on DA Form

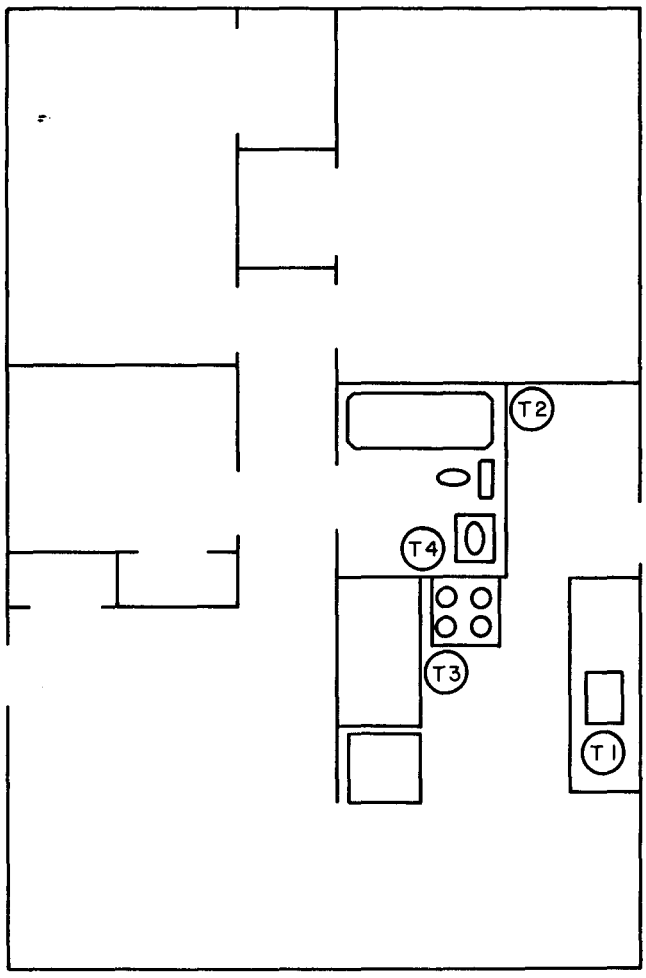

Figure 3–1. Floor plan of a typical set of quarters showing cockroach trap locations (see fig 3–3).

8013–R (Cockroach Collection Sites) (figs 3–3 and 3–4) should also be documented in the SOP and accompany each floor plan. A copy of the floor plan and listing of collection sites should be provided to the IPMC. DA Form 8013–R will be reproduced on 8 1/2- by 11-inch paper. A copy for reproduction purposes is located at the back of this bulletin.

Section II
Collection Methods and Recording Surveillance Data

3–5. Cockroach collections

a. General information.

(1) The sticky trap is a very valuable cockroach *surveillance* tool. Other methods used in cockroach surveillance include visual observation (during sanitation inspections), live traps, and night surveys. The quantitative results of cockroach surveillance using sticky traps are more objective and easier to interpret than the other subjective methods, since human judgment is not a variable.

(2) The use of sticky traps as a part of routine, monthly sanitation inspections is recommended as the most efficient method to be used by PVNTMED personnel. Nighttime surveys should be used to evaluate special control problems.

(3) Flushing with an aerosol spray is not recommended for surveillance of cockroach populations. An aerosol pesticide must not be used in an area where food is being prepared or served. Survey personnel will only get a subjective picture of the cockroach population that cannot be compared with previous or subsequent surveys conducted by other survey personnel.

b. Sticky traps.

(1) The most commonly used cockroach surveillance technique is sticky trap collections. Its usefulness in cockroach surveillance programs has been widely recognized.

(2) Cockroach sticky traps are—

(*a*) Available from installation self-help or pest control personnel.

(*b*) A standard stock item available through the supply system (Trap, Roach, Monitor, NSN 3740–01–096–1632).

(*c*) Available commercially. Contact USAEHA (app C) for information on these. It does not matter which kind of sticky trap is used so long as the same kind is used consistently.

(3) Sticky traps should be placed in locations where cockroaches are most likely to appear, such

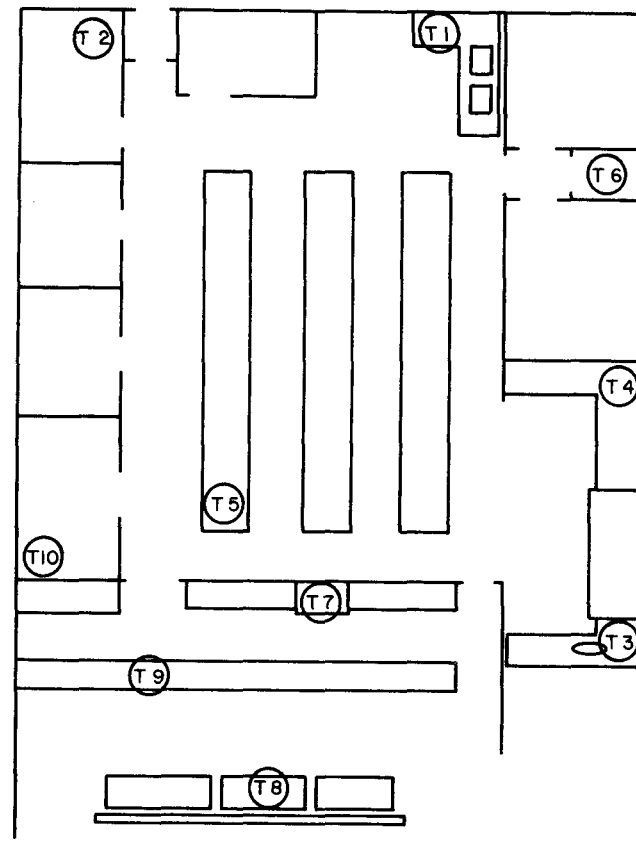

Figure 3–2. Floor plan of a typical food handling facility showing cockroach trap locations (see fig 3–4).

COCKROACH COLLECTION SITES

For use of this form, see TB MED 561; the proponent agency is OTSG

MISSION OF STRUCTURE/FLOOR PLAN: FAMILY HOUSING - Floor Plan No. 1

1. BUILDING NUMBERS 2300-2350
4500-4530

2. SITE NUMBER	3. LOCATION
T1	Under sink in kitchen
T2	In pantry
T3	Next to stove
T4	Under sink in bathroom

SAMPLE

DA FORM 8013-R, DEC 91

Figure 3–3. Example of a filled-in listing of cockroach collection sites form in a family housing unit (see fig 3–1).

COCKROACH COLLECTION SITES

For use of this form, see TB MED 561; the proponent agency is OTSG

MISSION OF STRUCTURE/FLOOR PLAN: DINING FACILITY - Floor Plan No. 2

1. BUILDING NUMBERS: 1680, 1690, 1710, 1720, 1730, 1740, 5454, 6715

2. SITE NUMBER	3. LOCATION
T1	In corner under pot sink
T2 & T10	Under shelf in store room
T3	Under disposal in dish washing room
T4	In corner behind dish washing machine
T5	Under deep fat fryer
T6	Under sink in utility closet
T7	Under serving line grill
T8	Under soda dispensing machine
T9	Under serving line steam table
	SAMPLE

DA FORM 8013-R, DEC 91

Figure 3–4. Example of a filled-in listing of cockroach collection sites form in a dining facility (see fig 3–2).

as where food, water, warmth and harborage are most plentiful. A long stick or collapsible radio antenna is helpful for placing or retrieving traps in hard-to-reach places.

(*a*) Prime locations for traps in a dining facility are—

1 Dishwashing area.

2 Pot washing area.

3 Under the serving line.

4 Around soda and milk dispensing machines.

5 Under utility sinks.

6 Around food preparation equipment.

CAUTION

When locating traps remember that if they get wet they will be ruined. Facility personnel must be instructed to leave the traps undisturbed.

(*b*) Prime locations in a housing unit are—

1 Under the kitchen sink.

2 Behind the refrigerator and stove.

3 In food cupboards.

4 Possibly in the bathroom.

(*c*) Prime locations in administrative buildings are—

1 In utility closets.

2 Behind food and drink vending machines.

3 In lunch or break areas.

4 In other areas indicated by building occupants.

(*d*) Other areas to consider when locating traps include—

1 Wall voids.

2 False ceilings.

3 Circuit breaker boxes.

4 Crawl spaces.

5 Nearby sources of moisture such as, condensation from refrigeration units, drains, and leaky pipes or faucets.

6 Stainless steel cabinets, tables, and serving counters, which have hollow legs and many crevices at junctures between metal surfaces.

(*e*) Do not locate a trap in or near movable items because it may not be there when you return to pick it up.

(4) Cockroaches are nocturnal insects and prefer cracks and crevices where they can remain in contact with a fixed surface. Traps should be placed against a wall or fixture, or under appliances, not in the open.

(5) Use at least 10 traps in a dining facility, 5 in a snack bar or administrative area, and 3 in a housing unit. More may be needed, depending on the size of the facility and extent of the infestation. One of the most common errors is not putting out a sufficient number of traps to accurately evaluate a facility. Traps that do not catch cockroaches should be relocated until the most productive sites are selected for routine surveillance. Once the most productive sites have been located, these sites should be plotted on a floor plan of the facility.

(6) Place the traps at the collection stations plotted on the facility floor plan. Use these sites each time, so that every time collections are made the data can be compared with previous collections. Label or mark each trap with the date, building number, and collection station number.

(7) Traps must be left in place at least 1 night but can be left in place for up to 4 nights. For comparability, the number of cockroaches caught must be recorded after a specific time period.

(8) Studies have shown that sticky trap surveillance is best conducted monthly. Surveillance conducted on a more frequent basis (except for pre- and post-treatment) was not effective in showing significant population fluctuations. Surveillance on a less frequent basis (more than 4 weeks apart) can allow undetected population buildup in some situations. The sampling at facilities that were not infested could be reduced to quarterly and returned to the monthly schedule if an increase in the cockroach population is detected.

(9) Pretreatment trapping should be scheduled so that the traps are removed before the insecticide is applied. After the insecticide application, allow a minimum of 48 to 72 hours for the treatment to take effect before initiating post-treatment trapping. Maximum effect of the treatment, however, will not be observed for 1 to 2 weeks.

c. Live traps.

(1) Live traps will provide quantitative data for cockroach surveillance. Live traps are not as convenient to use as sticky traps for routine cockroach surveillance because of the problem of disposal of live cockroaches and they are frequently stolen. Therefore, live traps are recommended when live specimens are required for resistance testing or when sticky traps are not available.

(2) Two types of live traps can be easily constructed.

(*a*) *Electric can trap.* This trap is the most effective live trap. It works by providing an electric shock to the cockroaches when they try to pass a foil barrier when leaving the can (fig 3–5). Materials necessary for construction include: a metal can, two small bolts with nuts and washers, a rubber grommet, double-sided tape (1-inch wide),

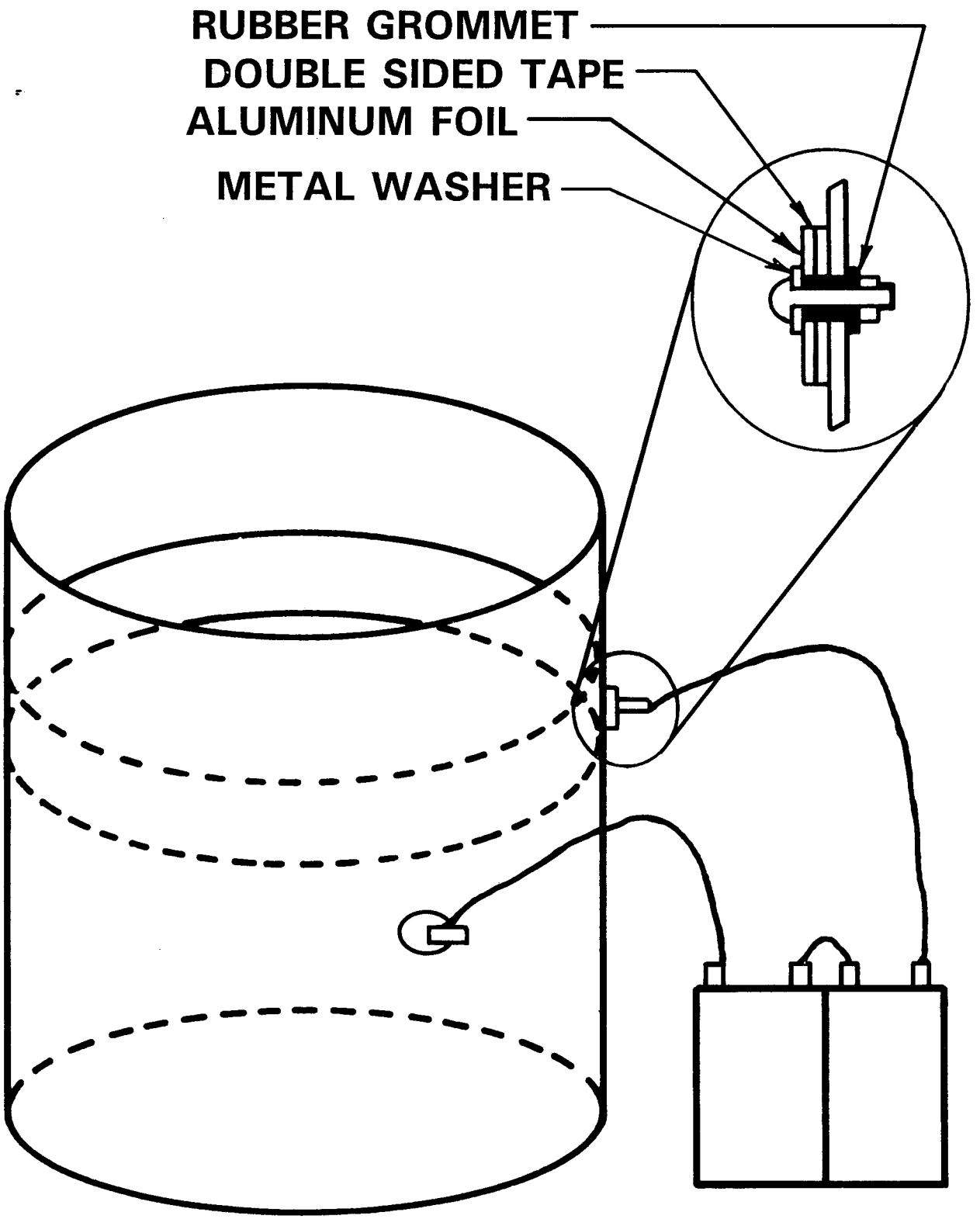

Figure 3–5. Electric can trap for collecting live cockroaches.

aluminum foil, insulated wire, and two 9-volt alkaline batteries (one may be sufficient). Instructions for constructing an electric can trap follow:

1 Drill two holes in the can the same diameter as the bolts; one about 1 inch down from the top and the other near the bottom.

2 Attach aluminum foil to one side of the double-sided tape.

3 Foil must not overlap the edge of the tape. Trim any aluminum foil that extends over the edge of the tape.

4 Attach the tape 1/4 inch down from the top edge on the inside of the can, centered over the top hole.

NOTE

The aluminum foil covered tape must make a complete circle around the inside of the can. It is critical that the aluminum foil does not touch the can or the trap will not work.

5 Cut a hole through the tape at the hole in the can.

6 Put the bolt through the top hole with the head and a metal washer on the inside of the can against the aluminum foil.

7 Use a rubber grommet to ensure that the top bolt does not touch the can.

8 Attach the end of a short piece of wire (6 inches) between the plastic washer and bolt head and tighten the nut.

9 Remove any paint around the bottom hole.

10 Put the bolt through the bottom hole with a metal washer inside and outside.

11 Attach end of a short piece of wire and tighten the nut.

12 Test with a multimeter to make sure the can operates properly.

13 Tape the batteries to the outside of the can halfway between the two bolts.

14 Connect the negative terminal of one battery with the positive terminal of the other using a piece of wire.

15 When ready to use the trap, connect the wire from the top bolt to the remaining positive battery terminal and the wire from the lower bolt to the remaining negative battery terminal. Wired in this way, there is no drain on the batteries unless a cockroach touches the aluminum foil and completes the circuit with its body.

(*b*) *Jar trap.* The jar trap is the simplest trap to construct.

1 A 1-pint capacity jar should be used, although jars ranging from 2-gallon capacity down to baby food jars have been used with success.

2 Coat the inside of the neck of the jar with a thin layer of a 2:1 mixture of petrolatum (vaseline) and mineral oil to prevent escape of the trapped cockroaches. In hot areas, use a very thin coating of undiluted petrolatum.

3 Cover the exterior of the jar with a paper towel, tape, or other material to provide better footing for the cockroaches entering the trap.

4 Place the jar in a normal upright position at the collection station.

(3) All live traps must be baited to attract the cockroaches. Almost any food substance can be used as bait, though aromatic baits work best. White bread, banana slices or peels, dog food (plain or soaked in beer), and peanut butter have been used with success. Live cockroaches, their excreta, and cast skins will also aid in attracting cockroaches to a trap.

(4) Traps should be placed at the collection stations plotted on the facility floor plan. If collection stations have not been established, place the live traps in locations where cockroaches are most likely to occur as discussed above for sticky traps.

(5) If cockroaches will be collected for resistance testing, contact the USAEHA pest resistance coordinator (app C) for instructions on collection and shipping.

(*a*) Each day specimens should be transferred to a container with food, water, and harborage. Collections need only be made once or twice a week if a pill vial with water saturated cotton is added to the trap. Transfer is easier if the traps are placed in a refrigerator to immobilize the cockroaches.

(*b*) Record the date, number collected, building number, and collection station number.

d. Nighttime surveys.

(1) A nighttime cockroach survey is a thorough examination of a facility for the presence of cockroaches and conditions conducive to cockroach infestation. Cockroaches are most active at night, and as a result, they are not usually seen during the day unless the infestation is very heavy. At night the foci of the infestation can be observed. In addition, sanitation, harborage areas, and food storage conditions conducive to cockroach infestation are readily apparent.

(2) Nighttime surveys on the other hand can be very time consuming (30 minutes per facility). They are difficult to coordinate and arrange. The data are primarily subjective and not comparable from one survey to the next. Therefore, nighttime surveys are not suited for routine cockroach surveillance.

(3) Nighttime surveys should be used as a supplement to routine cockroach trapping to evaluate special control problems. In one case, a nighttime survey revealed that the focus of a persistent cockroach infestation was found in the false ceiling of the facility.

(4) The survey is conducted at night after the facility lights have been extinguished at the end of a normal duty day. Cockroaches reach peak activity soon after the lights have been extinguished. The cockroaches should be left undisturbed for 30 minutes after extinguishing the lights, then the survey should be conducted within the next 4 hours. Make sure that coordination with facility personnel for complete extinguishing of the lights is made prior to the survey.

(*a*) Do not turn facility lights on for the survey, use a flashlight. Research conducted by the U.S. Department of Agriculture and University of Florida has shown that a gold light will provide adequate illumination to observe cockroaches when doing a nighttime survey but will not scare them into hiding. The Florida inspection light (a gold plastic filter for flashlights) is available for a nominal fee from: Whitmire Research Laboratories, 3568 Tree Court Industrial Blvd, St Louis, MO 63122.

(*b*) A floor plan of the facility should be used to record all observations.

(*c*) The IPMC, facility managers, and administrators can benefit by participating in the survey and should be invited. This is especially true if the nighttime survey has been scheduled to help resolve a special control problem. These persons need to witness the location, extent, and focus of the infestation to apply appropriate control measures.

(*d*) Report the findings to the facility chief the following day.

3–6. Recording surveillance data

a. Keep a permanent record of all cockroach surveillance data.

(1) Maintain a file of cockroach surveillance data on DA Form 8014–R (Cockroach Survey), as shown in figure 3–6, that provides a record of the number of cockroaches collected in each trap and the sanitation and harborage conditions in each facility surveyed.

(2) Calculate and record, for each facility, the average number of cockroaches per trap per night. A graph showing changes in the population level and dates of pesticide applications is often helpful. DA Form 8014–R will be reproduced locally on 8 1/2- by 11-inch paper. A copy for reproduction purposes is located at the back of this bulletin.

b. Cockroach surveillance data can provide the following types of information about cockroach infestations.

(1) The presence or absence of cockroaches is the most obvious indication. If trap catches are negative, the trapping frequency can be reduced and pesticide application is not necessary.

(2) If species other than German cockroaches are present, the surveillance effort may need to be adjusted to the habitats of the other cockroach species found.

(3) It can show changes in cockroach population levels over a long period of time that—

(*a*) Give a general indication of the effectiveness of the cockroach management program.

(*b*) Show which methods of control were most beneficial.

(*c*) Pinpoint areas where more emphasis is needed.

(4) Surveillance can also show changes in the location of an infestation within a building. Such changes can be expected when—

(*a*) Sources of food, water, and harborage are eliminated.

(*b*) New sources become available.

(*c*) Cockroaches seek an untreated area after pesticide application.

(*d*) A population outgrows the resources available in a given area.

(*e*) A new population is inadvertently brought into the building.

Section III
Control Recommendations and Important Species

3–7. General information

a. When the results of surveillance indicate control is needed, Department of Defense (DOD) policy requires the implementation of nonchemical methods, such as harborage elimination and improved sanitation, prior to the use of chemical control measures.

b. Installations should not rely on scheduled pesticide application for cockroach control. Report results of surveillance to the IPMC for use in determining appropriate control measures. Include recommendations to facility occupants to improve sanitation whenever conditions conducive for cockroach infestation are encountered.

c. Thresholds are guidelines that are established to help determine that a pesticide treatment is required. Thresholds are only indicators and, therefore, should not be the only determining factor in the decision to initiate cockroach control.

d. The following thresholds for cockroach control are based on results of a research project

COCKROACH SURVEY

For use of this form, see TB MED 561; the proponent agency is OTSG

1. BUILDING	2. ORGANIZATION		
5454	1st Bn / 1st Inf		
3. DATE	4. TIME	5. PERSON CONTACTED	
26 July	0900	SGT Cook	

PART I - MISSION OF STRUCTURE

6. MISSION OF STRUCTURE	7. FOOD HANDLING FACILITY		8 QUARTERS	
	a. MEALS/DAY	b. DAYS OPEN/WEEK	a. SINGLE	b. MULTIPLE UNIT
Dining Facility	600	7		

PART II - SANITATION

9 SANITARY CONDITIONS (check one)				10. FOOD DEBRIS (Yes (Y) or No (N))			
a. VERY GOOD	b. GOOD ✓	c. FAIR	d. POOR	a. HARD TO REACH AREAS Y	b. EASY TO REACH AREAS N	c. FOOD LEFT EXPOSED AT NIGHT N	d. OTHER

PART III - HARBORAGE

11 HARBORAGE CONDITIONS (check one)			12. SPACE AROUND PIPES SEALED	13. HOLES IN WALLS	14. SERVING LINE	15. EQUIPMENT
a. MINIMAL	b. MODERATE ✓	c. AMPLE	☐ YES ☒ NO	☒ YES ☐ NO	☐ YES ☐ NO	☐ YES ☐ NO

16. BAR	17 CRAWL SPACE	18. ATTIC	19. OTHER
☐ YES ☐ NO	☐ YES ☐ NO	☐ YES ☐ NO	

PART IV - COCKROACH SPECIES

20. KIND	21. OBSERVATION (check one)			
	a. LIVE INSECTS ✓	b. DEAD INSECTS ✓	c. EGG CAPSULES	d. FECAL MATERIAL
German				

PART V - STICKY TRAP DATA

22. TRAP NUMBER	23. LOCATION	24. NUMBER			25. COMMENTS
		NIGHTS a	COCKROACHES b	COCKROACHES/NIGHT c	
T1	Under pot Sink	1	10	10	
T2	Store room	1	2	2	
T3	Disposal	1	5	5	
T4	Behind DW	1	Ø	Ø	
T5	Under Fryer	1	1	1	

26. COMMENTS

per trap per night = 3.6
Exceeds threshold, PMC notified.

SAMPLE

DA FORM 8014-R, DEC 91

Figure 3–6. Example of a filled-in cockroach survey form.

using sticky traps to survey German cockroaches at Aberdeen Proving Ground. This research concluded that keeping a cockroach population below 1 per trap per night is a reasonable goal for a cockroach management program. These thresholds may vary from installation to installation depending on factors such as species, collection technique, and type of trap used.

(1) Chemical treatment is not recommended in facilities where cockroach populations show an average sticky trap catch of fewer than one cockroach per trap per night. There will be no benefit gained by applying pesticides in such relatively uninfested facilities, with the following exception: If one or two traps catch a large number of cockroaches while the rest of the traps are empty, then a recommendation for spot treatment of the infested area(s) is appropriate.

(2) A sticky trap catch between 1 and 3 cockroaches per trap per night shows that a cockroach population with a moderate potential for increase is present in the facility. PVNTMED personnel should focus on elimination of poor sanitation and harborage conditions conducive to cockroach infestation. If the cockroach population is located in one area and the focus can be identified, a spot treatment of that area should be recommended. A nighttime survey should be considered.

(3) Three or more cockroaches per trap per night shows that a significant cockroach population is present and without control measures an unacceptable population can be expected to develop. PVNTMED personnel should first assure sanitation is adequate then recommend treatment.

e. A key element of good cockroach control is accurate reporting of surveillance information to the pest control personnel.

(1) PVNTMED personnel must provide accurate and prompt reporting when pesticide treatment is required. Vague and indefinite reporting (for example, "we've got roaches in Building 6200," when actually 20 cockroaches were trapped under the serving line next to the grill) will waste a great deal of time and there is a good chance that the pest control personnel will not even get to the source of the infestation.

(2) Provide all pertinent information, such as where the cockroaches were found and in what numbers, to the IPMC. Floor plans showing trap locations and numbers caught in each, or showing foci identified during a nighttime survey should be provided for each facility requiring treatment.

3–8. Pest resistance

a. Resistance to pesticides may be suspected when cockroach populations persist after pesticide treatment. However, other factors that must be eliminated before concluding that the cockroaches have pesticide resistance are—

(1) Is sanitation adequate?
(2) Has harborage been eliminated?
(3) Has the pesticide been properly mixed?
(4) Was the pesticide applied correctly?
(5) Was the appropriate pesticide used?

b. If control difficulties persist after attempts have been made to resolve other potential reasons for control failure, the possibility of resistance should be investigated. Contact USAEHA (app C) for an on-site pest resistance study or for assistance in collecting and shipping cockroaches for laboratory testing.

3–9. Bionomics of important species

There are 3500 known species of cockroaches. Fewer than 1 percent are pests living in association with man. Of these, there are only six species of cockroaches that may be troublesome on U.S. Army installations in CONUS. The German cockroach is the best known and is widely distributed. Therefore, most surveillance programs are directed at this species. Biological data on important species are presented in table 3–1.

Table 3-1
Biological data on important species of cockroaches

Species	Habitat	Characteristics	Breeding habits	Life cycle
1. *Blattella germanica* (German cockroach)	Under kitchen sinks or anywhere warmth, moisture, and food are adequate.	Light brown with two dark longitudinal stripes on the thorax. Adults are 5/8 inch long and have fully developed wings.	Female carries the egg capsule until shortly before hatching.	40 to 60 days
2. *Periplaneta americana* (American cockroach)	Basements, sewer lines or near boiler plants. Is usually less common in food service facilities than the German cockroach.	Reddish brown to dark brown with light marking on the thorax. Adults are 1 1/2 inches long, and have fully developed wings.	Female may retain egg cases for several hours or days before depositing them in protected areas.	1 to 2 years
3. *Blatta orientalis* (Oriental cockroach)	Prefers slightly cooler areas. Often found in basements and cellars, crawl spaces, utility closets, and rest rooms.	Dark brown or black. Female is 1 to 1 1/2 inches long and has only rudimentary wings reduced to mere lobes. The male is a little shorter and has fully developed wings which do not reach to the end of the abdomen.	Female carries the egg capsules for several days before depositing them in warm sheltered locations where food will be available for the nymphs.	311 to 800 days
4. *Supella longipalpa* (Brown-banded cockroach)	Spreads throughout infested premises and is often found in furniture and cupboards.	Is sometimes confused with the German cockroach. Light brown with mottled reddish brown wings on the female and lighter wings on the male. The female has shorter wings. The wings are twice banded with brownish yellow horizontal stripes. The adults are 1/2 inch long.	Female carries the capsule for 24 to 36 hours before attaching it to some object.	95 to 276 days
5. *Periplaneta australasiae* (Australian cockroach)	Requires warm temperatures. Found in southern Florida.	Is sometimes confused with the American cockroach. Reddish brown to dark brown with yellowish markings on the thorax and yellowish streaks at the base of the wing covers. Adults are 1 inch long and have fully developed wings.	Female deposits egg cases shortly after formation.	6 to 12 months
6. *Blattella asahinai* (Asian cockroach)	Found in the western hemisphere, central Florida, and is spreading. Found in abundance in shaded areas of lawns and areas with heavy ground cover. Adults move indoors readily, living side by side with the German cockroach. At dusk they become active and fly toward lights.	Similar in appearance to the German cockroach except that its wings are longer, more narrow, and extend to the tip of the abdomen.	Egg case remains attached to the female for 17 to 20 days.	6 to 7 weeks

CHAPTER 4

FILTH FLIES

Section I
Filth Fly Surveillance

4–1. General information

a. Filth flies—

(1) Are medically important arthropod pests that require routine surveillance by PVNTMED personnel.

(2) Are carriers of organisms that cause typhoid, dysentery, and other diarrheas.

(3) Constitute a significant public health hazard.

(4) Transport disease organisms to food on their feet or body hairs.

(5) Contaminate food when they regurgitate on the food to liquefy it for ingestion.

(6) Annoy and interfere with human comfort.

b. House flies habitually enter dwellings and come in contact with human food or drink after breeding or feeding in excrement, dead animal material, or other contaminated media. Other filth fly species, which do not necessarily enter dwellings, are closely associated with man and can also mechanically transmit diseases.

c. The stable fly is not an effective disease vector but is a vicious biter and can be a serious pest.

d. Fly surveys are necessary to determine the effectiveness of sanitary practices and to determine the need for pesticide applications. Sanitation is the cornerstone of a sound filth fly control program. Normally pesticides should not be necessary to control a filth fly population if proper sanitation is maintained.

e. The primary purpose of PVNTMED fly surveillance is to prevent the accumulation of sites suitable for filth fly breeding by assuring proper sanitation practices. In addition, fly surveillance will assure adequate exclusion measures at food handling facilities to prevent access by flies and subsequent contamination of food.

4–2. How to establish filth fly surveillance

PVNTMED personnel—

a. Develop a listing of all potential filth fly infestation sites. A listing of facilities that receive sanitation inspections is a good place to begin. In addition, include landfills, stables, kennels, and refuse containers in housing (centralized collection points), barracks, hospital, and recreational areas.

b. Conduct a preliminary survey at all potential filth fly infestation sites listed. The purpose of this survey is to identify existing filth fly infestations.

c. Contact installation activities that are (or should be) concerned with fly control. Because sanitation is so important, successful filth fly control efforts require close coordination with all personnel involved. All personnel must be aware of the objectives of the surveillance program and their role in it.

(1) Meet with the IPMC to discuss—

(*a*) What is being done for filth fly control at the installation.

(*b*) How to integrate efforts.

(*c*) What criteria are used to initiate control measures; such as—

1 Surveillance data.

2 Schedule.

3 Service order.

4 Complaints.

(*d*) What facilities are or have been particular problems for filth fly control.

(2) Meet with managers of food handling facilities; that is, dining facilities, AAFES, the club system, and so forth. Also meet with managers from other activities that generate infestable waste, such as the commissary, stables, and kennels. Cooperation of these personnel is necessary for a successful filth fly control effort.

d. Select a method(s) and frequency for sampling the fly population. Fly collections are necessary to determine fluctuations in fly populations and the species present within a given area. Entomologists are on the staff at USAEHA (app C) and can provide assistance and guidance on appropriate surveillance techniques.

e. Initiate filth fly surveillance that consists of routine surveys for—

(1) The presence of flies.

(2) Favorable breeding conditions.

(3) Adequate exclusion at food handling facilities and other potential filth fly breeding sites. Survey personnel should be alert for conditions, such as properly bagged infestable refuse, closed dumpster lids, clean dumpsters, and properly screened windows and doors. The effectiveness of sanitary practices may be determined by these surveys.

f. Develop thresholds and control options (do not forget nonchemical measures). See paragraph 1–6*d* for a discussion of thresholds.

g. Coordinate with the IPMC to develop a policy for dealing with complaints from building occu-

pants in family housing, barracks, offices, and so forth. This policy should be consistent with the DEH's self-help policy.

h. Write an SOP. See USAEHA TG No. 176 for guidance.

(1) Document all aspects of filth fly surveillance in the SOP.

(2) Include floor plans of facilities and installation maps to show fly sampling sites.

4–3. How to update established filth fly surveillance

PVNTMED personnel—

a. Annually review the list of sites receiving routine filth fly surveillance to identify any changes during the past year.

b. Reestablish contact, if necessary, with other installation activities that are concerned with filth fly control.

c. Visit all sampling sites and review frequency of collections.

d. Replace those sampling sites that are no longer appropriate.

e. Review data, thresholds, and control options. Are the thresholds and control options still appropriate?

f. Update the SOP to reflect changes.

4–4. Filth fly surveillance

a. Installation food handling facilities should be the primary focus of filth fly surveillance.

(1) Proper disposal of food wastes is essential to prevent attraction and breeding of filth flies and to prevent contamination of food.

(2) Surveys for practices and conditions conducive to attraction, breeding, and exclusion of filth flies should be conducted on a routine schedule.

(*a*) Are filth flies present? This is an indicator that waste handling practices in the area are not sufficient to prevent breeding of filth flies.

(*b*) Are the lids and doors of multiple refuse containers (dumpsters) closed? Is garbage placed in cans with close fitting lids? Lids and doors must be tightly closed to deny filth flies access to food waste.

(*c*) Are garbage cans and dumpsters clean?

1 Garbage cans should be washed after each garbage collection. Wash water must be directed into the sanitary sewer. Wash water allowed to run on the ground will create a source of filth fly attraction.

2 Dirty dumpsters show that food waste is not being handled properly. Plastic bags that contain food waste must be secured to prevent leakage. Empty food containers must be rinsed before being deposited in the dumpster.

3 Dumpsters that are found encrusted with liquid and solid food should be steam cleaned to prevent filth fly breeding.

4 Does the contract for refuse disposal require washing of the dumpsters? If so, is it being done? A thorough washing of containers after each emptying will prevent build-up of encrusted liquid and solid food materials on surfaces.

(*d*) Are windows and doors adequately screened? Are doors being kept closed? Are air curtains operational and properly installed? Excluding filth flies from food handling facilities will prevent contamination of food and utensils.

b. Refuse containers in housing areas, near barracks, at the hospital or clinics, and in recreational areas should receive filth fly surveillance. Dumpsters in these areas can receive a wide variety of infestable material, such as fish entrails at the recreation area or medical waste at the hospital.

(1) Survey dumpsters for presence of flies. Ensure that the lids and door are closed, and maintain cleanliness as discussed in the previous paragraph.

(2) Collection frequency (especially during summer months) may not be enough to prevent fly breeding. House flies can complete development, from egg to adult, in 6 days.

c. The installation landfill is a potential major source of filth fly attraction and breeding if garbage is uncovered or improperly covered.

(1) Cover exposed refuse by the close of each day's operation.

(2) A compact cover of at least 6 inches (15 cm) of soil is needed to prevent fly emergence.

(3) PVNTMED personnel should regularly survey the installation landfill to assure that proper practices are being followed.

d. Stables and kennels have great potential for filth fly breeding if manure and urine-soaked straw are allowed to accumulate.

(1) These areas are especially important because they are usually run by non-appropriated fund activities and may rely on volunteers to do the work.

(2) PVNTMED personnel should conduct regular filth fly surveillance on stables and kennels to assure that proper manure management practices are being followed.

(*a*) Frequent removal of manure and urine-soaked straw is necessary to prevent accumulation of fly breeding media. Daily removal is recommended. A minimum frequency of twice a week is necessary to prevent filth fly breeding.

(*b*) Paved kennel runs should drain into a sanitary sewer. A washdown to remove feces is recommended twice daily. A minimum frequency of twice a week is necessary to prevent filth fly breeding.

(*c*) Properly dispose of manure after removal from a stable or kennel.

(*d*) If possible, locate stables and kennels at least a mile from cantonment areas.

Section II
Sampling Methods and Surveillance Data

4–5. Adult sampling methods

a. General information.

(1) There are many techniques for sampling adult filth flies. The most appropriate for PVNTMED personnel are based upon counting the number of flies on resting sites or those caught by sticky traps.

(2) The sampling should be conducted at a standardized time and at the same locations. Weekly fly surveys should be conducted throughout the fly breeding season. Sampling methods used in securing fly population estimates must be the same from one survey to the next.

b. Counting.

(1) *Fly grill technique.*

(*a*) This technique is used outdoors and is the most versatile of the counting techniques (fig 4–1).

(*b*) Place the grill over natural fly concentrations and count the number of flies landing on the grill for a given period of time (usually 1 minute).

(*c*) With practice it is possible to identify by sight several fly species that land on the grill.

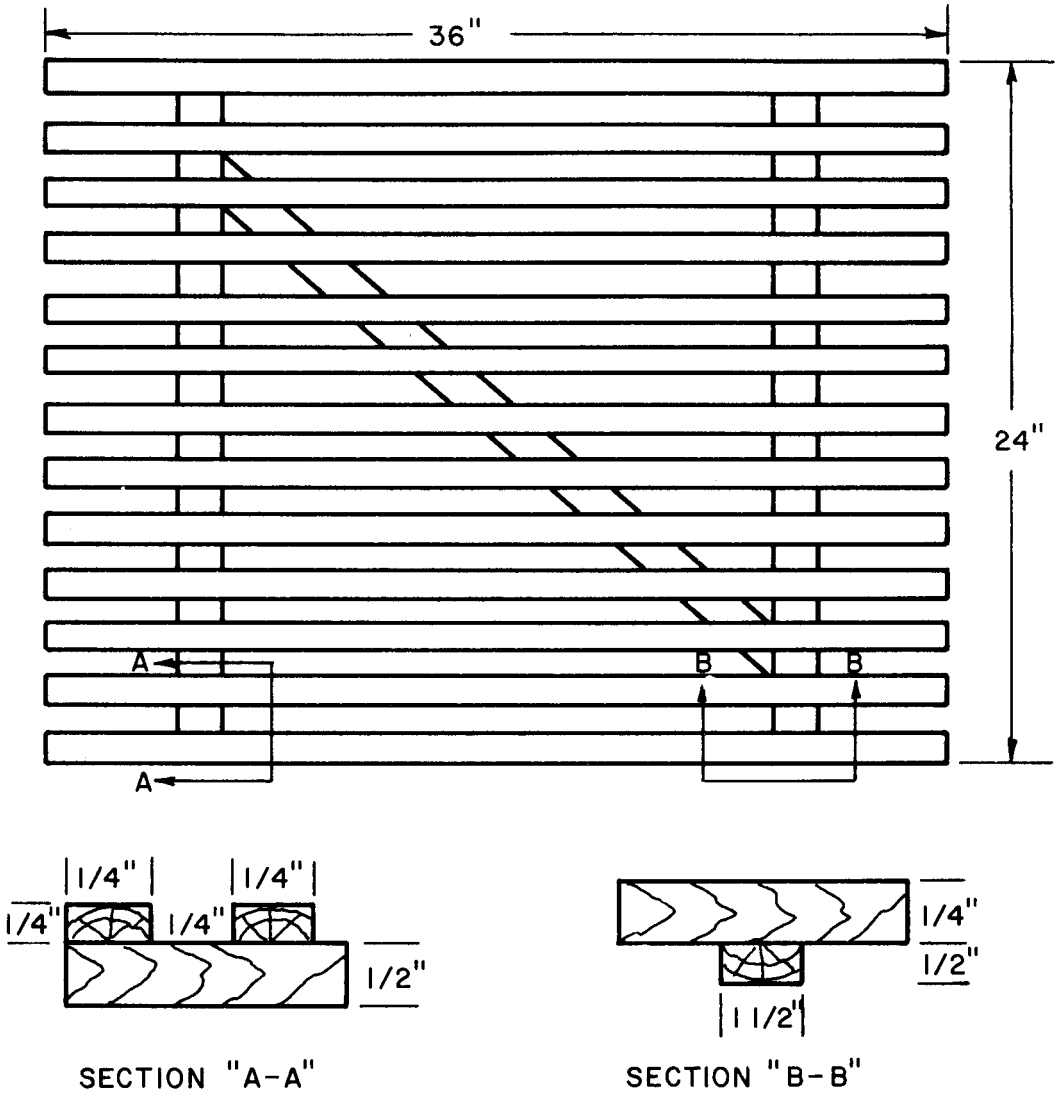

Figure 4–1. Fly grill for filth fly surveillance.

(2) *Fly bait technique.*

(*a*) Use this technique to determine fly densities indoors.

(*b*) A 1 square foot card that has been painted with a mixture of molasses and vinegar (1:2) should be placed near a location frequented by flies.

(*c*) The number of flies attracted to the card over a specified time (for example, 5 minutes) is recorded.

(*d*) Other baits such as syrup, molasses, or milk may be used but, in order for fly counts to be meaningful, uniformity of bait and technique is necessary.

c. Trapping.

(1) Sticky tapes or strips—

(*a*) Are used for assessing fly densities, particularly indoors where flies may occur.

(*b*) May be exposed to flies from 2 hours to 2 days (1 day is recommended). In order for data to be meaningful, the length of time and time of day must be uniform from observation to observation.

(*c*) Should be located near doorways or trash receptacles.

(*d*) Should not be placed over food preparation or serving areas.

(2) Live traps—

(*a*) Will provide quantitative data for fly surveillance.

(*b*) Are not as convenient to use for routine surveillance because of the problem of disposing the live flies.

(*c*) Are recommended only when live specimens are required for identification or resistance testing.

(3) The number of flies caught is strongly dependent on the location of the trap. Locations must be accurately identified so the trap will be placed in the same location for each subsequent survey.

d. Sweep net.

(1) Catching flies using a sweep net is useful to obtain samples of flies for identification, but quantitative estimates of the fly population are difficult to obtain and unreliable.

(2) Sweep nets are available through the supply system (Net, Insect, NSN 6640-00-435-6100). Extra nets may be obtained as Bag, Insect Net, NSN 6640-00-435-6105.

e. Shipment. Flies that cannot be locally identified should be forwarded to USAEHA (app C) no later than the day following the collection. General shipping instructions are provided in appendix B.

4-6. Recording surveillance data

a. A permanent record should be kept of all filth fly surveillance data.

(1) Maintain a file of filth fly surveillance data forms on DA Form 8015-R (Filth Fly Survey), as shown in figure 4-2, that provides a record of the number of filth flies counted or trapped, the species observed, and sanitation and exclusion conditions in each facility surveyed.

(2) Records of filth flies counted and trapped should be maintained, since they are useful indices for showing fluctuations in fly populations. The surveyor should use a graph that plots changes in the population level and dates of pesticide applications (fig 2-12). DA Form 8015-R will be reproduced locally on 8 1/2- by 11-inch paper. A copy for reproduction purposes is located at the back of this bulletin.

b. A composite index for a particular area or installation is calculated by averaging together several collection sites. The composite indices should be plotted in graph form. After some experience a threshold may be established. For example, in residential areas, a grill index of 25 flies may be unacceptable. See paragraph 1-6*d* for a discussion of thresholds.

c. Filth fly surveillance data can provide the following information about filth fly infestations:

(1) The presence or absence of filth flies is the most obvious indication.

(2) If species other than house flies are abundant, surveillance and control effort may need to be adjusted to the habits of the filth fly species found.

(3) It can show trends in filth fly population levels over a long period of time that—

(*a*) Provide an evaluation of the effectiveness of the filth fly management program.

(*b*) Indicate which methods of control were most effective.

(*c*) Pinpoint areas where more emphasis is needed.

Section III
Control Recommendations and Important Species

4-7. General information on control

a. Filth fly attractants and breeding areas must never be allowed to persist. Good sanitation is the single most important factor for effective filth fly control. PVNTMED personnel must enforce strict sanitation standards to prevent or eliminate filth fly attractants or breeding areas.

FILTH FLY SURVEY

For use of this form, see TB MED 561; the proponent agency is OTSG

1. BUILDING	2. ORGANIZATION
3454	1st Bn / 1st Inf

3. DATE	4. TIME	5. PERSON CONTACTED
6 July	0900	SGT Cook

6. FOOD HANDLING FACILITY		7. QUARTERS		
a. MEALS/DAY	b. DAYS OPEN/WEEK	a. SINGLE	b. MULTIPLE UNIT	c. OTHER
600	7			

8. SANITARY CONDITIONS (check one)				9. EXCLUSION (check one)				10. AIR CURTAINS PRESENT
a. VERY GOOD	b. GOOD	c. FAIR	d. POOR	a. VERY GOOD	b. GOOD	c. FAIR	d. POOR	☐ YES ☒ NO
	✓					✓		

11. OPERATIONAL/EFFECTIVE	12. WINDOWS SCREENED	13. FANS SCREENED	14. DOORS SCREENED
☐ YES ☐ NO	☒ YES ☐ NO	☐ YES ☒ NO	☒ YES ☐ NO

15. OTHER

Doors propped open.

16. REFUSE DISPOSAL (Yes (Y) or NO (N))				17 SAMPLING MEHTOD (check one)			
a. CONTAINER		b LIDS/DOORS		a. GRILL	b. STICKY TRAP	c LIVE TRAP	d SWEEP NET
(1) CLEAN	(2) RODENT-PROOF	(1) CLOSED	(2) IN GOOD REPAIR				
N	Y	N	Y	✓			

18. SURVEY DATA

a. LOCATION	b NUMBER COUNTED/TRAPPED/CAUGHT
Next to dumpster	# per min 4/15/13
Garbage can washing area	# per min 10/15/13

SPECIMENTS SENT TO USAEHA FOR ID

19 DATE	20. SPECIES

21 COMMENTS

SAMPLE

DA FORM 8015-R, DEC 91

Figure 4-2. Example of a filled-in filth fly survey form.

b. When the results of surveillance show that control is needed, elimination of conditions favorable to attraction and breeding of filth flies should be considered a prerequisite to chemical control.

c. PVNTMED personnel must provide accurate and prompt reporting of surveillance information and recommendations when pesticide treatment is deemed appropriate. Ensure that all pertinent information is provided such as where the filth flies have been found and how many.

d. Multiple refuse containers should not receive routine pesticide treatments, since this practice contributes little to the reduction of fly populations, wastes resources, and accelerates the development of resistance. Routine steam cleaning would be far more effective.

4–8. Bionomics of important species

Frequently encountered filth flies belong to three families of the order *Diptera*:

a. Muscidae. Filth flies in this family are differentiated by the dull color of the thorax and abdomen. Biological data on important species are presented in table 4–1. The stable fly, which is a biting fly, is included in this table because it breeds in filth fly habitats.

b. Calliphoridae (blow flies). Filth flies in this family are characterized by a dull colored thorax and shiny, metallic blue, green or purple abdomen. Blow flies are abundant around garbage dumps and meat processing plants. These flies usually deposit eggs on meat but will deposit them on decaying plant refuse if meat is not present. Commonly encountered blow flies include: Blue bottle flies (*Calliphora* spp.), green and bronze bottle flies (*Phaenicia* spp.), black blow flies (*Phormia* spp.) and secondary screwworm flies (*Cochliomyia* spp.). Adult cluster flies, *Pollenia rudis*, can become a nuisance when they enter buildings in the fall to hibernate.

c. Sarcophagidae (flesh flies). Filth flies of this family are differentiated by both the thorax and abdomen being a shiny, metallic green, blue or purple color. Flesh flies are larger than house flies, have three dark longitudinal stripes on the thorax and a checkerboard pattern of grayish and dark spots on the abdomen. Most species breed in meat, often in animal carcasses, and some breed in animal excreta, especially in dog stools. Females deposit living larvae rather than eggs.

Table 4–1
Biological data on important Muscidae filth flies

Species	Characteristics	Breeding habits	Remarks
1. *Musca domestica* (House fly)	Small, 6–9 mm in length. Gray with four dark stripes running lengthwise on the thorax. The sides of the abdomen are pale (yellowish).	The larvae breed in almost any type of warm, moist organic material. Garbage and manure, including human excrement, are important sources of breeding.	Adults feed on a wide variety of substances including human food. Predominate in the hot dry southwestern part of CONUS. Less abundant in the northern and eastern regions.
2. *Musca autumnalis* (Face fly)	A little larger than the house fly. Abdomen of the female is black on the sides.	Eggs are laid just beneath the surface of fresh cattle excrement.	Has assumed importance as a nuisance and in pathogen transmission. The hibernating adults mass together like cluster flies causing annoyance. Introduced to North America in 1950.
3. *Fannia* spp. (Little house fly)	Small (less than 7 mm) and resembles house flies but has only three dark stripes.	Eggs are laid chiefly in excrement of humans, horses, and cattle.	Has been implicated in human myiasis.
4. *Stomoxys calcitrans* (Stable fly)	Sharp, piercing, forward projecting proboscis. Abdomen with dark spots.	Breeds in fermenting marine vegetation near beaches (ocean and inland). Also lays eggs on collections of moist, rotting, and fermenting organic material.	Often known as the biting house fly because it bears a strong resemblance to the house fly. Not an effective disease vector, but a vicious biter and a serious pest near beaches.
5. *Muscina* spp. (False stable fly)	Slightly larger (8 mm) and has a heavier body than house flies. Distinguished by the pale tip of the scutulum.	Breeds in decaying animal and vegetable matter.	

CHAPTER 5

TICKS

Section I
Tick Surveillance

5–1. General information

a. Ticks are second only to mosquitoes among the vectors, encountered by PVNTMED personnel. They are also major nuisance pests.

b. Ticks are important vectors of a wide variety of diseases.

(1) They can transmit—

(*a*) Viruses.

(*b*) Rickettsiae.

(*c*) Bacteria.

(*d*) Protozoa.

(2) Human diseases transmitted by ticks in CONUS include—

(*a*) Lyme disease.

(*b*) Rocky Mountain spotted fever.

(*c*) Colorado tick fever.

(*d*) Q fever.

(*e*) Relapsing fever.

(*f*) Babesiosis.

(*g*) Tularemia.

(3) Some can also cause tick paralysis through neurotoxic salivary secretions when attached on the neck or head for long periods of time.

c. Ticks are among the most efficient vectors because they pierce the skin and attach firmly, suck blood, feed slowly, and may go unnoticed for a long period of time. Many species can withstand environmental stresses and may live for years. They have few natural enemies and feed on a wide range of hosts. Some species transmit pathogens to their offspring through the egg (transovarial transmission) and from larva to nymph or nymph to adult (transstadial transmission).

d. Ticks may be present in great numbers in localized areas called hot spots. Tick-borne diseases are endemic to certain regions of CONUS. PVNTMED personnel should routinely conduct tick surveillance to determine the number and species of ticks present and to monitor the potential for tick-borne diseases.

5–2. How to establish tick surveillance

PVNTMED personnel—

a. Develop a list and map areas where human activity overlaps favorable tick habitat.

(1) The highest tick concentrations are generally found in edge habitats. An edge habitat is defined as an area where forests open to fields, trails, or clearings.

(2) Activity in recreation, range, and training areas will bring people into contact with tick habitats. Housing adjacent to wooded areas will also bring dependents, especially children, into contact with tick habitats.

b. Conduct a preliminary survey where human use and favorable tick habitats coincide. The purpose of this survey is to identify existing tick concentrations.

c. Contact the community or State health department adjacent to the installation. This may be a valuable source of information on tick species, abundance, and tick-borne diseases present in the region surrounding the installation.

d. Meet with the IPMC to discuss what is being done for tick control at the installation.

e. Select appropriate monitoring methods and locations for sampling the tick population for the species of concern.

(1) Tick dragging and tick walks are effective techniques to monitor a broad spectrum of tick species. These techniques are also useful for quick spot checks of human risk.

(2) Locations where heavy human use and favorable tick habitats coincide should receive routine tick surveillance.

f. Determine frequency of sampling appropriate to the species and installation. Entomologists are on the staff at USAEHA (app C) and can provide assistance and guidance on appropriate tick collection frequency.

g. Develop threshold levels and control options. See paragraph 1–6*d* for a discussion of thresholds.

h. Write an SOP. Include a map with all tick sampling locations. See USAEHA TG No. 176 for guidance.

5–3. How to update established tick surveillance

a. Annually review the list of sites receiving routine tick surveillance to identify any changes during the past year.

b. Reestablish contact, if necessary, with local public health activities and installation pest control.

c. Visit all sampling sites and review frequency of collections to determine if they are still appropriate. Replace those no longer appropriate.

d. Review data, threshold levels, and control options. Are the thresholds and control options still appropriate?

e. Update the SOP to reflect changes.

Section II
Collection Methods and Recording Surveillance Data

5–4. Tick collection

a. Introduction.

(1) *Site selection.* Site selection is very important for success of tick surveillance because some habitats contain more ticks than others.

(*a*) Edge habitats (that is, where forests open to fields, trails, or clearings) are the areas of highest tick concentrations.

(*b*) Woodland trails are excellent locations for tick surveys.

(*c*) Areas where there are many animals (for example, deer, field rodents, foxes, coyotes, birds, or cattle) and good cover, there will be a high tick population.

(*d*) Open areas are often devoid of ticks, because they may not be visited by the animals carrying ticks and because the microclimate is not conducive for tick survival.

(2) *Attire and practices for tick surveillance.*

(*a*) Survey personnel must scrupulously practice personal protective measures during and after surveillance activities. They may attract more ticks than the collection devices.

(*b*) Personnel doing tick surveillance should work in pairs and inspect each other for ticks after each site has been sampled or more frequently if needed.

(*c*) Wear white or light-colored clothing so that ticks are readily visible. This is especially helpful in locating the tiny, immature stages. Blouse pants into socks and boots and then tape the pants-to-boot interface. Wear a white painter's hair covering (shower cap-like) to protect scalp and hair.

(*d*) Spray clothing with repellent to provide additional protection. Permethrin kills ticks and is effective even after multiple washings of clothing. Therefore, do not use permethrin or previously treated clothing when collection of live ticks is desired.

(3) *Tick removal.*

(*a*) The best method for removing attached ticks is to grasp the tick with tweezers at the mouth parts as close to the host's skin as possible. Then, pull with a steady, even pressure to detach the tick without leaving its mouth parts imbedded in the skin.

(*b*) Do not grasp the whole tick with the fingers. This can cause the injection of disease organisms into the bite wound as pressure is put on the tick's body.

(*c*) Do not attempt to make the tick "back out" (for example, by burning or using alcohol, fingernail polish, mineral oil, or petroleum jelly). This may cause regurgitation of disease organisms into the wound or kill the tick.

(*d*) Do not smash the tick with the fingers since disease transmission is possible by skin contamination.

(*e*) Use an adhesive lint roller or a wide piece of masking tape to remove ticks from clothing.

(*f*) Attached ticks that have been removed should be saved for reference by taping them to a 3- by 5-inch card. Record the date, location, and the person's name on the card.

b. Tick collection techniques. The most commonly used tick collection techniques are tick walks, tick dragging, host trapping and examination, and tick trapping using CO_2-baited traps. Techniques must be tailored to the tick species sampled and purpose of the surveillance.

(1) *Tick walks.*

(*a*) This technique also collects a representative sample of a broad spectrum of tick species and is useful in assessing human risk. It is the best technique for a quick spot check of an area for ticks.

(*b*) Personnel conducting tick walks should wear the attire and follow practices established in paragraph 5–4*a*(2).

(*c*) Do not use a repellent or permethrin (or clothing previously treated with permethrin) because the purpose of a tick walk is to attract and collect live ticks.

(*d*) A standard distance (for example, 50 paces) should be used at each site surveyed so that results can be compared.

(*e*) Time of day and weather conditions affect tick activity and can influence the number of ticks caught. Tick walks should not be conducted during rains, when vegetation is wet, or during periods when the air temperature is less than 54 °F. These conditions markedly reduce tick activity and, therefore, reduce the effectiveness of tick surveillance.

(2) *Tick dragging.*

(*a*) This technique collects a representative sample of a broad spectrum of tick species and is useful in assessing human risk. Tick dragging is very manpower intensive and nets few ticks in areas of low to moderate tick densities. However, it is a good technique for spot checking areas for ticks.

(*b*) The tick drag technique involves dragging a piece of cloth over the ground or vegetation

where ticks are awaiting a passing host. Ticks that cling to the cloth are removed, counted, and identified.

(*c*) A tick drag can be made from a sheet of white muslin or flannel, 4 feet long by 3 feet wide. Tightly-woven fabrics with a slick or shiny surface are not appropriate because ticks have a difficult time attaching. Sew or staple a 3 1/2 foot long stick or dowel into one end (this will help keep the sheet spread open as it is pulled over vegetation and small obstacles). To pull the drag, attach each end of an 8- to 10-foot cord to each end of the stick.

(*d*) A standard distance (for example, 50 paces) should be used at each site surveyed so that results can be compared.

(*e*) Personnel conducting tick dragging should wear the attire and follow practices established in paragraph 5–4*a*(2).

(*f*) Time of day and weather conditions affect tick activity and will influence the number of ticks the drag catches. Dragging should not be conducted during rains, when vegetation is wet, or during periods when the air temperature is less than 54 °F. These conditions markedly reduce tick activity and, therefore, reduce the effectiveness of tick dragging.

(3) *Host trapping and examination.* Host trapping and examination provides the most realistic assessment of a local tick population, when appropriate hosts are sampled. Wild animals are usually an excellent source of ticks to evaluate tick populations. However, difficulty in catching and handling these animals is a significant limiting factor of this surveillance technique. Contact USAEHA (app C) for detailed guidance before attempting host trapping.

(4) *CO_2 tick trap.*

(*a*) This technique relies on the ability of ticks to sense CO_2 and to move toward its source. A drawback of this method is that it attracts various species differently. For example, Lone Star ticks are attracted to CO_2 traps to a greater extent than American dog ticks. Nonetheless, more American dog ticks can generally be collected by this method than by dragging. *Ixodes* ticks are attracted to CO_2 but an extended period of trapping is required to attract these smaller, slower-moving ticks. CO_2 trapping provides the greatest number of ticks per man-hour expended.

(*b*) A CO_2 trap consists of a 2- by 3-foot piece of white cloth placed on the ground with an aluminum pie pan upside down in the center and a half-pound block of dry ice on the pie pan. Newspaper can be used to wrap the dry ice and prolong its attractiveness to ticks.

1 DACRON ® or nylon cloth is preferred over bed sheet material because ticks can be removed much easier from synthetic fabrics.

2 When spread on the ground, the edges of the cloth should be weighted down with sticks or stones to prevent the wind from disturbing the trap.

3 The half-pound block (roughly a 2 1/2-inch cube) of dry ice can be cut on a band saw and will last much longer (about 2 hours of trapping when temperatures are in the 80s) than an equal weight of dry ice chips. Additional dry ice is needed if the trap will be exposed to direct sun, warmer conditions, or for extended time periods.

4 The temperature of dry ice is -109 °F, so insulated gloves should be worn when handling it to prevent freeze burns.

(*c*) Studies have shown that the best CO_2 trap results are obtained between 0900 to 1100 on fair days when there is little or no wind. Trap data from an afternoon collection should not be compared to a morning collection, nor cloudy-day data compared to sunny-day data. Therefore, procedures and trapping conditions must be standardized to allow for comparison of data from different sites or from the same site over time.

(*d*) When trapping, if the duration must be increased to 12 or more hours (for *Ixodes* ticks), place the dry ice in a vented, insulated container (fig 5–1). Put tape around the perimeter of the trap to capture attracted ticks. The long duration trap will be more effective if the vent holes are covered with a shield and the tape is covered with a roof.

(*e*) Place three traps about 20 feet from one another at each site sampled.

(*f*) Count ticks in the trap by standing directly over the trap. Standing to one side will cause ticks to migrate toward that side and off the trap so fast that they cannot all be counted. The traps work well, but a person's body heat and expired CO_2 will work even better in attracting ticks. Holding your breath and limiting movement while observing trapped ticks also helps to reduce tick activity.

(*g*) Calculate a trap index for each site to adjust results for differences in time that traps were operated.

1 First, average the catch for the site (add the counts from all collections at one site and divide by the number of traps).

2 Then divide this number by the time (in hours) that the traps were run. Time in hours is calculated by dividing the number of minutes of trap time by 60.

DACRON R is a registered trademark of DuPont de Nemours, E. I. & Company, Inc., 1007–T Market Street, Wilmington, Delaware.

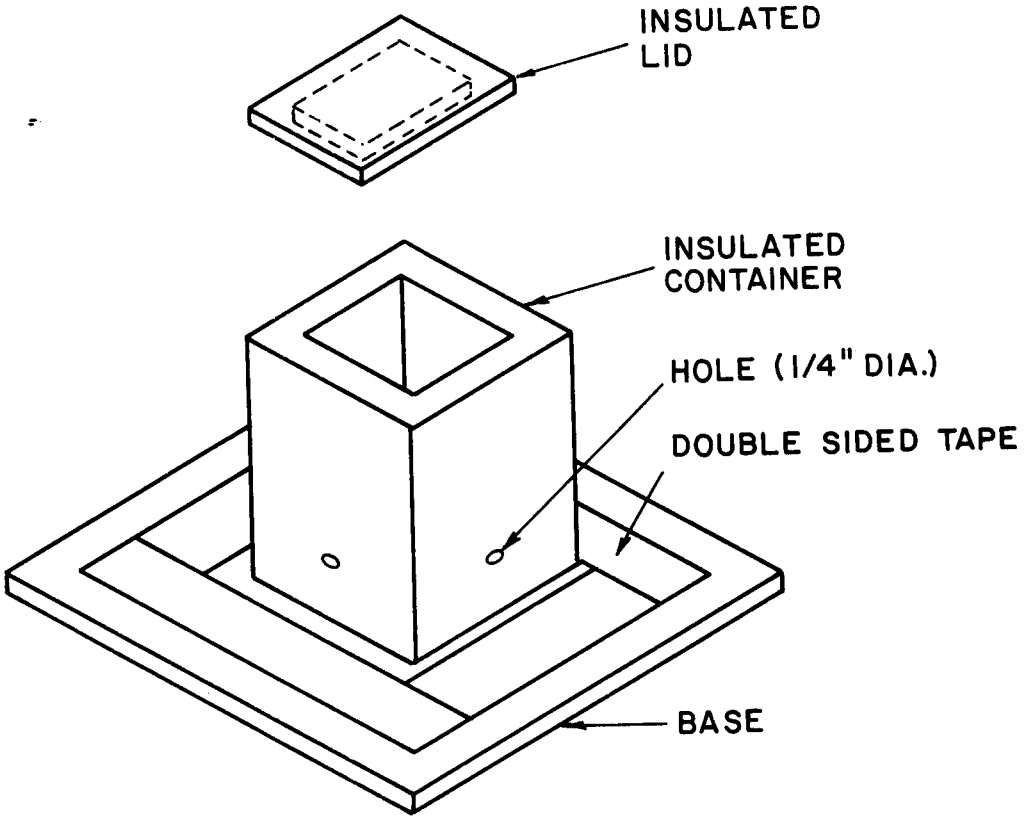

Figure 5–1. Example of a long duration CO_2 tick trap.

3 If all the dry ice is gone from the trap when returning to count ticks, do not include the data from that trap in the index calculation.

c. Preservation and shipment.

(1) Kill and preserve ticks being shipped for identification in 70 to 80 percent ethyl alcohol. Use any small screw-capped vial for shipment. Pack vials containing preserved ticks in mailing tubes and ship airmail to USAEHA (app C) for identification. Include a DA Form 8020–R (Miscellaneous Pest Collection), as shown in figure B–1, with the tick samples. This form will be locally reproduced on a 3- by 5-inch card. A copy of this form for reproduction purposes is located in the back of this bulletin. See appendix B for the general shipping instructions.

(2) Ticks may also be collected to determine the infection rate of diseases (that is, Lyme disease or Rocky Mountain spotted fever). Ticks must be alive to conduct these assays. Therefore, special shipping techniques are required to ensure survival of the ticks. Contact USAEHA (app C) or the laboratory receiving the specimens for detailed guidance before attempting to ship live ticks.

5–5. Recording surveillance data

a. The abundance of ticks is compared at different times, seasons, and years to determine the need for control measures and to monitor changes in human risk. Therefore a permanent record of all tick surveillance data is essential.

b. Maintain a file of tick surveillance data forms on DA Form 8016–R (Tick Survey Data/Tick Drag Data), DA Form 8017–R (Tick Survey Data/Carbon Dioxide Trap Data), and DA Form 8018–R (Tick Survey Data/Tick Walk Data) (as shown in figs 5–2, 5–3, and 5–4). These forms should include the date; site (grid coordinates); time(s) of surveillance; weather conditions; and species, stage, and number of ticks collected. DA Form 8016–R, DA Form 8017–R, and DA Form 8018–R will be reproduced locally on 8 1/2- by 11-inch paper. Copies for reproduction purposes are located at the back of this bulletin.

c. An index is usually calculated to average several collection sites or traps to provide a composite index for a particular area or installation. Plot the indices as a graph to help visualize changes in the tick population and detect long-term trends.

d. Thresholds for the initiation of tick control can be decided on by considering the presence of disease bearing ticks and the nature and frequency of human use of a given area. See paragraph 1–6*d* for a discussion of thresholds.

TICK SURVEY DATA/TICK DRAG DATA

For use of this form, see TB MED 561; the proponent agency is OTSG

1. DATE: 3 June

2. COLLECTOR	3. WEATHER DATA	a. TEMPERATURE	b. WIND SPEED	c. CLOUD COVER
SP Special		96	calm	10%

4. SITE NO	5. GRID	6. TIME	7. DISTANCE (PACES)	8. AREA	9. NUMBER a. LARVAE	b. NYMPHS	c. ADULTS	10. INDEX*	11. COMMENTS
1	678910	0815	20	60 sf	0	6	4	.16	
2	669012	0830	20	60 sf	0	25	6	.51	
3	789012	0845	20	60 sf	0	15	2	.28	
4	619234	0900	20	60 sf	4	15	6	.41	

*Total Number of Ticks Divided by Dragged Area

SPECIMENS SENT TO USAEHA FOR ID

12 DATE	13 SPECIES
4 June	Amblyomma americanum, Dermacentor variabilis

14 COMMENTS

SAMPLE

DA FORM 8016-R, DEC 91

Figure 5-2. Example of a filled-in tick survey data/tick drag data form.

TICK SURVEY DATA/CARBON DIOXIDE TRAP DATA

For use of this form, see TB MED 561; the proponent agency is OTSG

1. DATE: 3 July

2. COLLECTOR: SP Special

3. WEATHER DATA: a. TEMPERATURE: 96; b. WIND SPEED: calm; c. CLOUD COVER: 10%

4. SITE NO	5. GRID	6. TRAP	7. TIME a. START	7. TIME b. END	8. NUMBER a. LARVAE	8. NUMBER b. NYMPHS	8. NUMBER c. ADULTS	9. INDEX*	10. COMMENTS
1	678910	1	0815	1015	0	22	7	4.3	
		2	0820	1020	5	6	16	4.3	
		3	0825	1025	0	15	8	4.3	
2	669012	1	0915	1115	4	8	10	2.9	
		2	0920	1120	1	2	3	2.9	
		3	0925	1125	0	10	15	2.9	
3	789012	1	1015	1215	0	15	9	3.0	
		2	1020	1220	0	2	20	3.0	
		3	1025	1225	0	4	5	3.0	
		1							
		2							
		3							
		1							
		2							
		3							
		1							
		2							
		3							

*Average Number Ticks (3 Traps) Divided by Time in Hours

SPECIMENS SENT TO USAEHA FOR ID

11. DATE: 4 July

12. SPECIES: Amblyomma americanum, Dermacentor variabilis

13. COMMENTS

SAMPLE

DA FORM 8017-R, DEC 91

Figure 5–3. Example of a filled-in tick survey data/carbon dioxide trap data form.

TICK SURVEY DATA/TICK WALK DATA

For use of this form, see TB MED 561; the proponent agency is OTSG

1. DATE: 3 Aug

2. COLLECTOR: SP Special

3. WEATHER DATA

a. TEMPERATURE: 90

b. WIND SPEED: 10

c. CLOUD COVER: 50%

4. SITE NO	5. GRID	6. TIME	7. DISTANCE (PACES)	8. NUMBER a. LARVAE	8. NUMBER b. NYMPHS	8. NUMBER c. ADULTS	9. INDEX*	10. COMMENTS
1	678901	0815	35	3	6	4	.13	
2	669012	0830	35	6	25	6	.37	
3	789012	0845	35	5	15	2	.19	
4	609234	0900	35	4	15	6	.24	

*Total Number of Ticks Divided by Distance Walked

SPECIMENTS SENT TO USAEHA FOR ID

11. DATE: 4 Aug

12. SPECIES: Dermacentor variabilis

13. COMMENTS

35 paces = 100 ft.

SAMPLE

DA FORM 8018-R, DEC 91

Figure 5–4. Example of a filled-in tick survey data/tick walk data form.

Section III
Personal Protection, Control, and Important Species

5–6. Personal protective measures

The most effective and least costly protection against ticks and tick-borne diseases is the use of personal protective measures. PVNTMED personnel—

a. Initiate a public awareness program when the abundance of ticks approaches threshold levels.

b. Post warning signs surrounding high risk areas. Use DA Poster 40–5 per AR 40–5, paragraph 10–18.

c. Prepare articles for local newspaper or weekly bulletin, fliers for bulletin boards, and briefings for units and personnel entering infested areas. These articles (and briefings) should—

(1) Illustrate adults and immature ticks of the species present at the installation.

(2) Identify habitat and areas of highest tick concentration.

(3) Describe personal protective measures.

(*a*) Apply insect repellent to ankle, socks, pants cuffs, waist, fly, shirt sleeves, and neck.

(*b*) Tuck pants into socks, then into boots. If boots are not worn, tape pants closed where cuffs and shoes meet.

(*c*) Wear light-colored clothing so ticks can be spotted easily.

(*d*) Use the buddy method to check for ticks periodically (every half hour) on areas of the body that are not visible while in the infested area.

(*e*) Immediately after leaving the infested area, do a thorough check of the body (without clothing) for ticks using the buddy method or a mirror. Hairy areas should be checked closely. Bathing and close checking for ticks after each visit to infested areas are important preventive actions.

(4) Describe safe removal techniques for an attached tick. (See para 5–4*a*(3).)

(5) Warn against using flea and tick collars. Humans absorb toxins faster than dogs because humans have sweat glands and dogs do not. Dogs also have a layer of hair separating the collar from skin contact.

5–7. Tick density reduction

a. Tick harborage can be significantly reduced or eliminated by mowing. Lawns and grass in recreation areas should be maintained at a height less than 6 inches. Mowing also eliminates favorable sites for ticks to wait for a passing host and reduces host habitat and cover.

b. Removing leaf litter and underbrush helps to eliminate the tick habitat. This technique also reduces the harborage of small mammal hosts of ticks (such as mice), thereby decreasing the density of the hosts and subsequently reducing tick populations.

5–8. Pesticide application

Pesticide application should be recommended only after public awareness (for example, publicizing personal protective measures) and vegetation management have been carried out to the maximum extent possible.

a. Pesticide application may be appropriate in recreational areas and near housing (that is, areas frequented by dependents and children) and other heavily used areas, but only when the area is heavily infested with ticks and/or the possibility of disease transmission is high.

b. Ticks are very patchy in their distribution; therefore, PVNTMED personnel must provide accurate information to the IPMC when pesticide treatment is deemed appropriate. Provide exact location on a map or a sketch of tick-infested areas that require pesticide treatment.

5–9. Bionomics of important species

a. Ticks are not insects. They belong to the Class *Arachnida*, along with mites, spiders, and scorpions. Ticks are divided into two groups—

(1) *Hard ticks (Family Ixodidae).* Ticks of this family are characterized by the presence of a scutum and mouth parts that project forward. Frequently encountered hard ticks belong to three genera: *Amblyomma, Dermacentor*, and *Ixodes*. Biological data on important *Ixodidae* species are presented in table 5–1.

(2) *Soft ticks (Family Argasidae).* These ticks are characterized by the absence of a scutum and the presence of mouth parts that project downward. Soft ticks are medically important because they have painful bites and can transmit relapsing fever.

b. Hard ticks are much more abundant, usually cause greater annoyance, and are more important human disease vectors than soft ticks.

Table 5–1
Biological data on important Ixodidae ticks

Species	Habitat	Characteristics	Important diseases	Remarks
1. *Amblyomma americanum* (Lone star tick)	East of central Texas to the Atlantic coast and northward to Iowa.	Female has a conspicuous white spot at the tip of the scutum, and long mouth parts (palpi).	Rocky Mountain spotted fever and tularemia.	Its bite is quite painful and may itch for a long time.
2. *Dermacentor variabilis* (American dog tick)	Widely distributed east of the Rocky Mountains and occurs on the Pacific coast.	Dark brown with ornate markings on the scutum and short mouth parts.	Principle vector of Rocky Mountain spotted fever in the eastern portion of CONUS; also tularemia.	Can cause paralysis.
3. *Ixodes dammini* (Deer tick)	Atlantic coast from Maryland to Massachusetts and in Wisconsin and Minnesota.	Small black-brown, oval shaped, with long mouth parts.	Primary vector of Lyme disease.	
4. *Ixodes scapularis* (Black-legged tick)	Southern Atlantic coast States and throughout the South including Texas and Oklahoma.	Very similar to *Ixodes dammini.*	Carrier of Lyme disease.	

CHAPTER 6

COMMENSAL RODENTS

Section I
Commensal Rodent Surveillance

6–1. General information

a. Commensal rodents are important pests that should be routinely monitored by PVNTMED personnel. Rodents pose a significant economic and public health hazard.

b. Rats and mice are responsible for the spread of many diseases through their bites and by contamination of human food with urine or feces. Rodents also spread disease indirectly through their ectoparasites (such as fleas). These diseases include—

(1) Plague.
(2) Murine typhus fever.
(3) Rat bite fever.
(4) Salmonellosis.
(5) Leptospirosis.
(6) Trichinosis.
(7) Hemorrhagic fever.

c. Commensal rodents cause significant economic damage by—

(1) Consuming or contaminating vast quantities of food.

(2) Damaging structures and stored material by their gnawing.

d. At many U.S. Army installations it is common practice to use bait stations in warehouses for commensal rodent control on a routine, preventive basis. This practice of applying pesticide in the absence of the pest has several drawbacks, to include—

(1) Costly and time consuming.

(2) Encourages building managers to rely on chemical control methods instead of emphasizing good sanitation, harborage elimination, and exclusion.

(3) Promotes resistance to pesticides.

(4) Bait may serve as a source of food and habitat for stored product insect pests.

e. The PVNTMED services role in rodent control should be to discourage the unnecessary use of pesticides. To accomplish this, PVNTMED personnel—

(1) Enforce sanitary standards.

(2) Enforce rodent exclusion methods.

(3) Identify and prevent the development of sites that provide rodent food and harborage.

(4) Conduct rodent surveillance.

(5) Notify the appropriate organization for action when problems are encountered (that is, notify DEH to repair rodent exclusion devices or relay data to the IPMC for pesticide application).

f. Plague surveillance is not addressed in this bulletin. USAEHA TG No. 103 provides standardized plague surveillance procedures. Installations located east of the Great Plains need not be concerned with routine plague surveillance. Installations in the Plains States and in the West should contact USAEHA for guidance concerning the need for routine plague surveillance (app C).

6–2. How to establish commensal rodent surveillance

PVNTMED personnel—

a. Obtain a copy of USAEHA TG No. 138 for reference.

b. Develop a list of all potential commensal rodent infestation sites. This list should include food handling and storage facilities, landfills, stables, and kennels. Commensal rodents may be found almost anywhere that humans live and where food and harborage are available.

c. Conduct a preliminary survey at all the potential rodent infestation sites listed to identify existing rodent infestations.

d. Contact installation activities that are or should be concerned with commensal rodent control. On most installations rodent surveillance and control are conducted by personnel from different organizational elements; therefore, a successful rodent control effort requires close coordination with all personnel involved. Each person must be aware of the objectives of the surveillance program and their role in it.

(1) Meet with the IPMC to discuss—

(*a*) What is being done for rodent control on the installation.

(*b*) What criteria are used to initiate control measures.

(*c*) Whether rodent bait stations are located in warehouses.

(*d*) Whether past or present rodent control problems exist.

(2) Meet with managers from activities, such as dining facilities, AAFES, commissaries, club system, and any others that store food or generate infestable waste. Cooperation of these personnel is necessary for a successful rodent control effort.

e. Select methods and frequency for sampling the commensal rodent population. Collection of

rodents or their ectoparasites is not necessary in routine rodent surveillance. However, collection may be necessary to develop a control strategy. A wildlife biologist is on the staff at USAEHA (app C) and can provide assistance and guidance on appropriate collection techniques.

f. Initiate periodic commensal rodent surveillance that consists of routine surveys for—

(1) Presence of rodents.

(2) Favorable breeding conditions.

(3) Adequate exclusion at food handling facilities and other potential rodent concentration sites.

(4) Effectiveness of sanitary practices.

g. Develop action thresholds and control options. See paragraph 1–6*d* for a discussion on thresholds.

h. Write an SOP. Document all aspects of rodent surveillance in the SOP. See USAEHA TG No. 176 for guidance.

6–3. How to update established commensal rodent surveillance

PVNTMED personnel—

a. Annually review the list of sites receiving routine commensal rodent surveillance to identify any changes during the past year.

b. Reestablish contact, if necessary, with other installation activities that are concerned with rodent control.

c. Visit sampling sites and review frequency of collections.

d. Replace those sampling sites that are no longer appropriate.

e. Review data, thresholds, and control options. Are the thresholds and control options still appropriate?

f. Update the SOP to reflect changes.

6–4. Commensal rodent survey

a. Commensal rodents may be found almost everywhere humans live or work. The availability of food and harborage determines the magnitude of a rodent problem. Rodents are nocturnal and secretive animals and are rarely seen during the day except when infestations are heavy.

b. Commensal rodents leave a variety of signs in the areas they frequent. Survey personnel should be on the lookout for the following signs that indicate their presence.

(1) *Sounds.* Sounds of gnawing, scratching, squeaking, and running in walls and above ceilings can be heard in buildings infested by rodents.

(2) *Droppings.* Droppings (feces) are found in places rats and mice frequent. Mouse droppings are similar to those of bats and some insects; rat droppings are larger. Only fresh droppings are soft. Norway rat droppings are capsule shaped, 1/4- to 3/4-inch long and 1/16- to 1/4-inch in diameter. Roof rat droppings are spindle shaped and up to 1/2-inch long. Mouse droppings are rod shaped and 1/8- to 1/4-inch long.

(3) *Urine.* Rodent urine is not visible on all materials under natural light. Under ultraviolet light it fluoresces bluish white to yellowish white. Other materials such as lubricating oils and the optical bleaches found in many detergents also fluoresce.

(4) *Rub marks.* Rodents accumulate dirt and oil deposits on their fur. As they travel, they leave smudges where they rub against pipes, beams, and openings. Rat smudges are much more conspicuous than those left by mice.

(5) *Runs and trails.* Runs occur in sheltered areas where rodents feel secure as they move. They appear as dust-free pathways within buildings or beaten paths outdoors. Like smudge marks, rat trails are more conspicuous than those made by mice.

(6) *Tracks.* Footprints and tail marks may be found in dust and mud. Tracking patches made with flour or talc can be used to determine rodent presence in buildings. Dry soil dust can be used outdoors if it is protected from weather and disturbance.

(7) *Odor.* Mice produce a musky odor which an experienced person can differentiate from rat odor. Odor is probably not detectable when the population is low and ventilation is good.

(8) *Gnawing.* Rodent gnawing results in small piles of wood chips around doors, baseboards, and windows; damage to stored goods and food product containers; and enlarged openings where pipes and wires penetrate walls. Freshly gnawed areas are lighter in color than the ungnawed material, and tooth marks may be apparent.

(9) *Burrows.* Holes and enlarged openings in walls are often burrow entrances. Norway rat burrows may be found around shrubbery and sidewalks, under foundations, and along stream banks.

(10) *Nests and food caches.* Mouse and rat nests, usually in the form of a loose ball of shredded cloth, insulation, paper, or dry vegetation, may be found during cleaning of garages, attics, and other storage areas. Nests are often built in furniture, inside large electrical appliances, and in vehicles that have been parked for more than a few days. Rat and mouse food caches may be found during clean-up operations.

c. Besides looking for signs of rodents, a commensal rodent survey should include identification of conditions favorable to an existing or potential rodent infestation such as harborage, sources of food and water, and structural defects which facilitate rodent movement.

(1) *Building exteriors.* Survey the building exterior, making a complete circle of the facility. Inspect—

(*a*) Vegetation (including trees, shrubs, vines, weeds, and so forth) that provides cover for rodents approaching the building.

(*b*) Foundation, sidewalk, and driveway edges that are under shrubs which may conceal burrow openings.

(*c*) Doors and windows, looking for signs of gnawing.

(*d*) Wires, pipes, and drainspouts that have rub marks (used as access routes).

(*e*) Wall and roof vents that are unscreened.

(*f*) Unattended or infrequently used doors that are left open.

(*g*) Garbage near doorways not in rodent proof containers.

(2) *Building interiors.* Survey the building interior, starting in the basement and working up to the roof. Inspect—

(*a*) Areas infrequently visited by people, such as closets, utility chases and access tunnels; walls, floors, and ceiling voids; above suspended (false) ceilings; and areas around heating, cooling, and ventilation systems. Also inspect the area immediately under, on top of, and behind appliances. Pay special attention to cluttered areas.

(*b*) Holes (any opening over 1/4 inch) and gnawing where pipes and wires pass through walls, floors, or ceilings. Also, inspect around doors, and at the base of walls. Look for broken or missing floor drain covers and vent screening, which may allow rodents access to the building.

(*c*) Food storage locations. Look for spilled food, damaged food containers, non-rodent proof food storage, and plumbing leaks and condensation. Inspect dumpsters or other trash and garbage disposal systems.

d. A flashlight is essential for conducting rodent surveys since signs of rodents are most often found in poorly lighted locations. A survey checklist or notebook is also required for maintaining a complete and permanent record of findings. Other equipment that is often useful includes: an ultraviolet light for detecting rodent urine, and powder (flour and talc) for determining current activity level in runs.

Section II
Sampling Methods and Surveillance Data

6–5. Commensal rodent sampling methods

a. Before a commensal rodent control strategy can be developed, it is necessary to determine—

(1) Species present.

(2) Approximate size of the rodent population.

(3) Its distribution within the available habitat.

b. Trapping provides the most realistic assessment of a rodent population. Effective trapping depends on placing the traps where the rodents will contact them. Therefore, the IPMC and wildlife biologist at USAEHA may be contacted for guidance before trapping (app C).

(1) The best locations for traps are against walls, behind or under objects, and other places where rodents seeking concealment might go.

(2) Trapping should be conducted on 3 consecutive nights.

(3) Live traps and glueboards are not recommended due to the problem of disposal of live specimens. Each method requires experienced personnel to operate effectively.

(4) Collect dead rodents in plastic bags when servicing traps. Be sure to wear gloves when handling them. Dispose of the dead rodents in the landfill or by incineration.

c. An existing rodent population can be monitored by measuring consumption of non-toxic baits at bait stations or by tracks in a tracking powder.

d. Use USAEHA TG No. 138 for rodent identification. If rodents cannot be identified as to species, contact USAEHA (app C). Have the following measurements (in mm) available before making the call:

(1) Total length.

(2) Length of tail.

(3) Length of hind foot.

(4) Length of ear from notch to tip.

6–6. Recording surveillance data

a. Keep a permanent record of all commensal rodent surveillance data. Maintain a file of rodent survey forms on DA Form 8019–R (Rodent Survey), as shown in figure 6–1, that provide a record of sanitation and exclusion conditions at each facility when it was surveyed. DA Form 8019–R will be reproduced locally on 8 1/2- by 11-inch paper. A copy for reproduction purposes is located at the back of this bulletin.

b. The number and species of rodents trapped should be maintained since these data are necessary to estimate the population size and to monitor

RODENT SURVEY

For use of this form, see TB MED 561; the proponent agency is OTSG

1. BUILDING	2. ORGANIZATION	3. DATE
5454	1st Bn / 1st Inf.	26 July
4. TIME	**5. PERSON CONTACTED**	**6. SURVEY OFFICER**
0900	SGT Cook	SP Special

PART I - BUILDING INTERIOR

SECTION A - SANITATION

7. SANITARY CONDITIONS *(check one)*				8. SPILLED FOOD	9. RODENT-PROOF CONTAINERS	10. DAMAGED FOOD CONTAINERS
a. VERY GOOD	b. GOOD ✓	c. FAIR	d. POOR	☒ YES ☐ NO	☐ YES ☒ NO	☐ YES ☒ NO
11. PLUMBING LEAKS AND CONDENSATION ☐ YES ☒ NO				12. OTHER		

SECTION B - HARBORAGE

13. HARBORAGE CONDITIONS *(check one)*			14. ACCUMULATED DEBRIS	15. MATERIAL STORED NEXT TO WALLS	16. HOLES IN WALLS
a. MINIMAL	b. MODERATE ✓	c. AMPLE	☐ YES ☒ NO	☒ YES ☐ NO	☒ YES ☐ NO
17. ENLARGED HOLES AROUND PIPES AND DOORS ☐ YES ☒ NO			18. OTHER		

SECTION C - RODENT SIGNS

19. KIND *(check one)*		20. DEAD/LIVE RODENTS	21. TRACKS/TRAILS/RUB MARKS	22. DROPPINGS/ URINE	23. NESTS
a. MICE	b. RATS	☐ YES ☒ NO	☐ YES ☒ NO	☐ YES ☒ NO	☐ YES ☒ NO
24. ODORS ☐ YES ☒ NO	25. GNAWING ☐ YES ☒ NO	26. OTHER			
27. REMARKS					

PART II - BUILDING EXTERIOR

28. GENERAL CONDITIONS *(check one)*			SECTION A - DUMPSTER/REFUSE CONTAINERS				
a. GOOD ✓	b. FAIR	c. POOR	30. DIRTY	31. DRAIN PLUGS MISSING	32. LIDS		
29. FOOD/WATER AVAILABILITY *(check one)*					a. MISSING	b. NOT TIGHT FITTING	c. NOT OPERABLE
a. VERY GOOD ✓	b. GOOD	c. FAIR d. POOR	☐ YES ☒ NO	☒ YES ☐ NO			

SECTION B - HARBORAGE

33. HARBORAGE CONDITIONS *(check one)*			34. STORED MATERIALS	35. RUBBISH/TRASH/ JUNK	36. TALL GRASS/ WEED	37. SHRUBS/ TREES/VINES
a. MINIMAL ✓	b. MODERATE	c. AMPLE	☐ YES ☒ NO	☐ YES ☒ NO	☐ YES ☒ NO	☐ YES ☒ NO

SECTION C - RODENT ACCESS *(Check one)*

38. GAP *(1/4")* UNDER DOORS	39. DOORS LEFT OPEN ✓	40. OTHER	41. NO SCREENING		
			a. CRAWL SPACE	b. VENTS	c. OTHER MEANS OF ENTRY
42. ENLARGED HOLES AROUND		a. PIPES	b. DOORS	c. WINDOWS	

SECTION D - RODENT SIGNS

43. KIND *(check one)*		44. DEAD/LIVE RODENTS	45. TRACKS/TRAILS/RUB MARKS	46. DROPPINGS/ URINE	47. NESTS
a. MICE	b. RATS	☐ YES ☒ NO	☐ YES ☒ NO	☐ YES ☒ NO	☐ YES ☒ NO
48. BURROWS ☐ YES ☒ NO	49. GNAWING ☐ YES ☒ NO	50. OTHER			
51. REMARKS					

SAMPLE

DA FORM 8019-R, DEC 91

Figure 6–1. Example of a filled-in rodent survey form.

fluctuations in the population. A graph showing changes in the population level and dates of pesticide applications is often helpful.

c. Commensal rodent surveillance data can provide information about rodent infestations:

(1) Presence or absence of rodents is the most obvious indication.

(2) When the species is known, the surveillance and control effort can be adjusted to the habits of the rodent species present.

(3) Changes in population levels over a long period of time—

(*a*) Give a general indication of the effectiveness of the rodent management program.

(*b*) Show which methods of control were most beneficial.

(*c*) Pinpoint areas where more emphasis is needed.

Section III
Control Recommendations and Important Species

6–7. General information

a. Conditions favorable to commensal rodent infestation must never be allowed to persist. PVNTMED personnel must enforce sanitation standards that prevent or eliminate rodent food sources.

b. When the results of surveillance show that rodents are present, elimination of food and harborage conditions favorable to rodent infestation should be the first control action taken.

c. Rodent exclusion (rodent proofing) to prevent movement of rodents into a facility should be considered a prerequisite to chemical control. See USAEHA TG No. 138 for detailed guidance on rodent proofing techniques.

d. Review previous control efforts and results in order to—

(1) Avoid recommending solutions that have been ineffective.

(2) Identify control methods that may have failed because of incorrect application.

(3) Identify unique situations that require special study or non-standard control methods.

e. PVNTMED personnel must provide accurate and prompt reporting when pesticide treatment is deemed appropriate. Ensure that all pertinent information is provided, such as where the rodents have been found, what species, and how many. See USAEHA TG No. 138 for detailed guidance on rodent population reduction.

6–8. Bionomics of important species

a. The three important commensal rodents are the—

(1) Norway rat, *Rattus norvegicus.*

(2) Roof rat, *Rattus rattus.*

(3) House mouse, *Mus musculus.*

b. See USAEHA TG No. 138 for detailed guidance on the bionomics of commensal rodents.

CHAPTER 7

OTHER MEDICAL PESTS

7–1. General information

a. There are many other medically important pests that affect the health and welfare of an installation population such as:

(1) Lice.
(2) Stored product pests.
(3) Biting flies.
(4) Mites.
(5) Fleas.
(6) Venomous arthropods.
(7) Birds and bats.

Although routine surveillance of these pests is generally not necessary, PVNTMED personnel must be familiar with and be prepared to conduct surveillance in response to complaints or a public health emergency.

b. PVNTMED personnel—

(1) Develop a list of all medically important or annoying pests believed to have the potential to occur on their installation.

(2) Prepare SOPs for each and make them available for use by PVNTMED personnel in case a problem arises involving any of these pests.

(3) Obtain and use a copy of TM 5–632/NAVFAC MO–310/AFM 9–16.

c. Entomologists are on the staff at USAEHA and can provide guidance on appropriate surveillance techniques (app C).

7–2. Lice

a. Lice do not require surveillance by PVNTMED personnel. Health care professionals (physicians, nurses) are responsible for conducting examinations for lice. PVNTMED personnel, however, may be called on to assist during outbreaks (for instance, an outbreak of head lice among school children).

b. The presence of lice on any part of the body is called pediculosis and treatment must be prescribed by a physician. Therefore, any persons found to be infested with lice should be referred to a physician.

c. PVNTMED personnel will conduct mass delousing, if required.

d. If an outbreak of lice occurs, PVNTMED personnel—

(1) Initiate a public awareness program.

(2) Prepare articles for the local newspaper or weekly bulletin, fliers for bulletin boards, and briefings for units and personnel entering infested areas. In these articles (and briefings)—

(*a*) Explain that a louse infestation—

1 Is not a sign of being dirty.

2 Can happen to anybody anytime.

3 Can be completely eliminated with proper treatment.

4 Must be treated promptly because it will spread quickly.

(*b*) Describe signs of louse infestation—

1 Persistent itch, often with infected scratches or rash.

2 Small silvery egg cases attached to individual hairs.

3 Swollen lymph glands in neck or under arms.

(*c*) Discourage personnel from sharing personal articles, such as combs, hats, towels, bedding, and clothing.

(*d*) Address all family members or personnel in the barracks.

e. Concurrent to the disinfection process (shampooing and combing), to destroy lice and their eggs—

(1) Launder all clothing, towels, and bed linens used by the infested person(s) in very hot water (for example, 140 °F for 20 minutes).

(2) Soak brushes and combs in very hot water or treatment shampoo.

f. Pesticide treatment of a building (such as a barracks or family housing) for louse control is not needed and should not be recommended because lice die soon after leaving the host.

7–3. Stored product pests

a. Stored product pest surveillance is the responsibility of the installation veterinary service.

b. PVNTMED personnel conduct a joint survey with veterinary service personnel of food storage areas as often as necessary or at least twice per year.

c. USAEHA performs identification services (app C). Ship specimens according to the instructions in appendix B.

7–4. Biting flies

a. Biting flies can inflict painful bites and can be serious pests but are generally not important disease vectors, at least in CONUS. Flies included in this group are—

(1) Horse and deer flies (family *Tabanidae*).
(2) Black flies (family *Simuliidae*).
(3) Sand flies (family *Psychodidae*).

(4) Biting midges (family *Ceratopogonidae*).

(5) Stable flies (family *Muscidae* (table 4–1).

b. Adult biting or landing rate counts to evaluate complaints are the recommended surveillance technique for biting flies. The biology of the species involved must be understood before initiating surveillance other than biting counts.

c. Repellents are effective against biting flies. Repellents and physical barriers (for example, headnets) are methods available to ease the annoyance of biting flies.

d. It is difficult to control biting flies because their developmental sites are in environmentally sensitive aquatic and semi-aquatic habitats. Extensive areas would have to be treated which may cause undesirable environmental side effects. Pesticide treatment can temporarily reduce adults in an area but should only be used when large numbers are present and are causing significant annoyance.

7–5. Mites

a. Scabies is an important disease caused by mites and is transmitted by intimate personal contact or by sharing infested clothing, towels, or bedding. Treatment for scabies must be prescribed by a physician.

b. The most common mite problem encountered by PVNTMED personnel is caused by chiggers (*Trombicula* spp.). Chiggers are not important disease vectors in CONUS, but are often encountered in installation training areas. Chiggers can be very annoying and cause dermatitis and severe itching.

(1) Surveillance consists of making counts of chiggers that have been attracted to a 12-inch square glass plate that has been painted black. Lay the glass plate flat in a likely chigger habitat and count at specific intervals. If a glass plate is unavailable, you can use sheet metal, plywood, or cardboard.

(2) Chiggers are commonly found in damp, shady areas, with grass, brush, rotten logs, and tree stumps.

(3) Chigger populations can be significantly reduced by cultural practices such as—

(*a*) Keeping vegetation short to permit sunlight and air to circulate freely, drying the chigger habitat.

(*b*) Eliminating the habitat of vertebrate hosts (that is, rodents and birds).

(4) Wide scale pesticide application for control of chiggers is not warranted.

(5) Survey personnel must practice personal protective measures during and after surveillance activities. They may attract more chiggers than the survey technique. These measures include—

(*a*) Tucking pants into socks and boots and then taping the pants-to-boot interface.

(*b*) Spraying clothing (especially pants-to-boot interface) with repellent to provide additional protection, and applying topical repellent to skin.

(*c*) Bathing soon after the survey is completed.

(6) The public awareness program maintained by PVNTMED personnel when chiggers are abundant should include—

(*a*) Guidance to use repellents and other personal protective measures (discussed in para (5) above) which are an effective way to prevent attack and ease the annoyance of chiggers.

(*b*) Warnings against using flea and tick collars. Humans absorb toxins faster than dogs because humans have sweat glands and dogs do not. Also, dogs have a layer of hair separating the collar from skin contact.

c. Mites can also be a problem in buildings that are infested with vertebrate hosts such as birds (especially pigeons) and rodents. Mites from these animals or their nests may attack building occupants causing dermatitis. Control of vertebrate hosts infesting structures followed by control of mites left behind is the appropriate recommendation.

d. Other species of mites that will cause dermatitis are picked up during casual contact with animal hosts.

7–6. Fleas

a. Fleas are important vectors of diseases such as plague and typhus, and intermediate hosts of certain tapeworms which may parasitize humans. Flea bites can be very annoying and may produce dermatitis in hypersensitive individuals.

b. Household annoyance caused by the cat flea, *Ctenocephalides felis*, is the most common flea related problem that will be encountered by PVNTMED personnel.

(1) Household pets, namely cats and dogs, are the preferred hosts of these fleas, but they will readily bite humans when their preferred host is not available. Flea breeding will occur anywhere the pets sleep or rest such as carpets, overstuffed furniture, and the pet's bedding.

(2) A flea survey should be conducted to confirm the presence of fleas before recommending treatment. To construct a flea trap (fig 7–1)—

(*a*) Use a one gallon plastic jug. Cut out the sides of the jug to approximately one inch from the bottom of the container.

(*b*) Use a small light source such as a night light. Mount the light in the lid or mouth of the jug.

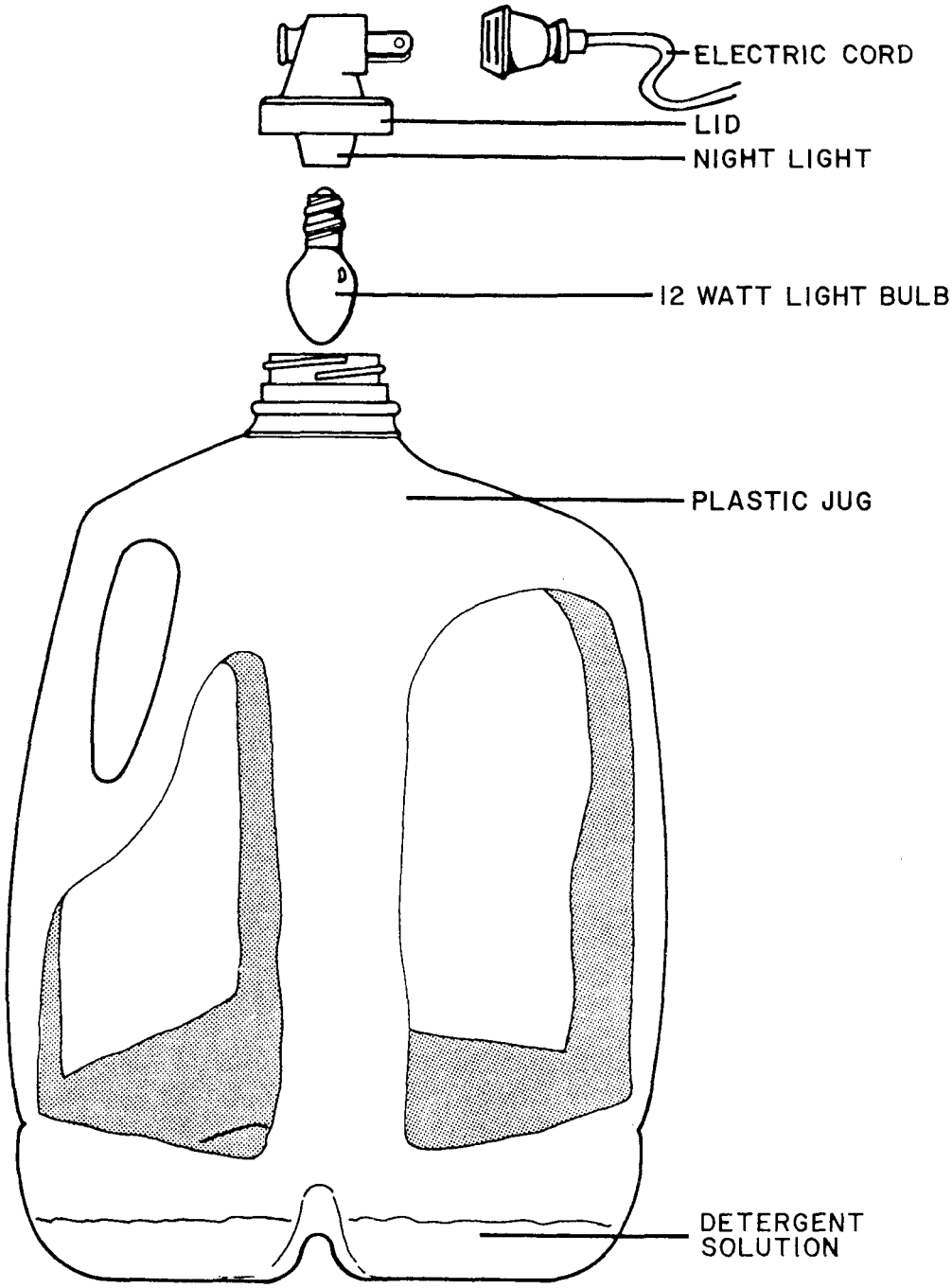

Figure 7–1. Flea trap constructed from a plastic jug.

(*c*) Place the trap in a suspected flea breeding area and fill the bottom of the trap with soapy water.

(*d*) Fleas are attracted to the light at night and will be caught by the trapping medium.

(*e*) Sticky fly paper or the bottom of a cockroach sticky trap placed under a light (located 6 inches above the surface) can also be used as a flea trap.

(*f*) Do not use this trap in areas where it might be disturbed by children or animals.

(3) Pesticides control fleas. Treat both the pet and the premises at the same time for effective control.

(*a*) Before applying a pesticide, vacuum the infested area thoroughly and, where possible, launder the pet's bedding in hot soapy water.

(*b*) When the control of fleas in installation facilities and residences is necessary, contact the IPMC. Identify locations which are frequented by the pets. However, sanitary practices and treatment of pets is the owners' responsibility.

c. Although plague epidemics in urban areas have not occurred in the United States during recent years, plague exists in the wild rodent populations in States west of Texas. Human cases of plague have resulted from contact with wild animals and their fleas.

(1) See paragraph 6–1*f* for plague surveillance.

(2) Many species of fleas are important in the transmission of plague in wild rodent populations. PVNTMED personnel should be familiar with the common fleas of wild rodents on their installation. The oriental rat flea, *Xenopsylla cheopis*, is the most important vector of bubonic plague and is closely associated with commensal rodents.

(3) When involved in plague outbreaks, always kill fleas prior to killing mammalian hosts.

d. Fleas can also be a problem in buildings that are infested with vertebrate hosts such as birds and rodents. Control of vertebrate hosts infesting structures followed by control of the fleas left behind is the appropriate recommendation.

e. Control of domestic and feral cats and dogs is important to the reduction of flea populations on all DOD installations. Local regulations on these animals which are written by the veterinarian, military police, the DEH, and PVNTMED service should be enforced.

7–7. Venomous arthropods

a. Venomous arthropods of local concern, such as the brown recluse spider, should receive priority attention due to the seriousness of the venom reaction. Other venomous arthropods, such as bees, wasps, fire ants, and spiders, can be a public health nuisance because of their painful stings. Medical importance is limited to the relatively few persons who are hypersensitive to the venom of these arthropods.

b. PVNTMED personnel evaluate complaints by inspecting typical habitats or searching for nests of the arthropod for which the complaint was received.

c. PVNTMED personnel provide location of nests to the IPMC and recommend control when large numbers are present and causing significant annoyance or when a hypersensitive person is at risk.

7–8. Birds and bats

a. Birds and bats are not usually considered medical pests. However, they can become a public health nuisance if they infest a structure in large numbers. Generally they become a problem in structures that are abandoned or in a poor state of repair. Bird and bat parasites, such as mites and fleas, may invade the inhabited areas of the structure (paras 7–5 and 7–6) and attack human occupants.

b. Histoplasmosis and cryptococcoses are diseases that may be present in bird and bat manure or in soil enriched by their manure. Disturbing the manure or soil can cause spores to become airborne. As a result, clean up is expensive and hazardous. See USAEHA TG No. 142 for detailed assistance.

c. Bats may be reservoirs of rabies. While the veterinarian has primary responsibility for rabies control, DEH workers and quarters occupants must be cautioned to exercise care in removal of bats.

d. PVNTMED personnel should notify the IPMC when bird or bat problems are encountered. This person will coordinate repair to infested buildings and control of the birds or bats, if required, followed by control of the parasites left behind.

APPENDIX A

REFERENCES

A–1. Army Regulations

AR 40–5 ..... Preventive Medicine

AR 420–76 ..... Pest Management

A–2. Other Publications

DOD Directive 4150 ..... Department of Defense Pest Management Program (Copies may be obtained from Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120–5099, DSN telephone number 442–3321.)

FM 8–250 ..... Preventive Medicine Specialist

HSC Pamphlet 40–3 ..... Environmental Health Program (Copies may be obtained from Commander, U.S. Army Health Services Command, ATTN: HSIM–S, Fort Sam Houston, TX 78234–6000.)

TM 5–632/NAVFAC MO–310/ AFM 9–16 ..... Military Entomology Operational Handbook

A–3. USAEHA Technical Guides

(Copies may be obtained from the Commander, U.S. Army Environmental Hygiene Agency, ATTN: HSHB–CI–O, Aberdeen Proving Ground, MD 21010–5422.)

USAEHA TG No. 103 ..... Plague Surveillance Guide

USAEHA TG No. 138 ..... Guide to Commensal Rodent Control

USAEHA TG No. 142 ..... Management of Bird and Bat Manure

USAEHA TG No. 174 ..... Personal Protective Techniques Against Insects and Other Arthropods of Military Significance

USAEHA TG No. 176 ..... How to Write and Manage Standing Operating Procedures (SOP)

A–4. Prescribed Forms

DA Form 8010–R ..... Mosquito Collection Sites. (Prescribed in para 2–4*d*.)

DA Form 8011–R ..... Mosquito Surveillance Light Trap Collections. (Prescribed in para 2–8*b*.)

DA Form 8012–R ..... Mosquito Surveillance Larval Collections. (Prescribed in para 2–8*b*.)

DA Form 8013–R ..... Cockroach Collection Sites. (Prescribed in para 3–4*d*.)

DA Form 8014–R ..... Cockroach Survey. (Prescribed in para 3–6*a*(1).)

DA Form 8015–R ..... Filth Fly Survey. (Prescribed in para 4–6*a*(1).)

DA Form 8016–R ..... Tick Survey Data/Tick Drag Data. (Prescribed in para 5–5*b*.)

DA Form 8017–R ..... Tick Survey Data/Carbon Dioxide Trap Data. (Prescribed in para 5–5*b*.)

DA Form 8018–R ..... Tick Survey Data/Tick Walk Data. (Prescribed in para 5–5*b*.)

DA Form 8019–R ..... Rodent Survey. (Prescribed in para 6–6*a*.)

DA Form 8020–R ..... Miscellaneous Pest Collection. (Prescribed in para 5–4*c* and B–1*g*.)

DA Form 8021–R ..... Miscellaneous Pest Identification. (Prescribed in para B–1*h*.)

DA Form 8022–R ..... Adult Mosquito Identification. (Prescribed in para B–3*e*.)

DA Form 8023–R ..... Adult Mosquito Collection. (Prescribed in para B–3*d*.)

DA Form 8024–R ..... Larval Mosquito Collection. (Prescribed in para B–4*g*.)

DA Form 8025–R ..... Larval Mosquito Identification. (Prescribed in para B–4*h*.)

DA Form 8026–R ..... Mosquito Egg Collection. (Prescribed in para B–5*d*.)

DA Form 8027–R ..... Mosquito Egg Identification. (Prescribed in para B–5*e*.)

A–5. Referenced Form

DD Form 1532 ..... Pest Management Report (RCS DD–M(A&AR)1080). (AR 420–76.)

A–6. Poster

DA Poster 40–5 ..... Lyme Disease

A–7. Selected Bibliography

Bram, Ralph A., ed. *Surveillance and Collection of Arthropods of Veterinary Importance*, Agriculture Handbook No. 518. APHIS, ARS, USDA, 1978.

Burns, B. *The Invisible Enemy: Cockroach Allergies*. Pest Control Technology, June 1987.

Darsie, R. F., and R. A. Ward. *Identification and Geographical Distribution of the Mosquitoes of North America, North of Mexico*. Mosq. Syst. Supplement 1:1–313, 1981.

Harwood, R. F., and M. T. James. *Entomology In Human and Animal Health*, New York: Macmillan Publishing Co., 1979.

Howard, W. E., and R. E. Marsh. *Rodent Control Manual, Pest Control*, 1974.

Keiding, J. *The House Fly—Biology and Control*, WHO/VBC/76.650, 1976.

Marsh, R. E., and W. E. Howard. *House Mouse Control Manual, Pest Control*, 1976.

Mosquito Surveillance Guide, 1986 Edition, Navy Environmental Health Center, Naval Station, Norfolk, VA.

Pratt, H. D. *Mites of Public Health Importance and Their Control*, DHEW Publication No. (CDC) 75–8297, 1975.

Pratt, H. D., B. F. Bjornson, and K. S. Littig. *Control of Domestic Rats and Mice*, DHEW Publication No. (CDC) 76–8141, 1976.

Pratt, H. D., K. S. Littig, and H. G. Scott. *Flies of Public Health Importance and Their Control*, DHEW Publication No. (CDC) 79–8218, 1978.

Pratt, H. D., and Harold E. Stark. *Fleas of Public Health Importance and Their Control*, DHEW Publication No. (CDC) 79–8267, 1979.

Ticks of Public Health Importance and Their Control, DHEW Publication No. (CDC) 78–8142, 1978.

Wood, F. E., W. W. Robinson, Sandra K. Kraft, and Patricia A. Zungoli. *Survey of Attitudes and Knowledge of Public Housing Residents Toward Cockroaches*. Bulletin Entomological Society of America. 27(1):9–13, 1981.

APPENDIX B

SHIPPING INSTRUCTIONS

Section I
General Shipping Instructions

B–1. General guide for shipping arthropods to USAEHA for identification

a. Process specimens (for example, sort, count, and record data) and ship on the day that they are collected. Timely identifications cannot be guaranteed if there is a time lag between the day of collection and the day of shipment.

b. Label specimen containers or vials with—

(1) Collection date.

(2) Installation.

(3) Collection site.

(4) Collector's name.

(5) Common name (suspected species, if known).

(6) Any other information necessary to positively identify their origin.

c. Place hard bodied (adult) specimens in pill boxes or plastic Petri dishes between layers of tissue paper (do not use absorbent cotton) in such a manner that specimens do not touch each other. Cut each layer of tissue paper to fit the container. Add sufficient layers of tissue paper to fill the container and hold the specimens in place to prevent damage during shipment.

CAUTION

Do not overpack the container, specimens may be crushed.

d. Preserve soft bodied (larval), tick, and flea specimens in a mixture of 5 parts of 70 percent isopropyl alcohol and 1 part glacial acetic acid. Completely fill the tubes or vials with the alcohol-acetic acid mixture to eliminate bubbles thus preventing specimen movement and damage. If glacial acetic acid is not available, use a solution of 75 to 80 percent ethanol.

e. If more than one container is required to accommodate all the specimens collected, include the following on the label: 1 of 3, 2 of 3, etc. Personnel at USAEHA will know from this information to include three containers in the sample.

f. Individually wrap each glass tube in cotton before placing them in the mailing case. When shipping specimens, use mailing case liners to reduce shock.

g. Enter collection data on a DA Form 8020–R (Miscellaneous Pest Collection) that will be reproduced locally on a 3- by 5-inch card (see fig B–1 for an example). A copy for reproduction purposes is located at the back of this bulletin. A new form is required for each collection site. Include the DA Form 8020–R in the shipping container.

h. USAEHA will return two copies of a DA Form 8021–R (Miscellaneous Pest Identification) to the installation submitting the collection (see fig B–2 for an example). The DA Form 8021–R will be reproduced locally. A copy for reproduction purposes is located at the back of this bulletin. File

MISCELLANEOUS PEST COLLECTION

For use of this form, see TB MED 561; the proponent agency is the OTSG

1. INSTALLATION		2. COLLECTION NUMBER
Ft. America		6
3. COLLECTION DATE	4. HABITAT/HOST	5. DENSITY
3 Aug	woods	10 / 60 sq. ft.
6. COLLECTION METHOD	7. COLLECTOR	
tick drag	SP Special	
8. REMARKS	Dermacentor variabilis :	
3 male , 1 female , 6 immature		
9. NEEDED SUPPLIES		

SAMPLE

DA FORM 8020-R, DEC 91

Figure B–1. Example of a filled-in miscellaneous pest collection form.

MISCELLANEOUS PEST IDENTIFICATION

For use of this form, see TB MED 561; the proponent agency is the OTSG

1. INSTALLATION	2. COLLECTION NUMBER	3. COLLECTION DATE
Ft America	6	3 Aug

4. HABITAT/HOST	5. DENSITY
woods	10 per 60 sq ft

6. COLLECTION METHOD	7. COLLECTOR
Tick Drag	SP Special

8. REMARKS

9. SPECIES IDENTIFIED	10. NUMBER		
	a. MALE	b. FEMALE	c. IMMATURE
Dermacentor variabilis	3	1	6

11. IDENTIFIED BY	12. DATE
SP Ident	10 Aug

SAMPLE

DA FORM 8021-R, DEC 91

Figure B-2. Example of a filled-in miscellaneous pest identification form.

one copy with the installation PVNTMED services; the other copy may be forwarded to any other interested activity (for example, the IPMC).

i. Check with the laboratory that will receive the specimens to obtain necessary shipping permits or special handling procedures required when shipping live specimens.

B–2. Items commonly used for shipment of all types of specimens

a. Acetic Acid	NSN 6505–00–100–2470
b. Isopropyl Alcohol	NSN 6505–00–261–7256
c. Cotton, Purified	NSN 6510–00–201–4000
d. Culture Tube	NSN 6640–00–443–4650
e. Dish, Culture, Petri	NSN 6640–00–851–9495
f. Tube, Mailing	NSN 8110–00–412–4060
g. Box, Pill	NSN 8115–00–469–0750
h. Box, Set-Up, Mail Dental	NSN 8115–00–511–5750
i. Tissue, Facial	NSN 8540–00–281–8360

Section II
Specific Shipping Instructions

B–3. Shipping adult mosquitoes for identification

a. Sort, record, and ship the light trap and resting station specimens on the day that they are collected. Process, record, and ship the landing count collections within 24 hours of collection. Accumulated collections cause unnecessary lag between the day of collection and receipt of identifications.

b. To separate mosquitoes from other entomological specimens and debris—

(1) Empty the contents of the killing jar on a sheet of white paper.

(2) Use fine forceps to sort mosquitoes. Mosquito species vary greatly in size; therefore, do not rely on size alone for sorting out and making a preliminary identification of adult mosquitoes. There are many insects that closely resemble mosquitoes, such as the smaller flies and midges. When in doubt on whether a specimen is a mosquito or not, include it with the group of insect specimens to be sent to USAEHA for identification.

c. After separating adult mosquitoes from other insects—

(1) Place them so they are not touching each other in pill boxes or plastic Petri dishes between layers of tissue paper (not absorbent cotton) cut to fit the container.

(2) Add sufficient layers of tissue paper to fill the container and hold the specimens in place to prevent movement and damage during shipment.

CAUTION

Do not overpack the container, specimens may be crushed.

(3) Label each specimen container with information necessary to positively identify it to the appropriate DA Form 8023–R (Adult Mosquito Collection).

d. Enter collection data from adult collections on DA Form 8023–R (see fig B–3 for an example) that will be reproduced locally on a 3- by 5-inch card. A copy for reproduction purposes is located at the back of this bulletin. A new form is required for each site. Include the DA Form 8023–R in the shipping container.

ADULT MOSQUITO COLLECTION
For use of this form, see TB MED 561; the proponent agency is the OTSG

1. INSTALLATION: Ft. America
2. COLLECTION NUMBER: 3
3. COLLECTION DATE: 3 June
4. COLLECTION METHOD: New Jersey light trap
5. COLLECTOR: SP Special, PVNTMED
6. REMARKS: males / females not separated.

SAMPLE

7. NEEDED SUPPLIES: Please send shipping tubes.

DA FORM 8023-R, DEC 91

Figure B–3. Example of a filled-in adult mosquito collection form.

e. USAEHA will return two copies of a DA Form 8022–R (Adult Mosquito Identification) to the installation submitting the collection (see fig B–4 for an example). The DA Form 8022–R will be reproduced locally. A copy for reproduction purposes is located at the back of this bulletin. File one copy with the installation PVNTMED services; the other copy may be forwarded to any other interested activity (for example, the IPMC).

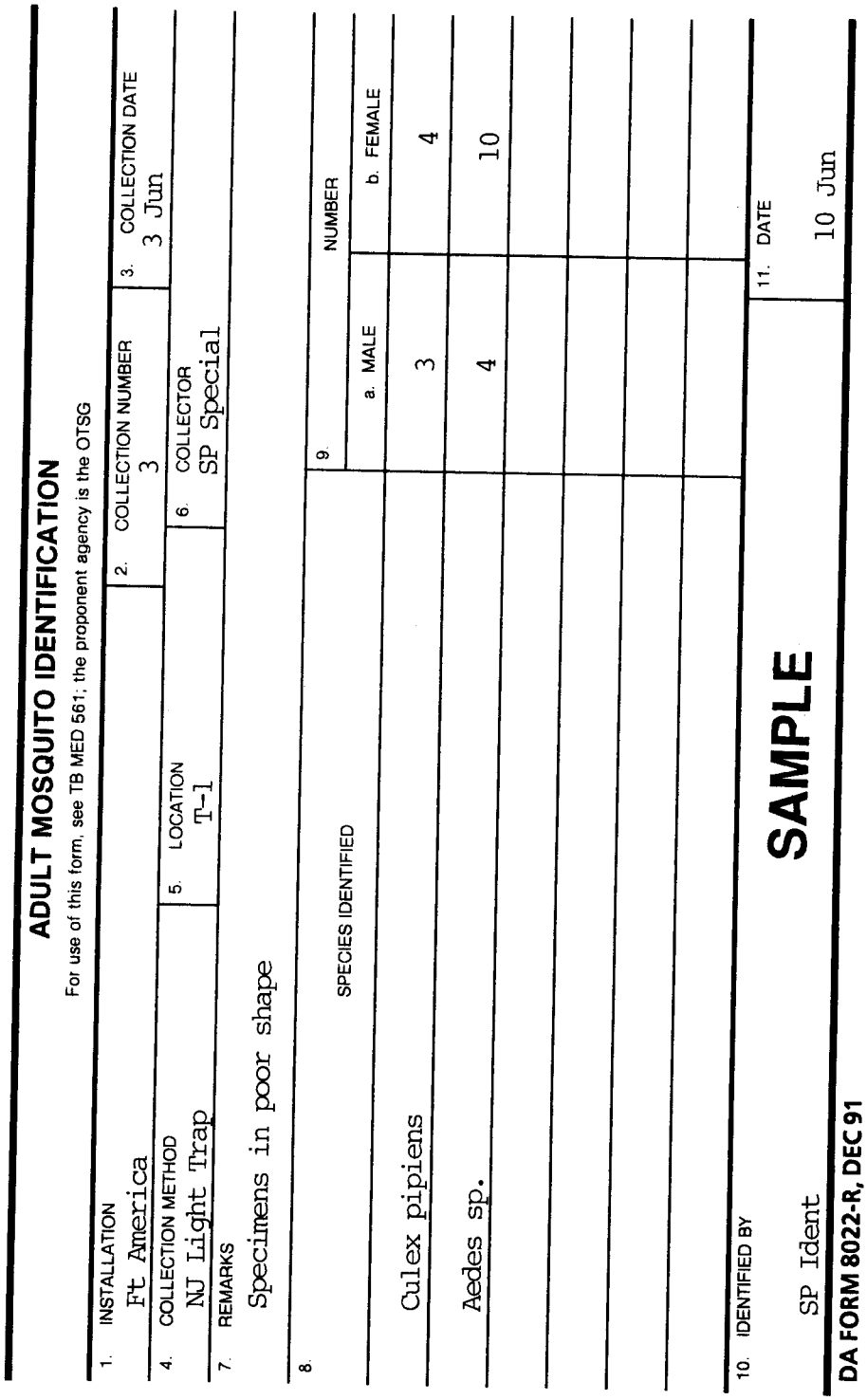

Figure B–4. Example of a filled-in adult mosquito identification form.

B–4. Shipping mosquito larvae for identification

a. Process, record, and ship larval collections within 24 hours of collection. Accumulated collections cause an unnecessary lag time between the day of collection and receipt of identifications.

b. Ship fourth instar larvae whenever possible. This makes identification easier and more accurate.

c. Process larval mosquitoes before shipping to USAEHA for identification.

(1) First, kill larvae by transferring them to a beaker of hot water. Do not use boiling water, hot tap water is sufficient. Larvae may be transferred directly into alcohol.

(2) After they are killed and floating on the surface, transfer the larvae to vials containing 75 to 80 percent ethanol. Larval mosquitoes may also be preserved in a mixture of 5 parts 70 percent isopropyl alcohol and 1 part glacial acetic acid. Alcohol, glycerin, and acetic acid solution (5 parts alcohol, 1 part acetic acid, and 1 part glycerin) is a third alternative which works very well to preserve larval hairs and prevent dehydration of the specimens.

d. The transfer may be made in the field directly from the dipper by carefully using an eye dropper to transfer the larvae, with as little water as possible, into prepared tubes. Some specimens will not pass through the narrow opening of an eye dropper. Do not force them. Reverse the bulb on the tube and try again.

e. Fill the tubes or vials with the alcohol, glycerin, and acetic acid mixture to eliminate bubbles that will damage the larvae during shipment. Individually wrap the glass tubes in cotton before placing them in the mailing case. Use mailing case liners to reduce shock to the specimens.

f. Prepare a pencil label and place it in the vial for each collection site. Make the label large enough not to move around in the vial, but small enough not to be stuffed. It should contain information necessary to positively identify the vial to the appropriate DA Form 8024–R (Larval Mosquito Collection).

g. Enter collection data from larval collections on a DA Form 8024–R (see fig B–5 for an example) that will be reproduced locally on a 3- by 5-inch card. A copy for reproduction purposes is located at the back of this bulletin. A new form is required for each collection site. Include the DA Form 8024–R in the shipping container.

h. USAEHA will return two copies of a DA Form 8025–R (Larval Mosquito Identification) to the installation submitting the collection (see fig B–6 for an example). The DA Form 8025–R will be reproduced locally. A copy for reproduction purposes is located at the back of this bulletin. File one copy with the installation PVNTMED services; the other copy may be forwarded to any other interested activity (for example, the IPMC).

B–5. Shipping mosquito eggs for identification

a. Check with the laboratory that will receive the eggs to obtain necessary shipping permits or special handling procedures required when shipping live specimens.

b. Mail the strips within 24 hours of the time they are collected. Time is critical since the laboratory must hatch the eggs and rear the larvae to fourth instar to make an identification.

LARVAL MOSQUITO COLLECTION

For use of this form, see TB MED 561; the proponent agency is the OTSG

1. INSTALLATION: Ft. America		2. COLLECTION NUMBER: 10
3. COLLECTION DATE: 3 July	4. COLLECTION SITE/HABITAT: D-3	
5. NUMBER PER DIP: 25		
6. COLLECTOR: SP Special, PVNTMED		
7. REMARKS: Site almost dry.		
8. NEEDED SUPPLIES	**SAMPLE**	

DA FORM 8024-R, DEC 91

Figure B–5. Example of a filled-in larval mosquito collection form.

LARVAL MOSQUITO IDENTIFICATION

For use of this form, see TB MED 561; the proponent agency is the OTSG

1. INSTALLATION		2. COLLECTION NUMBER	3. COLLECTION DATE
Ft America		10	3 Jul
4 COLLECTION SITE	5. NO./DIP	6. COLLECTOR	
D-3	25	SP Special	

7 REMARKS

8. SPECIES IDENTIFIED	9. NUMBER
Culex pipiens	50

10. IDENTIFIED BY		11. DATE
SP Ident	**SAMPLE**	10 Jul

DA FORM 8025-R, DEC 91

Figure B-6. Example of a filled-in larval mosquito identification form.

c. Pack the velour strips as follows:

(1) Cover a piece of bond paper with a dry paper towel.

(2) Staple strips to the paper towel with the rough or egg side up (be sure the strips do not touch).

(3) Cover the strips with another sheet of bond paper.

(4) Place this paper sandwich inside a padded mailing envelope.

d. Enter collection data from egg collections on a DA Form 8026–R (Mosquito Egg Collection) (see fig B–7 for an example) that will be reproduced locally on a 3- by 5-inch card. A copy for reproduction purposes is located at the back of this bulletin. Include the completed DA Form 8026–R in the envelope with the strips. If the strips are very moist, put the form inside a plastic bag.

e. USAEHA will return two copies of a DA Form 8027–R (Mosquito Egg Identification) to the installation submitting the collection (see fig B–8 for an example). The DA Form 8027–R will be reproduced locally. A copy for reproduction purposes is located in the back of this bulletin. File one copy with the installation PVNTMED services; the other may be forwarded to any other interested activity (for example, the IPMC).

MOSQUITO EGG COLLECTION

For use of this form, see TB MED 561; the proponent agency is the OTSG

1. INSTALLATION	2. COLLECTOR
Ft. America	SP Special
3. DATE PLACED	**4. COLLECTION DATE**
3 Aug	7 Aug

5. SITE NO.	6. SITE	7. TRAP CONDITION			8. REMARKS
		a. GOOD	b. DRY	c. OVERFLOW	
E-1	DRMO Tire Yard	✓			
E-2	Housing Area		✓		NO eggs
E-3		✓			

DA FORM 8026-R, DEC 91

MOSQUITO EGG COLLECTION *(CONT'D)*

5. SITE NO.	6. SITE	7. TRAP CONDITION			8. REMARKS
		a. GOOD	b. DRY	c. OVERFLOW	

9 NEEDED SUPPLIES

SAMPLE

REVERSE OF DA FORM 8026-R, DEC 91

Figure B–7. Example of a filled-in mosquito egg collection form.

MOSQUITO EGG IDENTIFICATION

For use of this form, see TB MED 561; the proponent agency is the OTSG

1. INSTALLATION	2. COLLECTOR
Ft America	SP Special
3. DATE PLACED	**4. COLLECTION DATE**
3 Aug	7 Aug

5. REMARKS

6. SITE NO.	7. NO. EGGS	8. STRIP CONDITION	9. NO. LARVAE	10. SPECIES IDENTIFIED
1	100	Good	25	Aedes triseriatus
3	50	Poor	0	Eggs collapsed

11. IDENTIFIED BY	12. DATE
SP Ident	15 Aug

SAMPLE

DA FORM 8027-R, DEC 91

Figure B-8. Example of a filled-in mosquito egg identification form.

APPENDIX C

USAEHA PEST SUPPORT SERVICE

C–1. CONUS pest identification and telephonic consultation may be obtained by contacting the following:

Supporting activity	*Area served*
Commander US Army Environmental Hygiene Activity—North ATTN: Entomological Sciences Division Fort George G. Meade, MD 20755–5225 DSN: 923–5281/6502 Commercial: (410) 677–5281/6502	Connecticut, Delaware, District of Columbia, Kentucky, Indiana, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, North Carolina, Ohio, Pennsylvania, Rhode Island, Vermont, Virginia, West Virginia
Commander US Army Environmental Hygiene Activity—South ATTN: Entomological Sciences Division Fort McPherson, GA 30330–5000 DSN: 572–2125/3332 Commercial: (404) 752–2125/3332	Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, Oklahoma, Panama, Puerto Rico, South Carolina, Tennessee, Central and Eastern Texas
Commander US Army Environmental Hygiene Activity—West Fitzsimons Army Medical Center ATTN: Entomological Sciences Division Denver, CO 80045–5001 DSN: 943–8090/8096 Commercial: (303) 361–8090/8096	Alaska, Arizona, California, Colorado, Idaho, Illinois, Iowa, Kansas, Michigan, Minnesota, Missouri, Montana, Nebraska, Nevada, New Mexico, North Dakota, Oregon, South Dakota, West Texas, Utah, Washington, Wisconsin, Wyoming

C–2. CONUS telephonic consultation and on-site support services may be obtained by contacting the following:

Supporting activity	*Area served*
Commander U.S. Army Environmental Hygiene Agency ATTN: Entomological Sciences Division Aberdeen Proving Ground, MD 21010–5422 DSN: 584–3015/3613 Commercial: (410) 671–3015/3613	CONUS-wide support to Activities listed above

C–3. OCONUS pest identification and telephonic consultation may be obtained by contacting the following:

Supporting activity	*Area served*
Commander U.S. Army Pacific Environmental Health Engineering Agency Sagami APO San Francisco 96343–0079	Hawaii, Japan, Korea, Okinawa, Philippines, Thailand, and all other Far East countries
Commander 10th Medical Laboratory ATTN: AEMML–PM–ENT APO New York 09180–3619 Commercial: West Germany (49) 06371–86–8357/8391	Europe, Africa, Middle East

C–4. Copies of an identification card for tick-borne diseases may be obtained from—
Commander
The Armed Forces Pest Management Board
Forrest Glen Section
WRAMC, Washington, DC 20307–5001
Commercial: (301) 427–5191

GLOSSARY

Section I
Abbreviations

AAFES
Army and Air Force Exchange Service

AC
alternating current

AR
Army regulation

CDC
Centers for Disease Control

cm
centimeter

CO_2
carbon dioxide

CONUS
continental United States

DA
Department of the Army

DC
direct current

DDVP
dichlorvos

DEH
directorate of engineering and housing

DEHEW
Department of Health, Education, and Welfare

DOD
Department of Defense

DRMO
Defense Reutilization and Marketing Office

DSN
defense switched network

F
Fahrenheit (temperature)

FM
field manual

HQ USAHSC
Headquarters, U.S. Army Health Services Command

IMA
installation medical authority

IPM
integrated pest management

IPMC
installation pest management coordinator

IPMP
installation pest management plan

mm
millimeter(s)

no.
number

NSN
national stock number

OCONUS
outside continental United States

oz
ounce

PVNTMED
preventive medicine

SSAM
solid state Army miniature

SOP
standing operating procedure

TG
technical guide

TM
technical manual

USAEHA
U.S. Army Environmental Hygiene Agency

Section II
Terms

Commensal rodent
A rodent that shares a human's habitat and food.

Integrated pest management
A comprehensive approach to pest control or prevention that considers various chemical, physical, and biological suppression techniques, the habitat of the pest, and the interrelationship between pest populations and the ecosystem.

Installation pest management coordinator
A person assigned by the installation commander (AR 420–76, para 1–4*b*), to oversee installation pest management operations. The specific duties performed by the IPMC include: maintain (write and update) the pest management plan, complete DD Form 1532 on a monthly basis, and when required, quality assurance evaluation of the contract pest control services.

By Order of the Secretary of the Army:

GORDON R. SULLIVAN
General, United States Army
Chief of Staff

Official:

MILTON H. HAMILTON
Administrative Assistant to the
Secretary of the Army

Distribution:
To be distributed in accordance with DA Form 12–34–E, block 3399, requirements for TB Med 561.

PIN: 069516-000

MOSQUITO COLLECTION SITES

For use of this form, see TB MED 561; the proponent agency is OTSG

COLLECTION METHOD:

SITE NUMBER *a*	GRID *b*	DESCRIPTION *c*

MOSQUITO SURVEILLANCE LIGHT TRAP COLLECTIONS

For use of this form, see TB MED 561; the proponent agency is OTSG

1. DATE TRAP(S) SET	2. DATE SPECIMENS COLLECTED	3. COLLECTOR

4. WEATHER DATA

HIGH *a*	LOW *b*	RAINFALL *c*	WIND SPEED *d*	WIND DIRECTION *e*

5 TRAP NUMBER	6. NUMBER				7. COMMENTS
	MALES *a*	FEMALES *b*	NIGHTS *c*	FEMALES/NIGHT *d*	

SPECIMENS SENT TO USAEHA FOR ID

8. DATE	9. SPECIES _____

10. PESTICIDE TREATMENT DATA

DATE *a*	PESTICIDE *b*	RATE *c*

11. METHOD OF APPLICATION

12. AREA(S) TREATED

MOSQUITO SURVEILLANCE LARVAL COLLECTIONS

For use of this form, see TB MED 561; the proponent agency is OTSG

1. DATE	2. COLLECTOR

3. WEATHER DATA

HIGH *a*	LOW *b*	RAINFALL *c*

4. SITE NUMBER	5. NUMBER			6. COMMENTS
	DIPS *a*	LARVAE *b*	LARVAE/DIP *C*	

SPECIMENS SENT TO USAEHA FOR ID

7. DATE	8. SPECIES _____

9. PESTICIDE TREATMENT DATA

DATE *a*	PESTICIDE *b*	RATE *c*

10. METHOD OF APPLICATION

11. AREA(S) TREATED

COCKROACH COLLECTION SITES

For use of this form, see TB MED 561; the proponent agency is OTSG

MISSION OF STRUCTURE/FLOOR PLAN:

1. BUILDING NUMBERS

2. SITE NUMBER	3. LOCATION

COCKROACH SURVEY

For use of this form, see TB MED 561; the proponent agency is OTSG

1. BUILDING	2. ORGANIZATION	
3. DATE	4. TIME	5. PERSON CONTACTED

PART I - MISSION OF STRUCTURE

6. MISSION OF STRUCTURE	7. FOOD HANDLING FACILITY		8. QUARTERS	
	a. MEALS/DAY	b. DAYS OPEN/WEEK	a. SINGLE	b. MULTIPLE UNIT

PART II - SANITATION

9. SANITARY CONDITIONS *(check one)*				10. FOOD DEBRIS *(Yes (Y) or No (N))*			
a. VERY GOOD	b. GOOD	c. FAIR	d. POOR	a. HARD TO REACH AREAS	b. EASY TO REACH AREAS	c. FOOD LEFT EXPOSED AT NIGHT	d. OTHER

PART III - HARBORAGE

11. HARBORAGE CONDITIONS *(check one)*			12. SPACE AROUND PIPES SEALED	13. HOLES IN WALLS	14. SERVING LINE	15. EQUIPMENT
a. MINIMAL	b. MODERATE	c. AMPLE	☐ YES ☐ NO	☐ YES ☐ NO	☐ YES ☐ NO	☐ YES ☐ NO

16. BAR	17. CRAWL SPACE	18. ATTIC	19. OTHER
☐ YES ☐ NO	☐ YES ☐ NO	☐ YES ☐ NO	

PART IV - COCKROACH SPECIES

20. KIND	21. OBSERVATION *(check one)*			
	a. LIVE INSECTS	b. DEAD INSECTS	c. EGG CAPSULES	d. FECAL MATERIAL

PART V - STICKY TRAP DATA

22. TRAP NUMBER	23. LOCATION	24. NUMBER			25. COMMENTS
		NIGHTS *a*	COCKROACHES *b*	COCKROACHES/NIGHT *c*	

26. COMMENTS

FILTH FLY SURVEY

For use of this form, see TB MED 561; the proponent agency is OTSG

1. BUILDING	2. ORGANIZATION	
3. DATE	4. TIME	5. PERSON CONTACTED

6. FOOD HANDLING FACILITY		7. QUARTERS		
a. MEALS/DAY	b. DAYS OPEN/WEEK	a. SINGLE	b. MULTIPLE UNIT	c. OTHER

8. SANITARY CONDITIONS *(check one)*				9. EXCLUSION *(check one)*				10. AIR CURTAINS PRESENT
a. VERY GOOD	b. GOOD	c. FAIR	d. POOR	a. VERY GOOD	b. GOOD	c. FAIR	d. POOR	☐ YES ☐ NO

11. OPERATIONAL/EFFECTIVE	12. WINDOWS SCREENED	13. FANS SCREENED	14. DOORS SCREENED
☐ YES ☐ NO	☐ YES ☐ NO	☐ YES ☐ NO	☐ YES ☐ NO

15. OTHER

16. REFUSE DISPOSAL *(Yes (Y) or NO (N))*				17. SAMPLING MEHTOD *(check one)*			
a.. CONTAINER		b. LIDS/DOORS		a.. GRILL	b.. STICKY TRAP	c.. LIVE TRAP	d. SWEEP NET
(1) CLEAN	(2) RODENT-PROOF	(1) CLOSED	(2) IN GOOD REPAIR				

18. SURVEY DATA

a. LOCATION	b. NUMBER COUNTED/TRAPPED/CAUGHT

SPECIMENTS SENT TO USAEHA FOR ID

19. DATE	20. SPECIES

21. COMMENTS

TICK SURVEY DATA/TICK DRAG DATA

For use of this form, see TB MED 561; the proponent agency is OTSG

1. DATE			
2. COLLECTOR	3. WEATHER DATA	a. TEMPERATURE	b. WIND SPEED	c. CLOUD COVER

4. SITE NO	5. GRID	6. TIME	7. DISTANCE *(PACES)*	8. AREA	9. NUMBER			10. INDEX*	11. COMMENTS
					a. LARVAE	b. NYMPHS	c. ADULTS		

**Total Number of Ticks Divided by Dragged Area*

SPECIMENS SENT TO USAEHA FOR ID

12. DATE	13. SPECIES

14. COMMENTS

TICK SURVEY DATA/CARBON DIOXIDE TRAP DATA

For use of this form, see TB MED 561; the proponent agency is OTSG

1. DATE	

2. COLLECTOR	3. WEATHER DATA	a. TEMPERATURE	b. WIND SPEED	c. CLOUD COVER

4. SITE NO	5. GRID	6. TRAP	7. TIME		8. NUMBER			9. INDEX*	10. COMMENTS
			a. START	b. END	a. LARVAE	b. NYMPHS	c. ADULTS		
		1							
		2							
		3							
		1							
		2							
		3							
		1							
		2							
		3							
		1							
		2							
		3							
		1							
		2							
		3							
		1							
		2							
		3							

Average Number Ticks (3 Traps) Divided by Time in Hours

SPECIMENS SENT TO USAEHA FOR ID

11. DATE	12. SPECIES

13. COMMENTS

TICK SURVEY DATA/TICK WALK DATA

For use of this form, see TB MED 561; the proponent agency is OTSG

1. DATE	

2. COLLECTOR	3. WEATHER DATA	a. TEMPERATURE	b. WIND SPEED	c. CLOUD COVER

4. SITE NO	5. GRID	6. TIME	7. DISTANCE *(PACES)*	8. NUMBER			9. INDEX*	10. COMMENTS
				a. LARVAE	b. NYMPHS	c. ADULTS		

**Total Number of Ticks Divided by Distance Walked*

SPECIMENTS SENT TO USAEHA FOR ID

11. DATE	12. SPECIES

13. COMMENTS

RODENT SURVEY

For use of this form, see TB MED 561; the proponent agency is OTSG

1. BUILDING	2. ORGANIZATION	3. DATE

4. TIME	5. PERSON CONTACTED	6. SURVEY OFFICER

PART I - BUILDING INTERIOR

SECTION A - SANITATION

7. SANITARY CONDITIONS *(check one)*				8. SPILLED FOOD	9. RODENT-PROOF CONTAINERS	10. DAMAGED FOOD CONTAINERS
a. VERY GOOD	b. GOOD	c. FAIR	d. POOR	☐ YES ☐ NO	☐ YES ☐ NO	☐ YES ☐ NO

11. PLUMBING LEAKS AND CONDENSATION	12. OTHER
☐ YES ☐ NO	

SECTION B - HARBORAGE

13. HARBORAGE CONDITIONS *(check one)*			14. ACCUMULATED DEBRIS	15. MATERIAL STORED NEXT TO WALLS	16. HOLES IN WALLS
a. MINIMAL	b. MODERATE	c. AMPLE	☐ YES ☐ NO	☐ YES ☐ NO	☐ YES ☐ NO

17. ENLARGED HOLES AROUND PIPES AND DOORS	18. OTHER
☐ YES ☐ NO	

SECTION C - RODENT SIGNS

19. KIND *(check one)*		20. DEAD/LIVE RODENTS	21. TRACKS/TRAILS/RUB MARKS	22. DROPPINGS/ URINE	23. NESTS
a. MICE	b. RATS	☐ YES ☐ NO	☐ YES ☐ NO	☐ YES ☐ NO	☐ YES ☐ NO

24. ODORS	25. GNAWING	26. OTHER
☐ YES ☐ NO	☐ YES ☐ NO	

27. REMARKS

PART II - BUILDING EXTERIOR

28. GENERAL CONDITIONS *(check one)*		
a. GOOD	b. FAIR	c. POOR

29. FOOD/WATER AVAILABILITY *(check one)*			
a. VERY GOOD	b. GOOD	c. FAIR	d. POOR

SECTION A - DUMPSTER/REFUSE CONTAINERS

30. DIRTY	31. DRAIN PLUGS MISSING	32. LIDS		
		a. MISSING	b. NOT TIGHT FITTING	c. NOT OPERABLE
☐ YES ☐ NO	☐ YES ☐ NO			

SECTION B - HARBORAGE

33. HARBORAGE CONDITIONS *(check one)*			34. STORED MATERIALS	35. RUBBISH/TRASH/ JUNK	36. TALL GRASS/ WEED	37. SHRUBS/ TREES/VINES
a. MINIMAL	b. MODERATE	c. AMPLE	☐ YES ☐ NO	☐ YES ☐ NO	☐ YES ☐ NO	☐ YES ☐ NO

SECTION C - RODENT ACCESS *(Check one)*

38. GAP *(1/4")* UNDER DOORS	39. DOORS LEFT OPEN	40. OTHER	41. NO SCREENING		
			a. CRAWL SPACE	b. VENTS	c. OTHER MEANS OF ENTRY

42. ENLARGED HOLES AROUND	a. PIPES	b. DOORS	c. WINDOWS

SECTION D - RODENT SIGNS

43. KIND *(check one)*		44. DEAD/LIVE RODENTS	45. TRACKS/TRAILS/RUB MARKS	46. DROPPINGS/ URINE	47. NESTS
a. MICE	b. RATS	☐ YES ☐ NO	☐ YES ☐ NO	☐ YES ☐ NO	☐ YES ☐ NO

48. BURROWS	49. GNAWING	50. OTHER
☐ YES ☐ NO	☐ YES ☐ NO	

51. REMARKS

MISCELLANEOUS PEST COLLECTION

For use of this form, see TB MED 561; the proponent agency is the OTSG

1. INSTALLATION		2. COLLECTION NUMBER
3. COLLECTION DATE	4. HABITAT/HOST	5. DENSITY
6. COLLECTION METHOD	7. COLLECTOR	
8. REMARKS		
9. NEEDED SUPPLIES		

DA FORM 8020-R, DEC 91

MISCELLANEOUS PEST IDENTIFICATION

For use of this form, see TB MED 561; the proponent agency is the OTSG

1. INSTALLATION	2. COLLECTION NUMBER	3. COLLECTION DATE
4. HABITAT/HOST	5. DENSITY	
6. COLLECTION METHOD	7. COLLECTOR	
8. REMARKS		

9. SPECIES IDENTIFIED	10. NUMBER		
	a. MALE	b. FEMALE	c. IMMATURE

11. IDENTIFIED BY	12. DATE

DA FORM 8021-R, DEC 91

ADULT MOSQUITO IDENTIFICATION

For use of this form, see TB MED 561; the proponent agency is the OTSG

1. INSTALLATION	2. COLLECTION NUMBER	3. COLLECTION DATE

4. COLLECTION METHOD	5. LOCATION	6. COLLECTOR

7. REMARKS

8. SPECIES IDENTIFIED	9. NUMBER	
	a. MALE	b. FEMALE

10. IDENTIFIED BY	11. DATE

DA FORM 8022-R, DEC 91

ADULT MOSQUITO COLLECTION

For use of this form, see TB MED 561; the proponent agency is the OTSG

1. INSTALLATION	
2. COLLECTION NUMBER	4. COLLECTION METHOD
3. COLLECTION DATE	
5. COLLECTOR	
6. REMARKS	
7. NEEDED SUPPLIES	

DA FORM 8023-R, DEC 91

LARVAL MOSQUITO COLLECTION

For use of this form, see TB MED 561; the proponent agency is the OTSG

1. INSTALLATION	2. COLLECTION NUMBER
3. COLLECTION DATE	4. COLLECTION SITE/HABITAT
5. NUMBER PER DIP	
6. COLLECTOR	
7. REMARKS	
8. NEEDED SUPPLIES	

DA FORM 8024-R, DEC 91

LARVAL MOSQUITO IDENTIFICATION

For use of this form, see TB MED 561; the proponent agency is the OTSG

1. INSTALLATION		2. COLLECTION NUMBER	3. COLLECTION DATE
4. COLLECTION SITE	5. NO./DIP	6. COLLECTOR	
7. REMARKS			

8. SPECIES IDENTIFIED	9. NUMBER
10. IDENTIFIED BY	11. DATE

DA FORM 8025-R, DEC 91

MOSQUITO EGG COLLECTION

For use of this form, see TB MED 561; the proponent agency is the OTSG

1. INSTALLATION	2. COLLECTOR
3. DATE PLACED	4. COLLECTION DATE

5. SITE NO.	6. SITE	7. TRAP CONDITION			8. REMARKS
		a. GOOD	b. DRY	c. OVERFLOW	

DA FORM 8026-R, DEC 91

MOSQUITO EGG COLLECTION *(CONT'D)*

5. SITE NO.	6. SITE	7. TRAP CONDITION			8. REMARKS
		a. GOOD	b. DRY	c. OVERFLOW	

9. NEEDED SUPPLIES

REVERSE OF DA FORM 8026-R, DEC 91

MOSQUITO EGG IDENTIFICATION

For use of this form, see TB MED 561; the proponent agency is the OTSG

1. INSTALLATION	2. COLLECTOR
3. DATE PLACED	4. COLLECTION DATE

5. REMARKS

6. SITE NO.	7. NO. EGGS	8. STRIP CONDITION	9. NO. LARVAE	10. SPECIES IDENTIFIED

11. IDENTIFIED BY	12. DATE

DA FORM 8027-R, DEC 91