Vector Control 2015

RESPONSE OPERATING GUIDELINES

June 9, 2015

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RECORD OF CHANGES RESPONSE OPERATING GUIDELINES VECTOR CONTROL

Change#	Date Entered	Location/Description of Change	Page #	Initials
1	May 29, 2015	Removed Attachment 9 – Cost Sharing	34	cwl
		Renumbered Attachment 10 to Attachment 9	34	cwl
2	June 2, 2015	Added local jurisdiction expenditure	11	cwl
		statement in B.2.d and B.3.a		
		Updated revision date of document	All	cwl
		Update all Attachments	All	cwl, mm
		Renumbered Table of Contents	2	cwl
		Updated TABLE 2: Human Cases of Arboviral	13	cwl
		Disease Reported in Texas, 2006-2013		
		Updated/Validated Hyper-links	All	cwl
3	June 9, 2015	Linked Instructions with form.	20,22	cwl
		Hyper-linked Table of Contents	2	cwl
		Formatted the document to be accessible	All	cwl

I. AUTHORITY

See Basic Plan, Section I, and Annex H – Health and Medical. Also, through assignment as primary agency for Health and Medical Emergency Support Function 8 for the State of Texas.

II. PURPOSE & SCOPE

A. PURPOSE

The purpose of this Response Operating Guide (ROG) is for use in response to an increase in the proliferation of mosquitoes after an incident has occurred creating possible vector control concerns and nuisance mosquitoes hindering response and recovery efforts.

B. SCOPE

1. Mosquito-borne illnesses continue to pose significant risks to parts of the population of the United States. Flooding caused by hurricanes and other heavy rain events can produce significant increases in biting mosquito populations in a short period of time for both inland and coastal areas. The increase in standing water provides additional breeding grounds for potential vector mosquito species and can cause dormant mosquito eggs to hatch. These events may increase the risk of viral mosquito-transmitted disease that can initiate, prolong or expand to an epidemic. The increase in vector mosquitoes may also promote or intensify virus amplification from low levels increasing human exposure (residents or responders) to vector mosquitoes.

2. A large population of biting mosquitoes could pose a threat to public health even when evidence of vector-borne diseases is not present or prevalent in the disaster-affected areas. Of particular concern are the following:

    a. An extraordinary or unusual number of biting mosquitoes that can impede response efforts. Workers that are required to work out-of-doors (i.e., debris removal operations, protection of damaged structures, restoration of power and telephone services, etc.) can often be significantly hampered in their work.

    b. Housing may be compromised due to extended power outages (i.e., windows and doors are opened), which could increase the general public's exposure to mosquitoes. This could in turn result in secondary infections, especially among those with weakened immune systems such as the elderly, the very young or the sick.

III. ACRONYMS & DEFINITIONS

A. ACRONYMS

CDC	Centers for Disease Control and Prevention
DSHS	Department of State Health Services
EPA	Environmental Protection Agency
FEMA	Federal Emergency Management Agency

GIS	Geographic Information System
GPS	Global Positioning System
HSR	Health Service Region
ROG	Response Operating Guidelines
SMOC	State Medical Operations Center
SOC	State Operations Center
TDA	Texas Department of Agriculture

B. DEFINITIONS

Center for Disease Control and Prevention (CDC): Responsible for monitoring health, detecting and investigating health problems, conducting research to enhance prevention, developing and advocating sound public health policies, implementing prevention strategies, promoting healthy behaviors, fostering safe and healthful environments, and providing leadership and training.

Federal Emergency Management Agency (FEMA): Responsible for responding to, planning for, making emergency evaluations to recover from, and mitigating against man-made and natural disasters while providing a single point of accountability for all federal emergency preparedness and mitigation and response activities.

Texas Department of State Health Services (DSHS): Responsible for providing supplemental and technical assistance in identifying and meeting the health and medical needs of disaster victims and emergency workers.

IV. SITUATION & ASSUMPTIONS

A. SITUATION

1. An incident has occurred that exceeds local response capability for mosquito management and vector control, necessitating State and/or Federal assistance.

2. Excessive rainfall and flooding events create potential mosquito breeding sites in areas of standing water.

3. The Texas Department of State Health Services (DSHS) has no ongoing, routine mosquito abatement program(s).

B. ASSUMPTIONS

1. The incident resulted in an increase in proliferation of mosquitoes that impede recovery operations by emergency workers, local authorities and area residents and/or pose public health risk(s) due to vector-borne disease(s).

2. Local jurisdictions will likely receive increased reports of mosquitoes swarming and of mosquito bites.

3. Local jurisdictions have the responsibility of monitoring the levels and types of vector mosquito populations and associated viral infections in animals and humans.

4. Jurisdictions will assign individuals to complete the tasks as outlined in this document.

5. Nuisance mosquitoes do not necessarily pose a public health risk but may justify mosquito abatement measures if nuisance mosquitoes are hampering recovery efforts.

6. Local public health initiates risk communications strategies for mosquito abatement and public service announcements (PSAs) related to mosquito control programs.

V. CONCEPT OF OPERATIONS

A. BACKGROUND INFORMATION

1. MOSQUITO-BORNE DISEASES

   a. Surveillance conducted by CDC and other agencies suggests that the risk of mosquito-transmitted viral disease does not increase immediately following hurricanes because vector mosquitoes prefer to lay eggs in stagnant, nutrient-rich water which is less available immediately following flooding. Therefore, surveillance for nuisance mosquitoes that are impeding recovery operations takes higher priority immediately following an incident.

   b. The primary diseases of concern from vector mosquitoes are below. See Attachment 1 for additional information on Arbovirus Diseases and Mosquito Vector Species Reported in Texas.

      i. Malaria

      This disease is caused by the malaria parasite carried by mosquitoes. In general, malaria is a curable disease if diagnosed and treated promptly and correctly. Symptoms begin to present as soon as 7 days and can be delayed as long as 30 days following a bite from an infected mosquito.

      The potential risk for malaria is also extremely low with no reported locally acquired cases in recent history.

      ii. West Nile Fever/Neuroinvasive Disease

      This disease is transmitted to humans by a bite from the infected mosquito. Currently, there is no specific treatment for West Nile Virus infections. Symptoms begin to present as soon as 7 days and can be delayed as long as 14 days following a bite from an infected mosquito.

      Historically, there has been a low incidence rate of West Nile illness. The primary West Nile season begins in mid to late July, peaks in mid-August, and continues with large numbers reported until mid-September; although a few early cases of illness may be reported in May or June.

iii. Dengue

This is a mosquito-transmitted disease caused by any one of four related viruses. There are not yet any vaccines to prevent infection with dengue virus nor are there medications to treat dengue virus infections. Symptoms begin to present as soon as 4 to 7 days and can last from 3-10 days following a bite from an infected mosquito.

The risk of transmission for dengue in Texas is low. The high transmission season begins in August and goes through November, and the low transmission season begins in March lasting until June.

iv. St. Louis Encephalitis

This disease is caused by the transmission of the virus to humans with a bite from a mosquito. There is no specific treatment for this disease and care is based on symptoms. Symptoms begin to present as soon as 5 to 15 day following a bite from an infected mosquito.

The risk for St. Louis encephalitis is low. Disease transmission occurs primarily in the late summer or early fall; however, in southern states, where the climate is milder, cases can occur year round.

v. Chikungunya

This is a mosquito-transmitted disease caused by a virus that began circulating in the Americas in 2014. There are no vaccines to prevent infection and treatment is based on symptoms. Infected humans can transmit the virus to mosquitoes and initiate local transmission. Symptoms begin to present as soon as 3 to 7 days following a bite from an infected mosquito.

Although no locally transmitted cases of chikungunya have been documented in Texas to date, the transmission season and risk will be similar to dengue since they have the same vector mosquitoes.

c. Local health departments can determine whether or not mosquitoes in a community present a risk of disease to the public by trapping, identifying and testing mosquitoes for arboviruses through local laboratories or the DSHS Laboratory.

2. VECTOR MOSQUITO CONTROL PLANS

a. Initial response to increased mosquito populations following heavy rain or flooding should be addressed in local mosquito vector control plans.

b. The plan’s purpose is to reduce the public health threat associated with diseases that may be transmitted to people by adult mosquitoes. Consequently, mosquito abatement activities should focus on areas with a higher population density to be the most cost-effective.

c. Ground-based pesticide (larvicide and adulticide) application is an effective means of mosquito control. Individuals who apply pesticides must have proper training and be licensed by the Texas Department of Agriculture (TDA).

d. People can further reduce mosquito bites by using mosquito repellent and wearing long sleeves and long pants outdoors when possible. See Attachment 2 for CDC Information on Insect Repellents.

e. Mosquitoes need standing water to breed, so locating and eliminating standing water in yards or other public areas will reduce the number of mosquitoes.

f. Methods to determine the level of nuisance from mosquitoes in a community include mosquito landing rates and mosquito counts from light traps.

g. Local jurisdictions should determine the type of vector control activities needed in their areas. These activities should be coordinated with surrounding jurisdictions, with technical assistance from DSHS Regional and Central Office personnel, to assure efficient and effective use of resources.

3. CHEMICAL SUPPRESSION MEASURES

a. Ground-based

i. Ground-based distribution of chemical suppression measures uses equipment that requires expertise, applicator licensure and training.

ii. Application of all chemical suppression measures used must be thoroughly documented, including areas treated; name, concentration, and amount of chemical used; and name of licensed applicator.

iii. The chemical suppression measures need to be used in conjunction with appropriate surveillance-based methods.

iv. The earliest larvicide briquettes should be applied to water identified to contain mosquito larvae is three (3) days after water stops flowing in the identified areas.

b. Aerial Spraying

Aerial spraying is only considered when it is determined that ground based mosquito control measures are insufficient and:

i. Vector mosquitoes with infection are present, as confirmed with laboratory testing of mosquito samples from the area(s).

and/or

ii. Recovery efforts are impeded by nuisance mosquitoes, as indicated by an abnormal rise in landing rates or trap counts, or significant changes in species composition when compared to pre-disaster surveillance results.

c. Aerial spraying is expensive and may not be the most effective tool in mitigating nuisance mosquitoes because it can only be completed when weather conditions are right, including no hindrance from wind, to ensure adult mosquitoes come in direct contact with the chemicals. Aerial spraying will not be done if the forecast calls for continued rain or high winds.

d. Aerial spraying in populated areas will only be considered if DSHS, in consultation with CDC and FEMA, determines that the public health risk from mosquitoes has increased and that recovery activities would be severely limited without spraying. Additionally, it may be considered if there are large areas of standing water near populated areas where other methods cannot access.

e. Any aerial spraying must follow proper procedures dictated by the EPA and CDC to ensure that the aerial applicator is properly licensed and that pesticide application is low dose, safe for humans and properly applied.

f. Aerial spraying is prohibited over national parks and wildlife refuges. Also, it will not be applied in agricultural areas.

g. Officials contemplating aerial application must consider potential harm to beneficial insects, such as honey bees which are important to agriculture, and that not all persons and groups support aerial spraying.

h. The State of Texas has developed an emergency management contract for pest control, including aerial spraying for mosquitoes. Local jurisdictions can access this contract thru the Texas Procurement and Support Services Cooperative Purchasing Program (State of Texas CO-OP).

Contract # 988-M1 http://www.txsmartbuy.com/contracts/view/239

B. LOCAL RESPONSE

Local jurisdictions should coordinate vector control activities and efforts with their respective counties to assure efficient and effective use of resources for an area response.

1. Surveillance

   a. Surveillance must be completed to identify locations within the impacted areas that have standing water that could be possible breeding grounds for mosquitoes. If GIS capabilities are available, maps should be made to display the highly populated areas identified to have standing water with a potential for mosquito breeding. Mapping areas of standing water will inform intervention planning.

   b. Surveillance activities should be done for both larval and adult mosquitoes in affected areas where the spread of vector-borne diseases and/or nuisance mosquitoes pose a threat to emergency workers and local residents required to work outdoors.

   c. All surveillance sites and activities must be thoroughly documented. Longitude and latitude should be noted in the documentation if GPS equipment is available. Activities to be carried out by local mosquito control personnel are:

      i. Larval Surveillance

         a) Surveying for the presence of mosquito larvae in standing water is an important component of an Integrated Mosquito Management program. Surveying for mosquito larvae is usually done with a white dipper that has a handle about 3' to 4' long attached to it. A specific dipper volume is not as important as using the same-sized dipper for repeated measurements over time. The surveyor must be careful while approaching mosquito larval or pupae sampling locations. If a shadow is cast across the water, the larvae or pupae will swim away.

         b) A dip is best made by quickly scooping a dipperful of water from the sampling site. This is accomplished by quickly plunging the dipper below the surface of the water, and then bringing back a dipper full of water. Try to avoid over filling the dipper as mosquito larvae may be lost in the overflow.

         c) Three days after the floodwaters have stopped flowing perform larval dipping procedures to verify presence of larvae in standing water prior to application of larvicide. Record results on Mosquito Larvae Surveillance Form (see Attachment 3).

         d) Observations from larvae surveillance are commonly reported as the Index of Larval Abundance (the average number of larvae and/or pupae per dip). The application of larvicide to breeding sites may be based on a relative assessment of this number, which is calculated as follows:

            1) Take 10 dips at various locations at the site.

            2) Count the larvae and/or pupae in each dipper sample.

3) Add the total number of larvae and/or pupae collected in all dipper samples and divide it by the number of dips taken to compute the Index of Larval Abundance.

ii. Adult Surveillance

a) As soon as weather permits following the event, begin performing and documenting morning mosquito landing rate counts in populated areas prior to intervention (see Attachments 4 and 5).

b) As soon as weather permits following the event, perform adult mosquito collections in the evening to verify abundance and species of mosquitoes in the affected populated areas with submission to DSHS Laboratory for virus isolation (see Attachments 5, 6 and 7).

c) Perform and document mosquito landing rate counts following intervention to document efficacy.

d) All adult surveillance activities must be completed and the information provided on how response and recovery efforts are hampered by the determined mosquito activity.

iii. Mapping Areas of Standing Water

Using GPS where available or alternative mapping methods, capture information on areas of standing water that may affect the nature of intervention to be employed using local, State, or federal assets.

2. Treatment

a. Initiate abatement process and purchase necessary supplies, if needed, to perform ground spraying vector control measures.

b. Jurisdictions must first use all locally and regionally available vector control resources and have unmet needs in their Vector Control Programs before requesting assistance for vector control activities.

c. Once all local and regional resources have been exhausted, a State of Texas Assistance Requests (STAR) should be submitted through the DDC to the SOC for those jurisdictions requesting State and/or Federal assistance for mosquito control.

d. DSHS reserves the right to decide whether to enter in to cost sharing contracts or agreements with local jurisdictions before providing mosquito abatement resources. Local jurisdictions will be expected to expend $0.40 per capita in any outbreak abatement effort prior to requesting assistance from the state.

e. Requests should include information from surveillance completed and from the analysis of adult mosquitoes by the DSHS laboratory including identification and disease testing from the collection samples obtained.

3. Documentation

The following items must be thoroughly documented throughout the entirety of the event:

a. Expenditures should include relevant information such as, but not limited to:

1) Existing vector control program expenditures.

2) Current outbreak abatement efforts as a per capita expenditure; see 2.d. above (Treatment).

b. Surveillance activities.

c. Treatment and abatement activities.

d. Inventories.

1) At the beginning of response.

2) Addition of any purchases and supplies received throughout the response.

3) Final, upon completion of response.

4) At the end of response, local jurisdictions are obligated to facilitate the return of any unused supplies and equipment provided by DSHS.

C. STATE RESPONSE

1. Health Service Region (HSR) Roles:

a. Assist local jurisdictions in surveillance activities.

b. Accumulate information and data from jurisdictions within the HSR.

c. Forward all documentation to response personnel in the SMOC.

d. Provide technical assistance to local jurisdictions.

2. DSHS Central Office Roles:

a. DSHS, along with the DSHS Health Service Region staff, will support local jurisdictions with assessing health threats and mosquito control recommendations for what types of mosquito control measures are needed based on surveillance, testing and any viruses detected.

b. Accumulates all data and information to make determinations of treatment based upon the vector disease threat, the mosquito landing rate counts, any ongoing flooding, any historical disease prevalence and the impact of mosquitoes on response and recovery efforts. Establishes, within the operations center, subject matter experts (SMEs) for coordination of vector activities.

c. Laboratory staff conducts necessary testing of mosquitoes trapped and submitted by local jurisdictions, for identification of species and any arboviruses present then provides reports of the results in order for DSHS to support any requests for chemicals. The time frame for final reporting is:

    i. Negative test results require about 10 days for the final report.

    ii. Positive test results may be available within 3-5 days for the final report.

e. Remains in constant contact with local and regional authorities in the impacted areas to best determine how to assess health threats and determine what mosquito control measures are needed based on available resources and any vector-borne diseases detected.

f. Initiates, if needed, a Vector Field Response team to provide assistance and coordinate to local and regional jurisdictions.

g. DSHS medical entomologist will advise local jurisdictions on integrated mosquito management and will consult with the Centers for Disease Control and Prevention (CDC) vector-borne disease experts on issues of mosquito control and criteria for FEMA support as necessary. Even if initial data indicates the potential for disease threat is low, the DSHS medical entomologist will continue to evaluate the situation to determine the best course and recommendations for mosquito control and consult CDC as necessary

h. Coordinates with the DSHS medical entomologist, the CDC and FEMA to develop recommendations for mosquito control measures and abatement activities, which may include aerial spraying. If aerial spraying is necessary, assistance requests will be submitted to FEMA.

i. Messaging

    i. Will coordinate with local jurisdictions to distribute public health messages in impacted areas so that the public can take proper precautions to avoid contact with mosquitoes.

    ii. The DSHS message on health-related mosquito precautions emphasizes the following:

    iii. Draining all standing water and emptying water from outdoor items such as old tires, cans and flower pot bases.

    iv. Using personal protection with an insect repellent that contains DEET, picaridin, oil of lemon eucalyptus or IR3535. Always follow label directions.

v. Ensure all door, porch and window screens are in good condition.

D. FEDERAL ASSISTANCE

1. FEMA Reimbursement

a. FEMA, in consultation with CDC, determines the level of mosquito activity required for federal support and/or reimbursement of mosquito vector control.

b. FEMA, in consultation with CDC, determines the time frame for federally-supported mosquito control activities.

c. For FEMA reimbursement, specific scientific surveillance data and management is required by state and local jurisdictions.

d. Expenses incurred by local jurisdictions and the State of Texas in responding to hurricanes and other natural disasters producing heavy rains and flooding MAY be eligible for reimbursement by FEMA (Attachment 9).

VI. MAINTENANCE & UPDATE

The Response and Recovery Unit is responsible for maintaining and updating the DSHS Response Operating Guidelines. These are living documents and will be reviewed, updated, and approved on an annual basis or more frequently in response to department policy or procedure changes. Revisions/changes made to the ROG after the Effective Date (Jan. 1) are recorded in the Record of Changes form found on Page 3. Below is the review and update schedule that will be followed:

November – December:	Review and Comment
January 1:	Effective Date

VII. ATTACHMENTS

ATTACHMENT 1 – Arboviral Diseases and Mosquito Vector Species Reported to Texas
ATTACHMENT 2 – CDC Information on Insect Repellents
ATTACHMENT 3 – Mosquito Larval Guidelines and Form
ATTACHMENT 4 – Mosquito Landing Rate Count Guideline and Form
ATTACHMENT 5 – DSHS Arbovirus Surveillance Program
ATTACHMENT 6 – Arbovirus Surveillance General Guidelines
ATTACHMENT 7 – Arbovirus Field Surveillance Techniques
ATTACHMENT 8 – FEMA Eligibility of Vector Control (Mosquito Abatement)

ATTACHMENT 1 – ARBOVIRAL DISEASES AND MOSQUITO VECTOR SPECIES REPORTED IN TEXAS

Seven major arboviruses/virus groups (arthropod-borne viruses) that infect humans occur in Texas: West Nile virus (WNV), St. Louis encephalitis virus, eastern equine encephalitis virus, western equine encephalitis virus, California serogroup viruses, dengue, and Chikungunya. Mosquito species that serve as vectors for these viruses are listed in Table 1.

Table 2 provides the numbers of human cases associated with these six diseases in a 5-year reporting period from 2010 to 2014. West Nile virus is overwhelmingly the most common arbovirus causing reported human infections in Texas. Dengue infections in Texas are almost all travel-associated, with the very few acquired in Texas sporadically reported in South Texas. Travel-associated Chikungunya cases increased in Texas during 2014 but local transmission has the potential to occur where the vector mosquitoes are found.

Human cases of malaria, caused by a protozoon, are also reported yearly, however all of these, with rare exception, are travel-associated. At least 13 species of Anopheles mosquitoes (the genus of mosquitoes that transmit malaria) are endemic to Texas.

TABLE 1: Major Mosquito Vector Species Associated with Arboviral Diseases Reported in Texas

Arbovirus	Major Mosquito Vector Species
West Nile Virus	Culex quinquefasciatus, Culex tarsalis
St. Louis Encephalitis Virus	Culex quinquefasciatus, Culex tarsalis, Culex nigripalpus
Eastern Equine Encephalitis Virus	Aedes vexans, Coquellettidia
Western Equine Encephalitis Virus	Culex tarsalis
California Serogroup Viruses	Aedes triseriatus
Dengue Virus	Aedes aegypti, Aedes albopictus
Chikungunya Virus	Aedes aegypti, Aedes albopictus

TABLE 2: Human Cases of Arboviral Disease Reported in Texas, 2010-2014

Disease	2010	2011	2012	2013	2014
California Encephalitis	1	0	3	0	0
Chikungunya	1	0	0	0	114
Dengue	19	7	16	95	32
Eastern Equine Encephalitis	0	0	0	0	0
St. Louis Encephalitis	3	0	3	1	4
West Nile Encephalitis	77	20	844	113	253
West Nile Fever	12	7	1024	70	126
Western Equine Encephalitis	0	0	0	0	0

General Effects of Major Storms and Flood Events on Mosquito Populations and Arboviral Disease Transmission Flooding tends to flush out both mosquito larvae and their predators from established mosquito breeding areas. Mosquitoes tend to recolonize faster than the predators dependent upon them, however, so following a flood a predictable pattern of heavy die-off of mosquitoes, followed by a spike in numbers, is commonly seen. The reasons for why mosquito populations rebound after storm or flood events vary with their genus-specific breeding habits, summarized below.

Anopheles spp. mosquitoes lay their eggs directly in clean, standing water; consequently existing larvae are washed away during floods and as floodwaters recede, leftover pools are used as breeding sites. Anopheles spp. mosquitoes will also lay their eggs in a wide range of environments (e.g., shady/sunny, flood pools, streams, irrigated lands, marshes, etc.), so events like hurricanes that cover a large area will yield massive breeding potential. It is predictably common to see spikes in Anopheles spp. populations following hurricanes and/or flood events. In Texas, Anopheles spp. doesn't currently serve as disease vectors, so they are more of a nuisance concern than a public health threat following a storm.

Aedes spp. mosquitoes lay eggs specifically in places that will be either subject to flooding (in the ground around streams for example) or in places affected by an increase in rainwater (like the sides of flower pots that will fill upon rainfall). Their eggs can sit for several months waiting for just such an event, thus heavy rains are an integral part of their reproductive strategy and a spike in Aedes spp. numbers can always be expected after a hurricane or excessive rains that lead to flooding. Ochlerotatus spp. and Psorophora spp. are also flood-dependent breeders. West Nile virus and La Crosse virus (in the California serogroup) are carried by some Ochlerotatus spp., but Psorophora spp. are nuisance mosquitoes only and are not vectors of human disease.

Culex spp. require stagnant water specifically (i.e. the kind often found accumulated in old tires, bird-baths, rusty coffee cans in landfills, etc.). Since heavy rains will fill up such items, an inevitable increase in Culex spp. populations is to be expected following rainfall events. All mosquito species lifecycle times are dependent upon temperature; the warmer the temperature, the faster they will reproduce. Although it varies by species and region, a good rule of thumb is that in a tropical environment you can expect a spike in adult mosquito numbers 10-15 days following the end of heavy rainfall.

Because WNV infection is currently the most commonly occurring arboviral infection in Texas, increases in the Culex spp. vector populations present the biggest public health concern. Post-hurricane/flood mosquito control strategies should focus on getting the public to dump out containers on their property that may have collected water. Larviciding is typically the best and most-efficient control strategy for adult mosquitoes, however during outbreaks of WNV or other arboviral diseases, adulticiding results in more rapid control of adult mosquito populations and thus more effectively decreases disease transmission. If no disease is present following an observed post-storm spike in mosquito numbers, then control methods will depend and focus on the particular need to control nuisance mosquito populations that may hinder recovery efforts.

ATTACHMENT 2 – CDC INFORMATION ON INSECT REPELLENTS
http://www.cdc.gov/westnile/resources/pdfs/wnvguidelines.pdf

A. Repellents are an important tool to assist people in protecting themselves from mosquito-borne diseases. (Page 41 of linked source)
CDC recommends the use of products containing active ingredients which have been registered by the U.S. Environmental Protection Agency (EPA) for use as repellents applied to skin and clothing. EPA registration of repellent active ingredients indicates the materials have been reviewed and approved for efficacy and human safety when applied according to the instructions on the label.

B. REPELLENTS FOR USE ON SKIN AND CLOTHING:
Repellents for use on skin and clothing: CDC evaluation of information contained in peer-reviewed scientific literature and data available from EPA has identified several EPA-registered products that provide repellent activity sufficient to help people avoid the bites of disease carrying mosquitoes. Products containing these active ingredients typically provide reasonably long-lasting protection:

1. DEET (Chemical Name: N,N-diethyl-m-toluamide or N,N-diethly-3-methyl-benzamide)
2. Picaridin (KBR 3023, Chemical Name: 2-(2-hydroxyethyl)-1-piperidinecarboxylic acid 1- methylpropylester)
3. Oil of Lemon Eucalyptus* or PMD (Chemical Name: para-Menthane-3,8-diol) the synthesized version of oil of lemon eucalyptus
4. IR3535 (Chemical Name: 3-[N-Butyl-N-acetyl]-aminopropionic acid, ethyl ester)

* Note: This recommendation refers to EPA-registered repellent products containing the active ingredient oil of lemon eucalyptus (or PMD). “Pure” oil of lemon eucalyptus (e.g. essential oil) has not received similar, validated testing for safety and efficacy, is not registered with EPA as an insect repellent, and is not covered by this CDC recommendation.
EPA characterizes the active ingredients DEET and Picaridin as “conventional repellents” and Oil of Lemon Eucalyptus, PMD, and IR3535 as “biopesticide repellents”, which are derived from natural materials. For more information on repellent active ingredients see: (http://www2.epa.gov/mosquitocontrol).

Published data indicate that repellent efficacy and duration of protection vary considerably among products and among mosquito species, and are markedly affected by ambient temperature, amount of perspiration, exposure to water, abrasive removal, and other factors. In general, higher concentrations of active ingredient provide longer duration of protection, regardless of the active ingredient, although concentrations above ~50% do not offer a marked increase in protection time. Products with <10% active ingredient may offer only limited protection, often from 1-2 hours. Products that offer sustained release or controlled release (micro-encapsulated) formulations, even with lower active ingredient concentrations, may provide longer protection times.

Repellents for use on clothing: Certain products containing permethrin are recommended for use on clothing, shoes, bed nets, and camping gear, and are registered with EPA for this use. Permethrin is highly effective as an insecticide and as a repellent. Permethrin-treated clothing repels mosquitoes, and retains this effect after repeated laundering. The permethrin repellents should be reapplied following the label instructions. Some commercial clothing products are available pretreated with permethrin. Additional information about CDC's repellent recommendations is available at: http://www.cdc.gov/ncidod/dvbid/westnile/RepellentUpdates.htm).

Mosquito bites can be avoided simply by not going outdoors when mosquitoes are biting, and recommendations to avoid outdoor activity when and where high WNV activity levels have been detected are a component of prevention programs. Recommendations to avoid being outdoors from dusk to dawn may conflict with neighborhood social patterns, community events, or the practices of persons without air-conditioning. It is important to communicate that the primary WNV vectors are active from dusk until dawn. Emphasize that repellent use is protective, and should be used when outdoors during the prime mosquito-biting hours.

E. REFERENCES:

1. Barnard DR, Xue RD. Laboratory evaluation of mosquito repellents against Aedes albopictus, Culex nigripalpus, and Ochlerotatus triseriatus (Diptera: Culicidae). J Med Entomol. 2004;41(4):726-30.

2. Barnard DR, et al. Repellency of IR3535, KBR3023, para-menthane-3,8-diol, and DEET to Black Salt March mosquitoes (Diptera: Culicidae) in the Everglades National Park. J Med Entomol. 2002; 39(6): 895-899

3. Fradin MS, Day JF. Comparative efficacy of insect repellents against mosquito bites. N Engl J Med. 2002; 347(1):13-8.

4. Thavara U et al. Laboratory and field evaluations of the insect repellents 3535 (ethyl butyletylaminopropionate) and DEET against mosquito vectors in Thailand. J of Am Mosq Cont Assoc. 2001, 17(3):190-195.

For more information, visit www.cdc.gov/westnile;
http://www2.epa.gov/mosquitocontrol/joint-statement-mosquito-control-united-states or
call CDC at800-CDC-INFO (English and Spanish) or 888-232-6348 (TTY).
Page last modified September 2012

ATTACHMENT 3 – MOSQUITO LARVAL GUIDELINES AND FORM

A. BACKGROUND INFORMATION:

Look for mosquito breeding (egg or larval) habitats. The more common breeding sites include: highly polluted water, artificial containers, tree holes, pastures that temporarily flood, drainage ditches, woodland pools, and man-made ponds. There is not much mosquito breeding in natural ponds, lakes, bayous or any bodies of water that flow. These habitats normally have many predators such as fish or other aquatic insects.

Supplies to Collect Larval Mosquitoes:

1. White dipper with 3-4 foot long handle (a specific dipper volume is not as important as using a consistent volume)
2. Mosquito Larval Surveillance Forms

Optional:

3. Vials, 6 dram with screw caps (or other vials with secure lids)
4. Disposable bulb pipets ("eye dropper")
5. Alcohol, 70% isopropyl

B. GUIDELINES:

Examine standing water to collect larval mosquitoes. The following types of water are most often productive:

1. Roadside ditches and other drainage water
2. Artificial containers (such as birdbaths, discarded or stacked tires, vases, watering troughs, barrels)
3. Ponds, stock tanks, creeks. The amount of larvae present will in large part, depend on the amount of aquatic predators that may be present
4. Other areas. Almost any water that stands for several days may be productive. It can be worthwhile checking such habitats as tree holes, livestock tracks (following rain), and clogged rain gutters.

Carefully approach the water and avoid casting a shadow across the sampling site. To determine the presence of larvae, take a sample of water using the dipper. If larvae are observed, take 10 dips at various locations at the site and count the larvae and/or pupae in each dipper sample; record on the Mosquito Larval Surveillance Form.

Some jurisdictions may wish to collect samples of the larvae for further identification at their facility. Larvae can be removed from the dipper with a bulb pipet and placed in a vial. Immature specimens (1st through 3rd instar) are quite small and may lack taxonomic characteristics true to the mature larval stages of species. Therefore, these specimens can be left in the collection water for a day or two until they develop into mature larvae. If larvae are mature (4th instar), alcohol should be placed in the vial to preserve specimens until they can be identified. Alcohol should be composed of at least 50 percent (estimated) of the liquid volume; therefore, it may be necessary to drain off some of the collected water. The loss of specimens that may occur while draining the water from the vial can be avoided by placing a small piece of cheesecloth, filter paper, or paper toweling over the mouth of the vial when pouring off water or by using a bulb pipet to remove water.

MOSQUITO LARVAL SURVEILLANCE FORM

PLEASE PRINT CLEARLY

CITY/ZONE: COUNTY:

DATE: (DD/MM/YYYY)
INSPECTOR:

S	Location (GPS coordinates or physical address)	D i		D i	D i	D i	D i	D i	D i	D i	D i	* Index of	Comments (estimated area covered by standing water.
1													
2													
3													
4													
5													
6													
7													
8													
9													
10													

* Index of Abundance equals the average of a 10-dipper count

Instructions

Using a white dipper with a 3'-4' long handle attached to it:

1. Select site with standing water. Record the location (physical address or, preferably, GPS coordinates).
2. Carefully approach the water and avoid casting a shadow across sampling site; take 10 dips at various locations at the site.
3. Count the larvae and/or pupae in each dipper sample and record on form.
4. Add the total number of larvae and/or pupae collected in all dipper samples and divide it by the number of dips taken to compute the average number of larvae and/or pupae per dip.
5. If the Index of Larval Abundance is above the established threshold, apply an appropriate larvicide per label directions.

NOTE: A specific dipper volume is not as important as using the same-sized dipper for repeated measurements over time.

ATTACHMENT 4 – MOSQUITO LANDING RATE COUNT GUIDELINES AND FORM

A. BACKGROUND INFORMATION:

Adult mosquito populations may be monitored by landing rate counts. For landing rate counts, an inspector visits a set number of sites every day, counting the number of mosquitoes that land on a part of the body within a given time interval. Landing rate counts provide immediate indicators of adult mosquito activity.

B. THE FOLLOWING GUIDELINES APPLY TO LANDING RATE COLLECTIONS:

1. Divide the city, precinct or county into four geographical zones and conduct counts at 5-10 locations within each zone.
2. The timing of the landing rate count should be consistent. Landing rate counts should be taken the same time each day. Counts should not be taken during the heat of the day because most mosquitoes are inactive. A time period between 8:00 a.m. and 10:00 a.m. for mosquito landing counts is recommended.
3. If time and resources permit, mosquito-landing counts should be conducted daily.
4. Wear solid light-colored long sleeves and pants, and work gloves. Mosquitoes are more easily seen on solid light-colored material versus a dark-patterned background.
5. Maintain a consistent clothing color among the counters within a county to keep the results comparable.
6. Mosquitoes do exhibit color preferences and wide variation in the background color of the clothing could cause variation within the data set.
7. If possible, the same person should perform the counts to maintain consistency.
8. No repellents, after-shaves or perfumes should be used.
9. Disturb the surrounding vegetation before starting the counts.
10. Stand still for three minutes before beginning the count.
11. Take all landing rate counts from a standing position.
12. Count only those mosquitoes that land in one minute on the front of one leg from the waist to the foot.
13. Complete the landing rate form using real numbers for the mosquito landing counts. For example, 25 or 75 are much more meaningful than using 50+ or 100+.

C. MOSQUITO LANDING COUNT SITE SELECTION TIPS:

1. Look for mosquito breeding (egg or larval) habitats. The more common breeding sites include: highly polluted water, artificial containers, tree holes, pastures that temporarily flood, drainage ditches, woodland pools, and man-made ponds. There is not much mosquito breeding in natural ponds, lakes, bayous or any bodies of water that flow. These habitats normally have many predators such as fish or other aquatic insects.
2. Contact local officials to obtain information on the location of citizen mosquito complaints in the area.
3. Be aware of snakes and wildlife, and learn to recognize plants that can cause a rash, such as poison ivy, poison oak, or bull nettle.

MOSQUITO LANDING RATES FORM

PLEASE PRINT CLEARLY

CITY/ZONE: _ DATE: (DD/MM/YYYY)
COUNTY: _ INSPECTOR:

No.	Location (GPS coordinates or physical	Time	Count	Comments (weather conditions, i.e.-temperature, wind, overcast,
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

ATTACHMENT 5 – DSHS ARBOVIRUS SURVEILLANCE PROGRAM

https://www.dshs.state.tx.us/lab/arbointro.shtm

The Arbovirus Surveillance Program at the Texas Department of State Health Services (DSHS) identifies mosquitoes and detects and tracks the circulation of arboviruses in mosquitoes in the environment prior to the development of human disease. This is a cooperative program including the Zoonosis Control Branch, Health Service Regions (HSR) Infectious Disease Control Unit, and the Laboratory Arbovirus/Entomology Team.

The Program targets mosquito species known to be primary vectors of encephalitis viruses recognized in Texas and that produce disease in humans. Based on past experiences with mosquito-borne encephalitis in Texas, Culex quinquefasciatus and Culex tarsalis are the important vectors for West Nile, St. Louis encephalitis, and western equine encephalitis viruses. Culiseta melanura is the known enzootic vector of eastern equine encephalitis virus (EEE); however, Aedes, Coquillettidia, Anopheles, and Culex species may be bridge vectors and transmit EEE virus to both humans and horses. The tree-hole mosquito Ae. triseriatus is the primary vector for La Crosse virus. In 2002, West Nile virus (WN) was first detected in wild birds collected in Houston, Texas. WN virus has been isolated from Cx. quinquefasciatus, Cx. salinarius, Cx. (Melanoconion) sp, Cx. restuans, Cx. tarsalis, Cx. nigripalpus, Ae. albopictus, Ae. taeniorhynchus, and Ps. columbiae.

Mosquito specimens are submitted to DSHS from numerous Texas city and county health departments, health service regions, military installations, universities, and local mosquito control programs. Specific information on field surveillance techniques is available at this site. At the Laboratory, the mosquitoes are identified to species, pooled, and tested for the presence of arboviruses. Whenever the laboratory isolates one of these viruses, laboratory personnel notify the agency that submitted the specimens and the appropriate HSR, as well as the Zoonosis Control Branch. The responsible HSR will work with the submitting agency to help assess any health threats and determine what mosquito control measures need to be initiated based on the virus detected.

A. PROGRAM SUMMARY:

A. Routine arboviral isolation studies (from mosquitoes collected around the state) are conducted from May through November of each year. The period may be extended in the event of an outbreak of encephalitis.

B. Mosquitoes received at other times of the year are identified to species only. Such specimens may be submitted for determination of species distribution and density, seasonal activity, and effectiveness of local control programs on mosquito populations.

C. Arboviral isolation studies are not conducted on nestling pigeons or other birds. Isolation studies from vector mosquitoes provide more useful information. However, special surveillance proposals with prior approval will be considered.

D. Mosquitoes received in unsatisfactory condition will be identified to species only.

E. Vector mosquito species will be pooled except following the isolation of a pathogenic arbovirus. Subsequent species of mosquitoes collected in that county will be kept separate.

F. Negative isolation results for mosquito pools consisting of pest species are not very meaningful. Therefore, arboviral isolation studies on species that are not implicated in the transmission of these viruses will be limited.

G. The gravid trap and use of aspirators at natural resting sites are the preferred methods of collecting adult mosquitoes.

H. New program participants should contact the Arbovirus/Entomology Team for the appropriate training at least one month in advance.

I. Sentinel chickens are no longer tested for arboviral antibodies.

J. Any proposed changes to standard field activities must be coordinated with the Arbovirus/ Entomology Team.

B. PUBLIC HEALTH BENEFITS OF THE PROGRAM:

1. Serves as an early warning system to detect the presence of virus activity in mosquito populations before humans are infected. (Note: The prevention of human cases is preferable to treatment after infection because there is no specific anti-arboviral therapy available and no vaccine readily available to the general public.)

2. Informs local health officials and physicians of the potential for human infections.

3. Informs state and local mosquito control programs of both vectors and viruses present in their areas so that control measures can be initiated quickly and appropriately.

4. Provides information to the general public of arboviral activity so that they can take proper precautions to avoid contact with mosquitoes.

5. Provides an opportunity to prevent potential epidemics.

6. Has the ability to detect the introduction of new arboviruses of public health significance, for example the West Nile virus in 1999.

ATTACHMENT 6 – ARBOVIRUS SURVEILLANCE GENERAL GUIDELINES
https://www.dshs.state.tx.us/lab/arboGuidelines.shtm

The following guidelines have been prepared for the DSHS Laboratory Arbovirus/Entomology Team to summarize the purposes, priorities, status, and procedures of the vector monitoring system for the Arbovirus Surveillance Program.

A. PURPOSES

1. Determine encephalitis virus activity in specific geographic areas prior to human cases so local health professionals can institute control measures. This is accomplished through use of intensified vector mosquito collection in areas of identified arboviral activity.

2. Notify local and state mosquito control personnel of arbovirus activity so appropriate and defined measures can be undertaken.

3. Identify and report potential vector mosquito species to local and state control personnel for use in their control activities.

4. Define virus foci, species involvement, and seasonal activity in various areas, overwintering mechanisms, and effectiveness of local control programs on species populations.

B. PRIORITIES

Increased emphasis on known vector mosquitoes as the most likely source of arboviral isolation.

C. STATUS

1. Routine arboviral isolation studies from mosquitoes collected around the state will be conducted from May through November of each year. The period may be extended in the event of an outbreak of encephalitis.

2. Projected tissue cell cultures are sufficient to handle proposed activities.

3. Basic scheduling and uniformity of programs are of continuing importance and are to follow guidelines as presented here.

4. Limited, special surveillance proposals with prior approval will be considered.

5. Field training for new program participants should be arranged with other established program participants or their appropriate HSR.

6. Any proposed changes to standard field activities must be coordinated with the Arbovirus/Entomology Team.

D. PROCEDURES

1. Agencies requesting Mosquito-Borne Encephalitis Surveillance Program

information should contact the Arbovirus/Entomology Team at (512) 776-7615 or (888) 963-7111 ext. 7615.

2. Arrange scheduling of shipments with the Arbovirus/Entomology Team.

3. Mosquito specimens should be submitted alive using only the insulated shipping boxes supplied by the Arbovirus/Entomology Team.

4. Submitting agencies will be notified (under comments on the mosquito report form) if mosquito specimens are received in an unsatisfactory condition for arboviral isolation studies. These specimens will be processed for species identification only.

5. Amount and type of mosquito specimens to be submitted will be determined through a cooperative effort between the participant and the Arbovirus/Entomology Team.

6. Identification of mosquitoes will be reported to the participant prior to arboviral isolation results.

7. Isolation of potentially pathogenic encephalitis viruses will be reported immediately by telephone to the submitter and the Health Service Region Zoonosis Control Office where the mosquitoes were collected.

ATTACHMENT 7 – ARBOVIRUS FIELD SURVEILLANCE TECHNIQUES
www.dshs.state.tx.us/lab/arboFieldSurveillance.shtm

The following information is presented to introduce the basic procedures of field surveillance. Completion of proper training and adherence to procedures as listed under the guidelines is necessary for participation in the Arbovirus Surveillance Program. Field training for new program participants should be arranged with other established program participants or their appropriate HSR.

Pathogenic mosquito-borne encephalitis viruses affect the well-being of humans in Texas and are a continuing public health threat. Although most attention is given to this infectious group of diseases when explosive outbreaks occur, scattered cases are reported each year.

A. Purposes

1. Collection of vector mosquitoes to be shipped to the Laboratory for identification and arboviral isolation studies.

2. Determination of vector mosquito breeding sites.

B. Materials

1. Adult mosquitoes

   b. Mosquito collection traps
   c. Mechanical aspirators
   d. Flashlight
   e. Labeled mosquito shipping boxes
   f. Mosquito collection cartons
   g. Newspaper or other packing material
   h. One(1) quart plastic container filled with water and frozen prior to sending mosquitoes, or polar packs

C. Preparation of materials (supplied by the laboratory)

1. Mosquito shipping boxes

These boxes consist of an outer and inner box, which are separated by fiber insulation. A return-addressed label is attached to the mosquito shipping box. A box may be used repeatedly. Plastic containers with ice or polar packs along with newspaper are placed in each box.

   1. Mosquito Collection Cartons

   These cartons are made from pint, plastic containers with lids especially prepared for proper airflow. A corked hole is located on the side of the container. A mosquito submission form must accompany each container. Attach it to the container with a rubber band.

D. Methods

1. An overall perspective of the area to be surveyed is possible by consulting location (county, city, area) maps, discussing mosquito problems and cases of encephalitis with local officials (sanitarians, mosquito control personnel, Zoonosis Control investigators), and reviewing any records pertaining to mosquito activities in that area. Areas where mosquitoes are most likely to pose problems are circled on the map and/or recorded on a referral list (preferably in convenient order of investigation).

2. A map and/or referral list is carried with field investigators when they begin fieldwork. Materials for live adult mosquito collections are collection traps, insulated mosquito shipping boxes, mosquito collection cartons with attached mosquito report forms, aspirators, flashlights, and frozen containers that are kept in the shipping boxes. Adults should never be placed in alcohol or other fluid as this will alter important taxonomic characteristics and will not be processed.

3. Each area marked on the map or list should be investigated. Although the amount of time spent at each site will vary, one should allow sufficient time for sites separated by a considerable distance. Random surveying of sites in scheduled areas may prove productive.

4. Permission from the property owner or other authorized person must be secured prior to surveying any site. It is usually most practical to seek such permission at the time of arrival at that site. Sometimes due to long travel distances, permission may be sought by telephone prior to leaving headquarters.

5. Suitable mosquito collecting locations at a site may be found by:

   b. Questioning a resident or property owner about recent mosquito activity.
   c. Observing any attempts to feed by daytime biting mosquitoes.
   d. Examining any fairly open structures that have areas or corners somewhat protected from sun and wind; some frequently productive collecting locations are garages, chicken houses, barns, stables, under bridges, and large diameter storm drains. Any structure housing chickens and/or livestock is particularly suitable because many species of mosquitoes are attracted to chickens and will readily feed on them. Diurnal or evening biters are most often found at these locations. Therefore, surveying at sites not listed but where these animals are noticed can be productive.

6. Daytime biters that are encountered while surveying may be removed from the person (such as from the pants leg) by using an aspirator. Several specimens may be collected at a time (making certain that either suction is maintained or the open end of rigid tubing is covered to prevent specimens from escaping) and then blown into the mosquito collection containers. The mosquitoes are introduced into the containers by removing the cork, blowing the mosquitoes through the hole, and rapidly reinserting the cork to prevent loss of specimens.

7. Mosquitoes found in structures are removed from their resting sites (webbing, boards, tires, walls, etc.) and placed in the cartons. Because most specimens

found in this type of habitat are frequently in the darkest and most protected corners or containers, a flashlight is necessary to locate individual specimens.

8. Separate cartons should be used for different collecting locations at a site. For instance, mosquitoes collected from the pants leg while surveying the grass at a site should be in a different carton than those collected from a chicken coop at the same site. Of course, different sites will also require separate cartons. Collect about 50 mosquitoes at a site; then enter all collection information on the mosquito submission form that accompanies the carton. Please use a ballpoint pen. Attach the form to the carton with a rubber band.

NOTE: The above method is most often used; however, if precise information pertaining to location and site is not important to the investigator, mosquitoes may be combined in the same cartons and labeled as desired (such as county, city, block, or code number).

9. Collected specimens are placed into a cooler that also contains several frozen containers. This will keep the live specimens cool and relatively inactive during the remainder of the survey.

10. Following surveillance activities, the collected mosquitoes are returned to headquarters. Plastic containers with frozen water or polar packs are placed into the shipping box with the collecting cartons.

IMPORTANT: Several moistened paper towels or moistened newspaper should be added to the inner box to keep humidity at a high level. Avoid saturating the paper because excess water in the cartons will damage the mosquitoes.

11. The prepared shipping box is then labeled for proper transit to the DSHS Laboratory. Shipment by bus has proven most efficient for the majority of program participants.

E. Quality Control: Live, Adult Mosquito Shipments

1. Handling
   The most critical part of submitting satisfactory specimens is in shipping techniques.
   a. Temperatures:
      Sustained high temperatures are very detrimental to mosquitoes. Plastic containers with frozen water or polar packs should be used during both collection and submission stages.
   b. Humidity
      This is another important aspect that can be easily overlooked. High humidity is necessary and can be achieved by placing several moistened paper towels or moistened newspaper into the inner box. Avoid saturating the paper because excess water in the cartons will damage the mosquitoes.
   c. Proper labeling
      Collection data should be written on forms. Lack of proper information can decrease the value of arboviral isolation studies, particularly if arbovirus positive mosquito specimens have been collected.
   d. Holding specimens
      Although variable, the natural life span of a typical adult, female mosquito is

quite short (about a month). In captivity, mortality increases significantly after two or three days. Therefore, specimens being sent for arboviral isolation studies should be sent as soon after collection as possible - preferably the same day as collected. It is also detrimental to unnecessarily handle the specimens, such as by conducting "pre-identifications." All mosquito specimens submitted are identified and, therefore such handling by the submitter does not assist the laboratory process but often increases the mortality rate of the mosquitoes during transit.

e. Shipping arrangements
It is always preferable to ensure specimens are received Monday – Friday 8 am – 5 pm. Shipments late in the week may not be received until Saturday. Because mosquito processing is not routinely conducted on a weekend, a delay may occur that could damage the quality of the specimens. State holidays should also be taken into consideration. Whenever an emergency situation (such as an outbreak) develops, please call the DSHS Arbovirus/Entomology Laboratory (888-963-7111 ext. 7615 toll free) to arrange for special pickup and/or processing of such specimens.

f. Contamination
Mosquitoes for arboviral isolation studies are quite susceptible to pesticides; contact should be avoided or damage to the shipment will occur. This should be kept in mind when storing equipment and supplies.

F. Sampling methods

1. Sampling patterns

It is most productive to routinely sample all areas of concern. Whether a city, county, or other designated area, a schedule for routine sampling should be established. Few programs are comprehensive enough to cover all areas at the same time; therefore, quadrants or some other subdividing of the area may be necessary. Each subdivision of the area can then be surveyed at regular intervals.

2. Pool size

Although a total of one mosquito can be tested for encephalitis viruses, an ideal pool for arbovirus testing consists of about 50 mosquitoes. Having too many mosquitoes in a carton will stress them and can compromise the identification process. Therefore, no more than 100 mosquitoes should be placed in one (1) carton.

3. Time of day

The time of day that collections are made can by very significant. Although daytime biters can be collected at almost any time during the daylight hours, evening biters may present a problem if survey times are not properly scheduled. Collection of evening biters, which includes Culex quinquefasciatus, the primary vector of West Nile and St. Louis encephalitis, is usually made in protected areas where these mosquitoes rest during the day. Generally, collection traps are placed in the late afternoon and checked early the next morning.

4. Habitats

   The primary vectors of West Nile, St. Louis encephalitis, and western equine encephalitis are frequently found in resting shelters during the day. Potential vectors of eastern equine encephalitis include some daytime biters that may be difficult to find in such places. These factors are important when surveying for particular types of encephalitis vectors.

5. Light trap for collecting adult mosquitoes

   The CDC miniature light trap is productive for surveillance of some vector species but counterproductive for others. Scheduling for setting out light traps and picking up collected specimens may present some problems. An important drawback of this method is the lack of proper species collected when surveying for West Nile and St. Louis encephalitis viruses; the primary vector in Texas Cx. quinquefasciatus, is only weakly attracted to light. The attachment of carbon dioxide in the form of dry ice will increase the yield of the primary vector, but the results can still be very unsatisfactory. However, light traps can be effective tools when surveying storm sewers, collecting potential vectors of La Crosse encephalitis, eastern or western equine encephalitis, or determining the presence of some mosquito species that are seldom collected by other methods.

6. Gravid trap for collecting adult mosquitoes

   The gravid trap provides a more effective and economical sampling system for female Culex mosquitoes as they come to oviposit. It is therefore selective for females that have already taken at least one blood meal and the chance of isolating an arbovirus is greatly increased.

ATTACHMENT 8– FEMA ELIGIBILITY OF VECTOR CONTROL (MOSQUITO ABATEMENT)

https://www.fema.gov/9500-series-policy-publications/952310-eligibility-vector-control-mosquito-abatement

RECOVERY POLICY 9523.10

I. TITLE:

Eligibility of Vector Control (Mosquito Abatement)

II. DATE:

September 12, 2006

III. PURPOSE:

This policy describes the criteria the Federal Emergency Management Agency will use to determine eligibility for vector control (mosquito abatement) measures.

IV. SCOPE AND AUDIENCE:

The policy is applicable to all major disasters and emergencies declared on or after the date of publication of this policy. It is intended for personnel involved in the administration of the Public Assistance Program, including applicants.

V. AUTHORITY:

Section 403 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act, 42 U.S.C. 5121-5206, and 44 CFR §206.225(a)(3)(i).

VI. BACKGROUND:

A. Mosquito-borne illnesses continue to pose significant risks to parts of the population of the United States. Heavy rains and flooding caused by natural disasters can produce significant increases in biting mosquito populations in a short period of time in both inland and coastal areas. The increase in standing water not only provides additional habitat for mosquito egg laying by potential vector species of Culex, but also causes Aedes and Psorphora mosquito eggs to hatch that have lain dormant for months or even years. Typically, the first brood of adult mosquitoes will emerge from the standing water within 5-10 days of the disaster event. These adults will persist for 2-4 weeks and will lay additional eggs during their lifecycle. The result can be an enormous increase in the density of several mosquito species following a natural disaster. If standing water persists for long periods or is replenished by repeated rainfall, flooding, or normal drainage patterns are altered by the effects of the disaster event, increased mosquito production may continue for several weeks or months.

B. Certain species of mosquitoes are important vectors of West Nile Virus and other viral encephalitides in the U.S. (e.g., eastern equine encephalitis, western equine encephalitis, Saint Louis encephalitis). Dengue, also spread by mosquitoes, is endemic in the Caribbean and Mexico, and local transmission has been documented with increasing frequency in Texas.

C. Disaster events may increase the risk of mosquito transmitted disease when epidemic virus transmission is occurring in the area prior to the disaster and the additional mosquitoes prolong or expand the epidemic. The increase in vector mosquitoes may also promote or intensify virus amplification from low levels (enzootic or background levels). Increases in human exposure (residents or responders) to vector mosquitoes further enhance risk.

D. Many states and local governments have ongoing programs to monitor the levels and types of vector populations and associated viral infections in animals and humans. Based on the pre-disaster ―background level‖ of virus in mosquitoes, public health officials are able to monitor changes in arbovirus transmission levels in a disaster- affected area.

E. A large population of biting mosquitoes can pose an immediate threat to public health even when evidence of vector-borne diseases is not present or significant in the disaster affected area. Of particular concern are the following:

1. An extraordinary or unusual number of biting mosquitoes that can seriously impede response efforts. Workers that are required to work out-of-doors (i.e., debris removal operations, protection of damaged structures, restoration of power and telephone service, etc.) can often be significantly hampered in their work.

2. Housing may be compromised due to extended power outages (i.e., windows and doors are opened), which could increase the general public's exposure to mosquitoes. This could in turn result in secondary infections, especially among those with weakened immune systems such as the elderly, the very young, or the sick.

VII. DEFINITIONS

A. Aedes: The genus name for a mosquito that transmits yellow fever and dengue.1

B. Arbovirus: A virus utilizing arthropods as vectors and is transmitted via their feeding to a definitive host.2

C. Culex: Common mosquito genus comprised of 29 species in North America.2

D. Dengue: An infectious tropical disease transmitted by mosquitoes and marked by fever, rash, and sever joint pain.1

E. Encephalitis: A pathological condition characterized by inflammation of the brain.2

F. Enzootic: A level of disease endemic in animals. An enzootic disease is constantly present in an animal population, but usually only affects a small number of animals at any one time.2

G. Landing Rate: An adult mosquito surveillance measure utilizing human volunteers as bait. Expressed as number of mosquitoes landing per minute.2

H. Methoprene Briquettes: A formulation of methoprene (compound that mimics the action of an insect growth-regulating hormone and prevents the normal maturation of insect larvae) growth inhibitor and a timed-release carrier that resembles a charcoal briquette. Briquettes are designed to control mosquitoes in small bodies of water artificial water- holding containers.2

I. Psorophora: Mosquito genus comprised of 13 species in North America.2

J. Sentinel Organism: An organism, usually fowl, purposely exposed to mosquito bites outdoors to monitor pathogen transmission by mosquitoes.2

K. Seroconversion: The development of detectable antibodies in the blood of a sentinel organism directed against an infectious agent.2

L. Trap Count: The number of female mosquitoes captured in a trap receptacle each night the traps are set.2

VIII. POLICY:

A. Vector Control for Disease-Carrying or Extraordinary Mosquito Populations.

Vector control measures may be eligible in the disaster area as emergency protective measures under 44 CFR §206.225(a)(3)(i). FEMA may provide reimbursement for such costs at the written request of the State or local public health officials after FEMA consults with the Centers for Disease Control and Prevention (CDC), based on the following:

1. Evidence of higher levels of disease transmitting mosquitoes in the disaster area following the event or a significant number of disease-carrying mosquitoes in the area due to the increase in event-related standing water; or evidence of the potential for disease transmission and human exposure to disease carrying mosquitoes based on the detection of arboviral diseases in sentinel organisms (poultry, wild birds, mosquito pools) in the impacted area: prior to the storm event, discovered during surveillance as part of mosquito abatement activities, or reported human cases in which transmission occurred prior to the storm event. Presence of known primary and secondary vector species in an affected area may presage future event-related disease transmission.

2. A determination that a significant increase in the mosquito population and/or the change of biting mosquito species poses a threat to emergency workers who are required to work out-of-doors; thereby significantly hampering response and recovery efforts. Such evidence may include an abnormal rise in landing rates or trap counts, significant changes in species composition or estimate of infection rates, when compared to pre-disaster surveillance results.

3. Verification from medical facilities within the affected area that an increase in the general public's exposure to mosquitoes has directly resulted in secondary infections, especially among those with weakened immune systems such as the elderly, the very young, or the sick. This may occur when increased numbers of

residents in disaster areas with extended power outages are forced to open buildings for air circulation.

B. Monitoring Mosquito Populations and Disease Transmission Levels.

Where possible, a determination of the need for vector control measures should be based on surveillance data provided by local agencies, or on surveillance conducted as a component of the emergency response. Similarly, termination of control efforts should be based on mosquito density and disease transmission monitoring, and on the degree of exposure to mosquitoes of residents and responders. Information useful in determining the need for emergency mosquito control measures includes:

1. The local jurisdiction's mosquito population density estimates pre- and post-disaster, including information about species composition.

2. Arbovirus transmission activity indices, including information about the location of surveillance activities. Indices may consist of:

    a. Infection rates in mosquitoes.

    b. Seroconversion in sentinel chickens.

    c. Equine cases.

    d. Human cases.

3. Additional information that assists in making an assessment of needs includes:

    a. The amount and type of flooding (e.g., saltwater/freshwater, coastal/inland).

    b. The extent and location of damage to housing.

    c. The extent, location, and anticipated duration of power interruption.

    d. The anticipated extent and duration of cleanup/recovery operations.

4. Description of the type of mosquito management required (e.g., aerial or ground-based adulticide applications, larvicide applications), and duration of application to reduce the threat and the areas where the interventions are needed.

C. Abatement Measures.

Insecticide formulations must be among those approved and registered by the U.S. Environmental Protection Agency for use in urban areas for mosquito control, and must be applied according to label directions and precautions by appropriately trained and certified applicators. Furthermore, mosquito abatement measures must comply with all federal, State and local laws, ordinances, and regulations concerning vector control. Below are frequent types of vector control used but are not limited to the following:

1. Adulticiding. The ground or aerial spraying of insecticides to kill adult mosquitoes.

2. Larviciding. The application of chemicals, including methoprene briquettes, by ground or aerial to kill mosquito larvae or pupae.

3. Breeding Habitat Removal/Alteration. The modification of potential breeding habitat to make it unsuitable for mosquito breeding or to facilitate larval control. This includes draining or removing standing water in close proximity to homes, schools, sheltering facilities, and businesses.

    a. Efforts may include increased dewatering through the pumping of existing drainage systems.

    b. Dissemination of information (e.g., inserting flyers w/ resident's water bills, public service announcements, newspaper campaigns) to direct residents to remove mosquito breeding habitats.

D. Federal Assistance.

FEMA may reimburse applicants for eligible mosquito control measures or may provide direct federal assistance through a mission assignment. The procedure listed below should be followed:

1. The applicant provides documentation addressed in Section 8B of this policy to the State Public Health Department for evaluation.

2. Upon positive verification of a vector threat, the applicant contacts the State Emergency Management official or its primary point of contact with the Public Assistance staff, usually a Public Assistance Coordinator (PAC).

3. A FEMA representative will consult with CDC regarding the applicant's written request.

4. Following consultation with CDC, FEMA will provide assistance, as appropriate, based on FEMA's eligibility parameters.

E. Eligible Costs.

1. FEMA will only reimburse for the increased operating cost for mosquito abatement. This is calculated by comparing the disaster related costs to the last three years of expenses (whether through force account or use of contractors) for the same period.

2. The description of the type of mosquito management and duration of application are required to establish the eligible scope of work.

3. FEMA will assist in generating equipment rates if the applicant cannot produce their own.

4. Costs for information dissemination as outlined in Section C.3.(b) of this policy may be reimbursed upon verification of expenses.

F. Consultation with CDC. FEMA will consult with the CDC Division of Vector-Borne Infectious Diseases to evaluate a State's request for assistance under this policy.

IX. ORIGINATING OFFICE:

Recovery Division (Public Assistance Branch)

X. SUPERSESSION:

This policy supersedes all previous guidance on this subject.

XI. REVIEW DATE:

Five years from date of publication.

//signed//
John R. D'Araujo, Jr. Director of Recovery

1 - Webster's II New Riverside University Dictionary; copyright 1994 by Houghton Mifflin Company.
2 - Joseph M. Conlon, Technical Advisor, American Mosquito Control Association.