

# Continuation of Mosquito Surveillance and Control During Public Health Emergencies and Natural Disasters

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Mosquitoborne disease outbreaks occur every year in the United States from one or more of the arboviral diseases dengue, West Nile, LaCrosse, Eastern equine encephalitis, and Zika (1). Public opinion communicated through traditional and social media and the Internet, competing public health and resource priorities, and local conditions can impede the ability of vector control organizations to prevent and respond to outbreaks of mosquitoborne disease. The Environmental Protection Agency (EPA) and CDC performed a coordinated review of the concerns and challenges associated with continuation of mosquito surveillance and control during public health emergencies and disasters. This report highlights the first joint recommendation from EPA and CDC. Mosquito surveillance and control should be maintained by state and local mosquito control organizations to the extent that local conditions and resources will allow during public health emergencies and natural disasters. Integrated pest management (IPM) is the best approach for mosquito control (2). IPM uses a combination of methods, including both physical and chemical means of control (3). For chemical means of control, CDC and EPA recommend the use of larvicides and adulticides following the EPA label. It is imperative that public health recommendations be followed to ensure the safety of the pesticide applicator and the public.

## Background

Mosquito control and public health agency efforts in mosquito surveillance and abatement are critical for preventing mosquitoborne diseases and protecting public health including during public health emergencies and responses to natural disasters. Initiating or continuing the delivery of mosquito control and public health organization services are essential for protecting public health and mitigating mosquitoborne diseases. This includes the safe, timely, and judicious use of pesticides against adult mosquitoes (adulticides) and larval mosquitoes (larvicides), according to their EPA labels, as part of a comprehensive integrated control effort.

## Methods

CDC and EPA performed a coordinated review of the concerns and challenges associated with continuation of mosquito surveillance and control during public health emergencies and disasters. CDC and EPA work closely together and with federal,

state, tribal, local, and territorial organizations to protect the public from mosquitoborne diseases. CDC, in close collaboration with public health and mosquito control partners, monitors the potential sources of outbreaks of mosquitoborne diseases, and provides technical assistance for prevention and control activities. CDC/Agency for Toxic Substances and Disease Registry monitors exposures to pesticides in the U.S. population, provides information on health effects of certain pesticides, and responds to community concerns. EPA conducts rigorous scientific analyses to ensure that mosquito control and public health organizations have access to effective pesticides and mosquito control products that will not pose unreasonable risk for adverse effects to human health or the environment when used according to the label.

## Rationale and Evidence

Mosquitoborne diseases can pose threats to communities amid public health emergencies or following a natural disaster (e.g., flooding, fires, and hurricanes). To mitigate mosquitoborne disease threats, it is critical that mosquito control and public health organizations continue their surveillance and control programs to the extent that local conditions and resources will allow. A reduction of mosquito surveillance and control efforts can result in increased rates of mosquitoborne illness, and a lapse in services can reduce the efficacy of control strategies after they are reinstated. For example, properly planning and implementing control strategies to interrupt the mosquito lifecycle require ongoing surveillance, and monitoring can also inform appropriate timing of the application of adulticides and larvicides.

State, tribal, local, and territorial public health and mosquito control organizations play a critical role in protecting the public from mosquitoborne diseases. They serve on the front lines, providing information through their outreach programs to the human and environmental surveillance networks that first identify possible human illness outbreaks and emerging risk. They also manage the mosquito control programs that carry out prevention, public education, and mosquito surveillance and control. These organizations determine whether the use of pesticides for mosquito control is appropriate for their area.

CDC and EPA recommend IPM as the best approach for mosquito control (2). IPM uses a combination of methods and can include both physical and chemical means of control

(3). CDC and EPA recognize a need for use of adulticides and larvicides as a component of IPM. This is especially true during periods of mosquito-borne disease transmission.

Before a pesticide can be sold or distributed in the United States, it must be registered (licensed) by EPA to ensure that it meets federal safety standards to protect human health and the environment. By law, EPA registration means that the agency has determined a mosquito control pesticide product, when used according to label instructions, can perform its intended function without unreasonable risk to persons or the environment.

When evaluating pesticides, including those for mosquito control, EPA assesses a wide variety of data (e.g., potential long and short-term toxicity, carcinogenic, reproductive and developmental effects, exposure modeling, environmental fate, etc.) to estimate potential risk to persons and the environment from proposed use of the product. Many plant and wildlife species can be found in or near areas where mosquito control pesticides are used, including cities, agricultural fields, and recreational areas, so EPA considers risks in all these areas.

EPA's risk assessments evaluate the potential for harm to adults and children, considering special populations (such as a pregnant woman and her fetus, immunocompromised persons, the elderly, and others) as well as nontarget wildlife, fish, and plants (including endangered species). EPA also assesses the potential for contamination of surface water or ground water from leaching, runoff, and spray drift and how this might affect the long and short-term health of humans and wildlife in the area. When assessing risks from pesticides, the amount of a substance a person or nontarget organism is exposed to is as important as the toxicity of the pesticide. This concept is critical when analyzing the risks from mosquito control pesticides.

Many mosquito adulticides are applied as ultra-low volume (ULV) sprays in very small amounts. ULV sprayers dispense extremely small droplets using precision equipment that must be calibrated annually or more frequently depending on state requirements. A typical ULV adulticide, for example, is applied in droplets of 80 microns or less, which means hundreds of thousands of droplets could fit inside something as small as a pea. Common mosquito adulticides degrade quickly and do not have a residual effect (4,5). When released from an airplane, these tiny droplets are intended to stay airborne and drift through an area above the ground, killing the mosquitoes in the air on contact. As soon as the pesticide is released from the airplane's nozzle, it begins to degrade, minimizing potential risk for nontarget exposures, including those to humans or the environment.

In cases where the risk assessment reveals potential adverse impacts on humans or the environment, EPA works with the pesticide registrants and users to find ways to reduce the risk. For mosquito control products, the risk might be lowered

## Summary

### What is already known about this topic?

Mosquito surveillance and control programs, established throughout the continental United States, provide data to support timely and effective mosquito control actions to reduce mosquitoes and the risk of mosquito-borne disease.

### What is added by this report?

This is the first published policy report by CDC and the Environmental Protection Agency (EPA) to recommend the continuation of mosquito control surveillance and control during nonmosquito-related public health emergencies and natural disasters and to support the use of larvicides and adulticides following the EPA label instructions.

### What are the implications for public health practice?

The recommendations support continuation of mosquito control operations and use of resources to monitor and manage mosquitoes when there are competing priorities.

by such measures as reducing the application rate, increasing the release-height for aircraft, placing limits on usage under certain weather conditions (such as high wind speeds or temperature inversions), and tightly controlling the droplet size, among others.

EPA manages the risks of pesticides through its approval of a pesticide's label, requiring use directions and precautions to ensure that the pesticide is only used in a manner that does not cause unreasonable adverse effects. The label language is carefully crafted to ensure that the directions for use and safety measures are appropriate to any potential risk and can be enforced by law. Following label directions is required by law and is necessary to ensure that the use does not cause unreasonable adverse effects.

The decision to perform mosquito control, whether using adulticides or larvicides, should be 1) based on evidence (e.g., increasing virus infection rates in mosquitoes, sentinel animal infections, human cases, increasing mosquito abundance beyond acceptable levels as described by the Federal Emergency Management Agency (6) and defined by states); 2) made by professionals trained and certified in the safe handling, storage and application of pesticides; 3) applied using equipment that is properly calibrated; 4) timed to coincide with mosquito activity and minimize exposure to nontargets; and 5) applied strictly following the EPA-approved label. Before mosquito control applications, there should be an assessment of efficacy and resistance to the product. A postapplication evaluation of the efficacy of the application should also be performed. Public notification requirements vary; however, consideration might be given to notifying the public of scheduled pesticide applications and providing information about the pesticide product.

## Policy

CDC and EPA strongly recommend the continuation of mosquito surveillance and IPM-based control in the United States during mosquito-borne disease outbreaks, nonmosquito-related public health emergencies, and natural disasters. CDC supports EPA's science-based review of mosquito control adulticides and larvicides for registration and use in the United States that ensures, when applied following the EPA label, that these pesticides will not cause unreasonable adverse effects and will benefit human health.

## Discussion

This joint CDC-EPA statement supports mosquito control and public health organizations in planning, performing, and maintaining continuity of mosquito surveillance and control activities, and the use of EPA-registered adulticides and larvicides, under normal and emergency situations. The position should remain in effect during public health emergencies as well as during other unusual circumstances, natural disasters, and mosquito-borne disease outbreaks, and under the condition that other federal or jurisdictional guidance might be in place that should be incorporated into planning and operations.

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### References

1. Rosenberg R, Lindsey NP, Fischer M, et al. Vital signs: trends in reported vectorborne disease cases—United States and territories, 2004–2016. *MMWR Morb Mortal Wkly Rep* 2018;67:496–501. <https://doi.org/10.15585/mmwr.mm6717e1>
2. Environmental Protection Agency. Joint statement on mosquito control in the U.S. Washington, DC: Environmental Protection Agency; 2020. <https://www2.epa.gov/mosquitocontrol/joint-statement-mosquito-control-united-states>
3. World Health Organization. Handbook for integrated vector management. Geneva, Switzerland: World Health Organization; 2012. [https://www.who.int/neglected\\_diseases/vector\\_ecology/resources/9789241502801/en/](https://www.who.int/neglected_diseases/vector_ecology/resources/9789241502801/en/)
4. Schleier JJ III, Peterson RKD. Pyrethrins and pyrethroid insecticides. In: Lopez O, Fernandez-Bolanos JG, eds. *Green trends in insect control*. Cambridge, United Kingdom: The Royal Society of Chemistry; 2011.
5. Ware GW. *The pesticide book*. 4th ed. Fresno, CA: Thomson Publications; 1994.
6. Federal Emergency Management Agency. Public assistance program and policy guide. Washington, DC: Department of Homeland Security, Federal Emergency Management Agency; 2018. <https://www.fema.gov/media-library/assets/documents/111781>