



FOR YOUR INFORMATION

Larvicides for Mosquito Control

**EPA evaluates and
licenses pesticides**

The Environmental Protection Agency (EPA) evaluates and registers (licenses) pesticides to ensure they can be used safely. These pesticides include products used in the mosquito control programs which states and communities have established. To evaluate any pesticide, EPA assesses a wide variety of tests to determine whether a pesticide has the potential to cause adverse effects on humans, wildlife, fish and plants, including endangered species and non-target organisms.

**mosquito officials
select control
measures that best
suit local conditions**

Officials responsible for mosquito control programs make decisions to use pesticides based on an evaluation of the risks to the general public from diseases transmitted by mosquitoes or on an evaluation of the nuisance level that communities can tolerate from a mosquito infestation. Based on surveillance and monitoring, mosquito control officials select specific pesticides and other control measures that best suit local conditions in order to achieve effective control of mosquitoes with the least impact on human health and the environment. It is especially important to conduct effective mosquito prevention programs by eliminating breeding habitats or applying pesticides to control the early life stages of the mosquito. Prevention programs, such as elimination of any standing water that could serve as a breeding site, help reduce the adult mosquito population and the need to apply other pesticides for adult mosquito control. Since no pesticide can be considered 100% safe, pesticide applicators and the general public should always exercise care and follow specified safety precautions during use to reduce risks. This fact sheet provides basic information on larvicides, a type of pesticide used in mosquito control programs.

What are Larvicides?

**larvicides kill insect
larvae**

The mosquito goes through four distinct stages during its life cycle: egg, larva, pupa, and adult (see box). Larvicides kill insect larvae. Larvicides include

biological insecticides, such as the microbial larvicides *Bacillus sphaericus* and *Bacillus thuringiensis israelensis*. Larvicides include other chemicals used for controlling mosquito larvae, such as temephos, methoprene, oils, and monomolecular films. Larvicide treatment of breeding habitats help reduce the adult mosquito population in nearby areas.

How are Larvicides Used in Mosquito Control?

larvicides are used as one of several tools in mosquito control

State and local agencies in charge of mosquito control typically employ a variety of techniques in an Integrated Pest Management (IPM) approach, which include *surveillance*, *source reduction*, *larviciding* and *adulticiding*, to control mosquito populations. Since mosquitoes must have water to breed, source reduction aims to cut down opportunities for breeding, and can be as simple as turning over trapped water in a container to large-scale engineering and management of marsh water. Larviciding involves applying chemicals to habitats to kill pre-adult mosquitoes. Larviciding can reduce overall pesticide usage in a control program by reducing or eliminating the need for ground or aerial application of chemicals to kill adult mosquitoes.

What are Microbial Larvicides?

microbial larvicides are bacteria that are registered as pesticides

Microbial larvicides are bacteria that are registered as pesticides for control of mosquito larvae in outdoor areas such as irrigation ditches, flood water, standing ponds, woodland pools, pastures, tidal water, fresh or saltwater marshes, and storm water retention areas. Duration of effectiveness depends primarily on the mosquito species, the environmental conditions, the formulation of the product, and water quality. Microbial larvicides may be used along with other mosquito control measures in an integrated pest management (IPM) program. The microbial larvicides used for mosquito control are *Bacillus thuringiensis israelensis* (Bti) and *Bacillus sphaericus* (Bs).

Mosquito Life Cycle

egg - hatch when exposed to water;

larva - (pl. - larvae) lives in the water; molts several times; most species surface to breathe air;

pupa - (pl. - pupae) non-feeding stage just prior to emerging as adult;

adult - flies short time after emerging and after its body parts have hardened.

microbial larvicides
are harmful to insects
but not mammals

- ▶ *Bacillus thuringiensis israelensis* (*Bti*) is a naturally occurring soil bacterium registered for control of mosquito larvae. *Bti* was first registered by EPA as an insecticide in 1983. Mosquito larvae eat the *Bti* product which is made up of the dormant spore form of the bacterium and an associated pure toxin. The toxin disrupts the gut in the mosquito by binding to receptor cells present in insects, but not in mammals. There are 25 *Bti* products registered for use in the United States. Aquabac, Teknar, Vectobac, and LarvX are examples of common trade names for the mosquito control products.
- ▶ *Bacillus sphaericus* is a naturally occurring bacterium that is found throughout the world. *Bacillus sphaericus* was initially registered by EPA in 1991 for use against various kinds of mosquito larvae. Mosquito larvae ingest the bacteria, and as with *Bti*, the toxin disrupts the gut in the mosquito by binding to receptor cells present in insects, but not in mammals. VectoLex CG and WDG are registered *B. sphaericus* products, and are effective for approximately one to four weeks after application.

Do Microbial Larvicides Pose Risks to Human Health?

The microbial pesticides have undergone extensive testing prior to registration. They are essentially nontoxic to humans, so there are no concerns for human health effects with *Bti*, or *B. sphaericus*, when they are used according to label directions.

microbial larvicides
do not pose concerns
for human health or
the environment
when used according
to product labels

Do Microbial Larvicides Pose Risks to Wildlife or the Environment?

Extensive testing shows that microbial larvicides do not pose risks to wildlife, non-target species or the environment.

What is Methoprene?

Methoprene is a compound first registered by EPA in 1975 that mimics the action of an insect growth regulating hormone and prevents the normal maturation of insect larvae. It is applied to water to kill mosquito larvae and it may be used along with other mosquito control measures in an IPM program. Altosid is the name of the methoprene product used in mosquito control and is applied as briquets (similar in form to charcoal briquets), pellets, sand granules, and liquids. The liquid and pelletized formulations can be applied by helicopter and fixed-wing aircraft.

methoprene is an
insect growth
regulator

Does Methoprene Pose Risks to Human Health?

methoprene used in mosquito control programs according to label directions does not pose unreasonable risks to human health or the environment

Methoprene, used for mosquito control according to its label directions, does not pose unreasonable risks to human health. In addition to posing low toxicity to mammals, there is little opportunity for human exposure, since the material is applied directly to ditches, ponds, marshes or flooded areas which are not drinking water sources.

Does Methoprene Pose Risks to Wildlife or the Environment?

Methoprene used in mosquito control programs does not pose unreasonable risks to wildlife or the environment. Toxicity of methoprene to birds and fish is low, and it is nontoxic to bees. Methoprene breaks down quickly in water and soil, and will not leach into groundwater. Methoprene is highly toxic to some species of freshwater, estuarine, and marine invertebrates if misused. For that reason, EPA has established specific precautions on the label to reduce such risks.

What is Temephos?

temephos is an organophosphate (OP)

Temephos is an organophosphate (OP) pesticide registered by EPA in 1965, to control mosquito larvae, and is the only organophosphate with larvicidal use. It is an important resistance management tool for mosquito control programs; its use helps prevent mosquitoes from developing resistance to the bacterial larvicides. Temephos is used in areas of standing water, shallow ponds, swamps, marshes, and intertidal zones. It may be used along with other mosquito control measures in an integrated pest management (IPM) program. Abate is the trade name of the temephos product used for mosquito control. Temephos is applied most commonly by helicopter, but can be applied by backpack sprayers, fixed-wing aircraft, and right-of-way sprayers in either liquid or granular forms.

Does Temephos Pose Risks to Human Health?

temephos used according to label directions does not pose unreasonable risks

Temephos, applied according to the label for mosquito control, does not pose unreasonable risks of human health effects. It is applied to water, and the amount of temephos is very small in relation to the area covered, less than one ounce of active ingredient per acre for the liquid and eight ounces per acre for the granular formulations. Temephos breaks down within a few days in water

high dosages of OPs can overstimulate the nervous system

and post application exposure is minimal. However, at high dosages, temephos, like other OPs, can overstimulate the nervous system causing nausea, dizziness, confusion.

Does Temephos Pose Risks to Wildlife or the Environment?

temephos is toxic to bees and it can be toxic to some birds and aquatic species if misused

Because temephos is applied directly to water, it is not expected to have a direct impact on terrestrial animals, but temephos can be highly toxic to some bird species and aquatic organisms if misused, and it is toxic to bees. For that reason, EPA has established specific precautions on the label to reduce such risks. The registrant of temephos has submitted studies on toxicity to aquatic invertebrates, which are being reviewed by EPA.

What is the Current Regulatory Status of Temephos?

EPA is currently reviewing temephos

As part of its responsibility to reassess all older pesticides registered before 1984, EPA is currently reviewing temephos as part of its reregistration process. The review of temephos is scheduled for completion this calendar year. A risk assessment covering all uses of temephos is available to the public on the EPA web site. From the pesticide program home page (see address below), select "OPs," then select "OP Schedule and Documents."

What are Monomolecular Films?

films drown larvae, pupae and emerging adults

Monomolecular films are chemicals that spread a thin film on the surface of the water that makes it difficult for mosquito larvae, pupae and emerging adults to attach to the water's surface, causing them to drown. Films may remain active for typically 10-14 days on standing water, and have been used in the United States in floodwaters, brackish waters, and ponds. They may be used along with other mosquito control measures in an IPM program. They are also known under the trade names Arosurf MSF and Agnique MMF.

Do Monomolecular Films Pose Risks to Human Health?

films do not pose a risk to humans

Monomolecular films, used according to label directions for larva and pupa control, do not pose a risk to human health. In addition to low toxicity, there is little opportunity for human exposure, since the material is applied directly to ditches, ponds, marshes or flooded areas which are not drinking water sources.

Do Monomolecular Films Pose Risks to Wildlife or the Environment?

films pose minimal risks to the environment

Monomolecular films, used according to label directions for larva and pupa control, pose minimal risks to the environment. They do not last in the environment for a long time, and are usually applied only to standing water, such as roadside ditches, woodland pools, or containers which contain few non-target organisms.

What are Oils?

oils form a coating on the water to drown mosquito larvae, pupae and emerging adults

Oils, like films, are used to form a coating on top of water to drown larvae, pupae and emerging adult mosquitoes. They are specially derived from petroleum distillates and have been used for many years in the U.S. to kill aphids on crops and orchard trees, and to control mosquitoes. They may be used along with other mosquito control measures in an IPM program. Trade names for oils used in mosquito control are Bonide, BVA2, and Golden Bear-1111 (GB-1111).

Do Oils Pose Risks to Human Health?

oils do not pose a risk to human health, but may be toxic to aquatic animals if misapplied

Oils, used according to label directions for larva and pupa control, do not pose a risk to human health. In addition to low toxicity, there is little opportunity for human exposure, since the material is applied directly to ditches, ponds, marshes or flooded areas which are not drinking water sources.

Do Oils Pose Risks to Wildlife or the Environment?

Oils, if misapplied, may be toxic to fish and other aquatic organisms. For that reason, EPA has established specific precautions on the label to reduce such risks.

Where Can I get More Information About Larvicides and Mosquito Control?

Centers for Disease Control and Prevention

For more information about mosquito control in your area, contact your state or local health department. The federal Centers for Disease Control and Prevention is also a source of information on disease control, and their Internet web site includes a listing of state health departments. To contact the

Centers for Disease Control and Prevention (CDC):

Call: 970-221-6400

Fax: 970-221-6476

E-mail: dvbid@cdc.gov

web site: <http://www.cdc.gov>

national toll-free pesticide hotline

Information on pesticides used in mosquito control can be obtained from the state agency which regulates pesticides, or from the **National Pesticide Telecommunications Network (NPTN)**. The NPTN web site includes links to all state pesticide regulatory agencies.

Toll-free hotline: 1-800-858-7378 (9:30 a.m. to 7:30 p.m. EST) daily except holidays. Callers outside normal hours can leave a voice mail message, and NPTN returns these calls the next business day.

E-mail: nptn@ace.orst.edu

web site: <http://ace.orst.edu/info/nptn>

mosquito control professionals

Information on mosquito control programs can also be obtained from the **American Mosquito Control Association (AMCA)** web site at: **<http://www.mosquito.org>**. This site also lists many county mosquito agencies.

federal pesticide program office

For more information regarding the federal pesticide regulatory programs, contact:

EPA Office of Pesticide Programs (OPP)

Telephone: 703-305-5017

Fax: 703-305-5558

E-mail: opp-web-comments@epa.gov

web site: <http://www.epa.gov/pesticides>

EPA's 10 Regional Offices are also a source of pesticide information, as well as on pesticide program activities in the individual regions.

10 EPA regional offices

EPA Region I - CT, MA, ME, NH, RI, VT

888-372-7341

www.epa.gov/region01

EPA Region II - NJ, NY, PR, VI

732-321-4391

www.epa.gov/region02

EPA Region III - DE, DC, MD, PA, VA, WV

800-438-2474

EPA Region IV - AL, FL, GA, KY, MS, NC, SC, TN

800-241-1754

www.epa.gov/region4

EPA Region V - IL, IN, MI, MN, OH, WI

800-621-8431 (Region V only) or 312-353-2000

www.epa.gov/region5

EPA Region VI - AR, LA, NM, OK, TX
800-887-6063 (Region VI only) or **214-665-6444**
www.epa.gov/region6

EPA Region VII - IA, KS, MO, NE
800-223-0425 or **913-551-7020**
www.epa.gov/region7

EPA Region VIII - CO, MT, ND, SD, UT, WY
800-227-8917 (Region VIII only) or **303-551-7020**
www.epa.gov/region08

EPA Region IX - AZ, CA, HI, NV, AS, GU
415-744-1500
www.epa.gov/region09

EPA Region X - AK, ID, OR, WA
800-424-4372 (Region X only) or **206-553-1200**
www.epa.gov/r10earth

Other Helpful EPA Publications

For Your Information - How to Use Insect Repellents Safely
(735-F-93-052R)

For Your Information - Mosquitoes: How to Control Them
(735-F-98-003)

For Your Information - Naled for Mosquito Control
(735-F-00-003)

For Your Information - Malathion for Mosquito Control
(735-F-00-001)

For Your Information - Synthetic Pyrethroids for Mosquito Control
(735-F-00-004)

Questions and Answers - Pesticides and Mosquito Control