

MOSQUITO CONTROL AERIAL SPRAYING

Public Information and Education

Advertising and outreach programs educate and inform the public about mosquito control and prevention methods through the use of media, participation in community events and presentations to various organizations.

Mosquito and Vector Surveillance

We closely monitor mosquito activity, climate change and virus activity by testing mosquitoes and wild birds for the presence of several viruses. This research and surveillance information helps guide all control efforts.

Biological Control

Biological control is the use of living organisms to control a particular pest. This organism will attack the harmful pest, resulting in a reduction of its population levels. The primary biological control used against mosquitoes is the mosquito fish, *Gambusia affinis*.

Physical Control

Physical control or manipulating the environment to reduce mosquito breeding sites is a very effective method of mosquito control. A few examples of physical control include: promoting effective drainage, controlling vegetation and appropriate timing of irrigation.

Microbial and Chemical Control

Microbial and chemical control is the prudent use of chemical compounds (insecticides) that reduce mosquito populations. Chemical products are used when other control methods are not practical or have been incapable of maintaining mosquito numbers below a tolerable level.

The most important thing I can say about the Microbial or chemical products we use to control mosquitoes in Multnomah County are that they are not a commodity. We purchase very specific materials that are designed to kill mosquito larvae while at the same time create little or no damage to non target organisms.

These products undergo rigorous testing by the Environmental Protection Agency before they are allowed to be marketed in the United States. Once we begin to use a product we carefully study its effectiveness and its effect on non target organisms in our County as well.

We perform mosquito control throughout all of Multnomah County including public as well as privately owned property. We very clearly understand that we are in a sense a guest on these properties, who at times must make an application of pesticides. We work very hard to educate the effected property owners and our stakeholders about our activities and the products we are applying.

Our education campaign for these products with our landowners and stakeholders has always been based on the trade names of these products as well as the active ingredients. It has taken many years to gain at times a grudging support or tolerance for the products

we use. If we are required to make our purchases based on the lowest bid price for a specific active ingredient we will be forced to reeducate all property owners and stakeholders each time we switch materials before making applications. This process can be very time consuming requiring at times large public town hall meetings to individual sessions with dozens of agencies or property owners.

It may take several months to implement a pesticide change in our helicopter application program. We work with three other counties in a cooperative agreement for aerial applications to the floodplains of the Columbia River, Clark and Cowlitz Counties in Washington and Columbia County in Oregon. Part of our agreement with the other agencies is to use the same helicopter company and the same material at the same rate per acre. This helps hold down costs for all the agencies and insures standardization of control throughout the floodplain. Additionally the helicopter company is only required to calibrate their application equipment for the same material at the same rate one time instead of recalibrating for each districts material need. Again this helps hold down the cost of application for all agencies.

When we do introduce a new product into our inventory it is done over time so that we can gain confidence in the manufacturing process, manufacturer's ability to provide inventory when needed, effectiveness, effects on non targets and finally time to educate our land owners and stakeholders.

Applying a material County wide without having any real data on the standards used in its production, its efficacy against the species of mosquitoes in our County or its effect on non targets species would be no different than purchasing the cheapest flu vaccine available with no knowledge of the standards used in manufacturing and hoping that its use causes no ill effects.

Here are the specific reasons we have chosen to use *Bacillus thuringiensis*, subspecies *israelensis* (Bti) products produced by Valent Bio Science Corporation (VBC). The product trade names would be Vectobac G, Vectobac CG and Vectobac 12AS.

The VectoBac strain of Bti (AM65-52) has met the specifications of the World Health Organization Pesticide Evaluation Scheme (WHOPES). This was done in the process of WHOPES review of VectoBac WG for its global use by ministries of health. No other manufacturer's strain has met these specifications. This is a great selling point for this material to other concerned agencies because it represents an agency other than the Environmental Protection agency or the manufacturer testing the product for safety and efficacy.

VBC has a full time Microbiology group that maintains their microbial strains, including Bti AM65-52. Not all manufacturers have this capacity.

The active ingredient in VectoBac G is produced by fermentation of the AM65-52 Bti strain in an FDA monitored fermentation facility operated by Abbott Laboratories in North Chicago, Illinois, which has over 60 years of fermentation experience and 30 years

experience fermenting the AM65-52 strain. No other Bti product is fermented in an FDA monitored facility.

VectoBac G (like all VBC products) is formulated in an International Standards Organization (ISO) certified facility and VBC operates under ISO processes (certificate attached). Other Bti products are not made in facilities meeting ISO standards or by organizations that follow ISO processes. Again this demonstrates to our stakeholders the safety, consistency and review by a third party of the VBC products.

VectoBac products are monitored for biopotency in a dedicated, in-house bioassay laboratory at Abbott Laboratories. Other manufacturers do not maintain in-house bioassay capacity, and therefore do not have capacity to monitor fermentation or production lots as closely as VBC does. A consistent fermentation process reduces the likelihood of poor formulations or less than lethal concentrations of BTI that contribute to control failures and repeat applications. Control failures and repeat applications not only cost additional money but they erode the confidence in our agency and the materials we use that we have worked hard to instill in our stakeholders.

The capacity of VBC to produce and deliver large volumes of quality product when Multnomah County needs it to control mosquitoes is unsurpassed by any manufacturer.

Trade Names and mode of action for common larvaciding products used in Multnomah County

***Bacillus thuringiensis israelensis* (Bti)**

Trade names used by Multnomah County Vectobac G, Vectobac CG, and Vectobac 12AS.

Bacillus thuringiensis, subspecies *israelensis* (Bti) is a naturally occurring soil bacterium that can effectively kill mosquitoes during the larval stage of development. Bti is an endospore-forming bacterium that is ingested by the actively feeding larvae. When the bacteria Bti encysts, it produces a protein crystal toxic to mosquito larvae. Once the bacteria have been ingested, the toxin disrupts the lining of the larvae's intestine causing it to stop eating and die. Bti is the primary material used for mosquito control in Multnomah County because of its low toxicity to non-target species. Bti is highly pathogenic against the first through third larval instars of mosquitoes (family Culicidae), blackflies (Family Simuliidae) and has some virulence against certain other Dipteran Families, especially midges (Family Chironomidae). Bti has been extensively studied for effects on non-target organisms and environmental consequences of use with no reported adverse effects. It is not toxic to bees.

Bti products are available in liquid, pellet, granular, and briquette formulations. The type of Bti formulation influences the activity of the product. Generally, Bti does not persist long after application, with toxicity persisting from 24 hours to over one month when the longer lasting formulations are used.

Larval toxicity can depend on the species, its feeding activity and other possible factors such as UV light, water quality, pH, temperature, agitation, and sedimentation.

Bacillus sphaericus (Bs)

Trade Names used in Multnomah County Vectolex CG, Vectolex WDG and Vectolex WSP

Bacillus sphaericus is a naturally occurring spore-forming bacterium, which produces a protein endotoxin at the time of sporulation. The toxin is only active against the larval stage and must be ingested and digested before it activates. *B. sphaericus* has unique property of being able to control mosquito larvae in highly organic aquatic environments such as manure waste lagoons and stormwater catch basins.

B. sphaericus can offer up to six weeks of control in many habitats because the protoxins and spores can remain suspended in the water column for extended periods and due to the recycling of bacteria in dead larvae. Duration of control will depend upon habitat factors such as water depth, flushing, water chemistry and frequency of oviposition to maintain the recycling process. Vectolex CG and Spheratax SPH 50 G are the trade names for *B. sphaericus*,

B. sphaericus was first registered for the control of *Culex* mosquitoes but its uses have been expanded to include control of several *Aedes*, *Anopheles*, *Ochlerotatus*, *Psorophora* and *Coquilettidia* species. *B. sphaericus* is not acutely toxic to freshwater and saltwater invertebrates, honeybees, mayfly larvae, does not appear to be harmful to fish and other marine life, and is not toxic to birds on a sub chronic basis. In tests, *B. sphaericus* was not pathogenic, infective or toxic in laboratory animals by the oral, dermal, pulmonary and intravenous routes of exposure.

Insect Growth Regulator Methoprene

Trade names used in Multnomah County Altosid 30 day pellets, Altosid WSP, Altosid XR and Altosid XRG.

Methoprene is a compound that mimics the action of an insect growth-regulating hormone and prevents the normal maturation of insect larvae. Unable to metamorphose, the mosquitoes die in the pupal stage. Methoprene is classified as a biochemical pesticide because it controls mosquito larvae by interfering with the insect's life cycle rather than through direct toxicity. Methoprene is available in numerous formulations and sold under the product names: Zoecon Altosid, Biosid, and Strike. Studies indicate that Methoprene is of low toxicity and poses little risk to people when used according to label instructions. Methoprene was not shown to have any significant toxicological effects in the standard battery of toxicity studies used to assess human health effects. The pesticide has very low acute oral and inhalation toxicity potential and is not an eye or skin irritant. Methoprene is also of low acute dermal (skin) toxicity and is not a human skin sensitizer.

In laboratory tests, the toxicity of Methoprene to birds and fish is low, and it is nontoxic to bees. Field studies involving Methoprene have shown that it has no lasting adverse effects on populations of invertebrates or other non-target aquatic organisms when used

according to label instructions for mosquito control. Methoprene mosquito control products present minimal acute and chronic risk to freshwater fish, freshwater invertebrates, and estuarine species. Methoprene is not persistent in the environment. It degrades rapidly in water, being susceptible to transformation by sunlight and microorganisms.

Monomolecular Surface Films

Trade name used in Multnomah County Agnique MMF

Monomolecular surface film (MMF) is a non-petroleum surface oil that acts as a physicochemical agent by altering the mosquito's habitat. It belongs to the alcohol ethoxylate group of surfactants (products meant to increase product efficacy), which are used in detergent products. MMFs disrupt the cohesive properties of water, which allow mosquitoes to use the water's surface as an interface for breeding. In effect, by making the surface "wetter," MMFs drown mosquitoes.

MMFs kill larvae and pupae by making it impossible for them to keep their breathing tubes above the water's surface. Mosquitoes that require little or no surface contact for breathing, such as *Coquillettidia* species, require properly timed applications at surface contacting stages—the pupae to emerging adult—for maximum impact. Since MMFs kill mosquitoes with a physical mechanism (rather than a toxic mechanism), it is not effective in habitats with persistent winds of greater than ten miles per hour, or in areas with very choppy water.

Some species, such as the midge, and some arthropods that require attachment to the water surface have been shown to be affected. MSF is non-toxic to most non-target wildlife. According to EPA, MMFs poses minimal risks to the environment when used according to FIFRA label directions. MMFs are not a skin irritant, are only a mild eye irritant on prolonged or repeated contact, and are considered to be non-toxic by animal tests. The film persistence is dependent on temperature, water flow, amount of bacteria in the water, and the duration and strength of the wind following application. MMFs typically persist on the water surface for 5-22 days.

Spinosad

(spinosyn A and spinosyn D) are a new chemical class of insecticides that are registered by the _____ (EPA) to control a variety of insects. The active ingredient is derived from a naturally occurring soil dwelling bacterium called *Saccharopolyspora spinosa*, a rare actinomycete reportedly collected from soil in an abandoned rum distillery on a Caribbean Island in 1982 by a scientist on vacation.^[1] It has not been found in nature since that time, and was subsequently described as a new species. The bacteria produce compounds (metabolites) while in a fermentation broth. The first fermentation-derived compound was formulated in 1988. Spinosad has since been formulated into insecticides that combine the efficacy of a synthetic insecticide with the benefits of a biological pest control organism.

Spinosad topical suspension, 0.9%, was approved by the U.S. Food and Drug Administration (FDA) on 2011-01-18 for the topical treatment of head lice infestation in patients four (4) years of age and older.^[2] It is marketed as the trade name **Natroba** in the US by ParaPRO Pharmaceuticals.^[2] Spinosad is a mixture of spinosyn A and spinosyn D in a ratio of approximately 5 to 1 (spinosyn A to spinosyn D).^[3]

Spinosad kills susceptible species by causing rapid excitation of the insect nervous system. Due to this unique mode of action, Spinosad is valued in resistance management programs. Spinosad must be ingested by the insect, therefore it has little effect on non-target predatory insects. It is highly effective used as an oral anti-flea medication for dogs, and apparently has the potential for killing any blood-sucking insect.

Spinosad is relatively fast acting. The insect dies within one to two days after ingesting the active ingredient. There appears to be 100% mortality.