Cache Mosquito Abatement District's

Pesticide Discharge Management Plan (PDMP)

Adopted on January 26, 2012
Reviewed & Updated February 25, 2016
Review & Updated April 22, 2021

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Introduction

The Pesticide General Permit (PGP) for point source discharges to waters to the state of Utah from the application of pesticides covers any qualified "operator" that meets the eligibility requirements identified in Part 1.C.1 and Part 1.D.1, and if so required, submits a Notice of Intent (NOI) in accordance with Part 1.A.3.

As a Mosquito Abatement District (activity covered in Part 1.C.1), the Cache Mosquito Abatement District (CMAD) is eligible for the coverage under the PDP. Also, as an "Operator Group 2" defined in Part 1.D.1, the CMAD has to submit an NOI regardless of the size of the area to be treated. The NOI was submitted to the Department of Environment Quality on October 14th, 2011.

The PGP requires any "operator" that is required to submit an NOI and comply with the water quality based effluent limitations to also develop a written Pesticide Discharge Management Plan (PDMP) to document measures taken to meet the effluent limits.

The PDMP requires that the following to be documented:

1. Pesticide discharge management team information;
2. Pest management area description;
3. Control measure description; and
4. Schedules and procedures pertaining to control measures used to comply with the effluent limitations

The CMAD must keep the PDMP up-to-date for the duration of coverage under the PGP. The PDMP may contain other documents to describe how we will comply with the effluent limitations of the permit. A copy of any portions of any documents that we will use must be attached to the PDMP.

You will find in the next pages the description of the different control measures implemented.

/s/ Joe Hansen Date: 4/22/2021
Chairman
CMAD Board of Trustees

Next review date: March 2022.

1. Pesticide Discharge Management Team Information.

All persons may be contacted at:

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A. Person(s) responsible for managing pests in relation to the pest management area:

Richard Rigby, Manager
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B. Person(s) responsible for developing and revising the PDMP:

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C. Person(s) responsible for developing, revising, and implementing corrective actions and other effluent limitation requirements:

Richard Rigby, Manager
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D. Person(s) responsible for pesticide applications (mix, load, apply):

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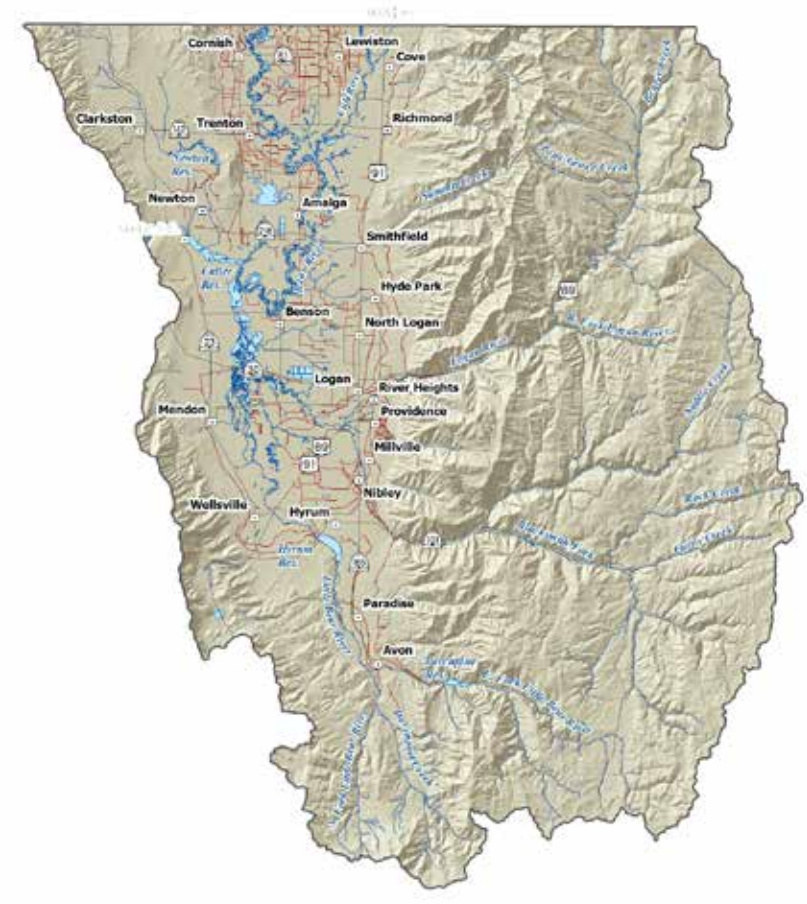
PEST MANAGEMENT AREA DESCRIPTION

General Description and Location

Cache County lies in the northern part of Utah and is bounded by mountains with the higher Bear River Mountains on the east and the Wellsville Mountains and Clarkston Mountains on the west. The main valley extends some fifty miles in length from south to north (into southern Idaho) with a width of around twenty miles at its widest. The highest point is Naomi Peak in the Bear River Mountains (9,980 ft). The valley floor is predominantly privately owned and used for agriculture. The more urban areas of the county lie along the eastern side and benches while small farm towns are found in the west and north.

The county has a total area of 1,174 square miles (751,360 acres). Roughly half of the county is mountainous, forested, and publicly owned. The Cache Mosquito Abatement District (CMAD) includes the county unincorporated area and all municipalities except Logan, River Heights, and Paradise. College-Young Mosquito Abatement District is separate from CMAD; the Logan environmental department provides abatement services within the Logan municipal boundaries. CMAD total area is 313,180 acres of primarily rural area with small communities.

Population for the district is roughly 60,230 people; about half live in the 16 towns that are part of CMAD. Average temperature ranges from 24° in the winter to 71°F in the summer. Cache County averages 18 inches of precipitation annually with 13.5 in as rain and 61.7 in as snow.



Natural Environments

CMAD concentrates its abatement and surveillance activities in the valley floor. The Bear River and its tributaries traverse the valley floor and eventually drain into the Great Salt Lake. Cutler Marsh and Cutler Reservoir are in the center of the valley and total 10,350 acres. With the hidden channels and abundant plant growth, this comprises the main natural breeding area for mosquitoes. Many channels are cut off from flowing water once the spring runoff ends and provide abundant breeding pools.

Many natural springs and small creeks are found throughout the valley and bench areas. The water from these springs and

creeks often is caught in pools and ponds throughout the area, especially once warmer temperatures arrive, and serve as nurseries for the mosquitoes found in the region.

Man-made Environments

Shallow, roadside ditches and canals are frequently suggested as sources of mosquito problems. Such sites often remain dry throughout much of the year because of temperature, but in some suburbs, runoffs from flooded fields can keep them wet for a good part of the year and become very attractive sites for mosquito females to lay their eggs.

Trenches and ruts from the heavy equipment used in construction sites can generate many new mosquito development sites. These newly established "lows" can hold water for prolonged periods of time, and are productive as larval mosquito sites until they are developed or regenerate.

Livestock pastures can pose a serious problem to mosquito abatement agencies, as the livestock not only provide a reliable blood meal for female mosquitoes but form numerous larval habitats from their hoof prints. The presence of watering troughs on the sites also adds to the problem.

Containers come in all sorts of shapes and sizes. These may be represented by something as small as a bottle top to something as large as a discarded or unkempt boat. Many items in people's backyard could be potential development sites for mosquitoes (toys, bird baths, old tires, etc.).

Other man-made sites include borrow pits, agricultural fields, and retention and detention ponds. Fields flooded on purpose by farmers to water their crops are also a major issue for the district.

Pest Problem Description

The county is known to contain five genera of mosquitoes, although the Cache Mosquito Abatement District actively surveys and conducts control efforts primarily on two species: *Culex tarsalis* and *C. pipien*s. The *Culex* spp. are known to be carriers of the West Nile virus (WNV) in Cache County. By August, primarily *Culex* mosquitoes are found in the traps while *Ochlerotatus* spp. predominate early in the season (May and June). *Aedes*, *Anopheles*, and *Culiseta* species are occasionally found, but in much lower numbers (about 2% of total mosquitoes).

Culex pipiens are found widely distributed throughout the world and are usually considered the most common pest mosquito in urban and suburban settings. It is called the "Northern House Mosquito" because it is rarely found below 39 degrees latitude and is more suited for cooler weather conditions. They are regularly found entering homes. Adults are generally active only during the warmer months (typically late July, August, and early September) and prefer to bite birds over mammals. These are "bridge" vectors, because they maintain the viruses within bird populations and then transmit viruses between birds and mammals. *Culex pipiens* is a vector, or carrier, of St. Louis Encephalitis (SLE), West Nile Virus (WNV), Western Equine Encephalitis (WEE), Heartworm in dogs, and bird Malaria.

Culex tarsalis is widely distributed throughout Cache County. They are primarily rural mosquitoes, preferring pasture and other flood irrigated crops and wetlands. In Utah, *C. tarsalis* is the most likely to transmit the WNV when taking a blood meal. This mosquito prefers to feed on birds and small mammals in rural areas, but will invade neighborhoods, too. It is the most common vector to humans and horses for WNV. In early spring, infected mosquitoes may be found, probably as infected overwintering females.

Ochlerotatus dorsalis and *O. nigromaculis* are also found in the district; they are typically less than 10% of the mosquitoes trapped. These species are not known to be natural carriers of disease. Pasture mosquitoes are considered pests and can interfere with agricultural operations as well as the use of recreational areas.

Action Threshold

The Cache Mosquito Abatement District uses an integrated pest management approach to control mosquitoes. Methods include larviciding, surveillance, and fogging. The criteria for treatment are established based on the fact that the district was created to treat for nuisance and/or public health concerns.

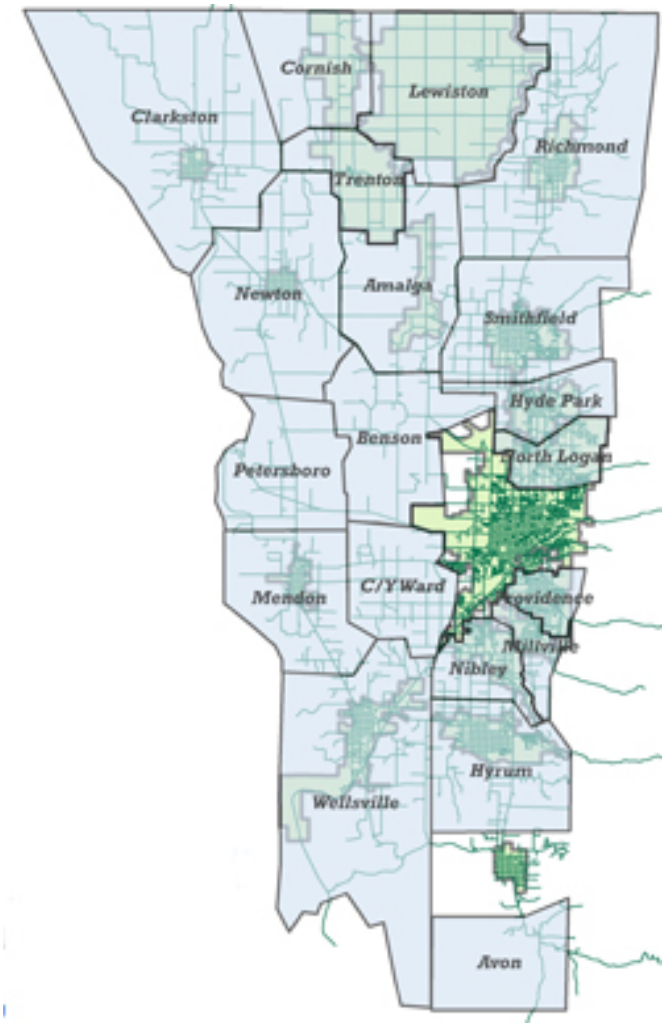
Larvicide treatments vary depending on mosquito species present, local demographics, and other conditions. If 1 larva is found in any dip (using a standard 12 oz dipper), the larval mosquito habitat will be treated. A number of known, historic breeding sites may be treated after a major rain or flooding event if there is insufficient time to inspect and treat all larval sites within the district.

Surveillance, including the distribution of mosquito traps throughout the District, tracks increased numbers of adult mosquitoes and allows for the identification of those mosquitoes and testing for the presence of WNV. The number of mosquitoes and/or the species will trigger adulticide treatment (fogging).

- More than 50 mosquitoes that are disease vectors, i.e. *Culex tarsalis* or *C. pipiens*, found in any trap site in the district.
- More than 50 mosquitoes that are considered nuisance species (*Ochlerotatus*, *Anopheles*, or *Aedes* species) from a trap site.
- Complaint calls from residents. If this is from an area where a threshold has been reached, fogging is already scheduled and performed. If the calls are from an area where a threshold has not been reached, a trap will be set up and numbers assessed to see if thresholds are at the treatment level.
- Field workers reporting a larvicide failure at any breeding site located near a populated area.
- Limited area treatments may be conducted prior to special events or community functions based on a service request by the organizers.

General Location

Control of mosquitoes at the larval stage is the major part of mosquito control by CMAD, comprising nearly 70% of the time spent in the field. Trained technicians survey potential larval habitats and use larvicides when larvae are found. Larval habitat is constantly changing throughout the season although known “hotspots” have been identified. Larvicides are pesticides that are added to the water in order to kill the mosquito larvae before they emerge as adults.



Many of the products are applied by hand or with a spreader. This is done on foot, from all terrain vehicles (ATV's), or from trucks.

The main pesticides used for larviciding, both in granular and liquid formulations, would include bacterial products, surface agents, chemicals (nerve toxins), and growth regulators.

Adult mosquito control is used to rapidly knock down biting adult mosquitoes. This can become necessary when larval control measures are insufficient or not feasible. Adulticiding is used mostly when there is a high possibility of disease transmission in an area such as the West Nile virus (WNV) and where adult mosquitoes are considered a nuisance for the public. The district uses ultra-low volume (ULV) spraying, or fogging. ULV spraying is the process of putting very small amounts of liquid into the air as a fine mist of droplets. These droplets float on the air currents and quickly kill mosquitoes that come into contact with them. ULV adulticides are applied in the evening and the night hours when mosquitoes are most active and bees and other pollinators are typically in shelter. ULV applications are only done during environmental conditions that ensure desirable product movement.

Labels and Material Safety Data Sheets (MSDS) of all larvicides and adulticides used in our operation are posted on the District’s website (www.cachemosquito.com) and available for the public. The modes of action of those different families of products are also described on the website.

The United States Environmental Protection Agency (USEPA) approves the use of pesticides nationally. Before pesticides are registered by USEPA, they must undergo laboratory testing for acute and chronic health effects. In these tests, laboratory animals are purposely given a

pesticide at high doses for an extended period of time specially to see if toxic effects occur. These tests help scientists judge how these chemicals might affect humans, domestic animals, and wildlife in the case of exposure.

Water Quality Standards

Waterways in Cache County are not impaired with any pesticides used by the Cache Mosquito Abatement District.

CONTROL MEASURE DESCRIPTION

A brief explanation of the control measures to demonstrate how to meet the applicable technology-based or water quality-based effluent limitations. The control measures used at the site to reduce pesticide discharge include evaluation and implementation of management tools.

No action or at least delayed action may be taken by CMAD at times when a major portion of the district has been inundated with water. When a county wide flooding event takes place, it is generally more economical and environmentally friendly to allow mosquito larvae to emerge and treat for adults at a later time if necessary. This is because not all larval habitats can be treated in a timely manner to prevent adult emergence, and adult mosquitoes will migrate into our service area from the surrounding regions that have no or reduced mosquito control resources. Conversely, no action may also be taken when sites containing larvae are shallow, and extended weather forecasts indicate dry conditions. Such situations allow larval habitat to dry before mosquitoes can complete their aquatic life stages, and no adults result.

Prevention, mechanical/physical methods, and cultural methods are by definition very similar in nature and share many characteristics. These methods can be as basic as simply emptying water from containers or as complex as repairing broken water lines which often requires the involvement of county and municipality departments. Mechanical/physical and cultural methods manipulate larval habitat to prevent favorable conditions for mosquitoes to complete their aquatic development.

Educational program and area events allow the opportunity to suggest ways that residents can assist in the prevention of mosquito problems by removing containers and articles from their yards that provide larval habitat, and to be mindful that birdbaths and pet water bowls or watering troughs could serve as mosquito sanctuaries when not properly maintained.

Biological control products can be used for the control of larval stages of mosquitoes. Formulations containing *Bacillus thuringiensis israelensis* are used to treat flood water and other larval sites. Chemical pesticides often are any abatement agency's last choice of control measures. These products are applied as directed by their respective label, and all equipment used in this process is closely monitored and calibrated by certified personnel.

A list of all insecticides (labels and MSDS) used in the past or currently in use is provided on the CMAD website (www.cachemosquito.com). You can also find on the website the mode of action of the different families of products (organophosphates, growth regulators, etc.). Both documents are also posted at the end of this document.

- Operators must consider impact to non-target organisms, impact to water quality, pest resistance, feasibility, and cost effectiveness when evaluating and selecting the most

efficient and effective means of pest management to minimize pesticide discharge to waters of the U.S. Control measures are evaluated separately on the basis of mosquito life stage as follows:

- Adult Control efficacy is determined from pre and post treatment trap counts when a trap site is located within the spray block. In addition, landing rates taken by staff are used to supplement this data when trap sites are not located near a treatment area.
- Larval control efficacy is more difficult to access, as our primary larvicide product is a growth hormone that does not cause mortality until the later stages of the larvae's development. Often, in this case, a failure is not realized until "healthy" adults are found emerging after their pupal stage. However, post-treatment surveys do verify successful treatments when using larvicide oils and films or biological control products, such as *Bti* products.

SCHEDULES AND PROCEDURES

Control measures used to comply with the effluent limitations

- Application Rate and Frequency Procedures.
    1. Application Rate Determination
    2. Determine species and age of target mosquito(es)
    3. Evaluate environmental conditions
    4. Consider target area flora and fauna
    5. Determine appropriate application rate based on product label recommendations, previous experience and efficacy tests
- Frequency Determination
    1. Determine target site treatment history with selected pesticide
    2. Evaluate effect of selected pesticide use on frequency and quantity thresholds for active ingredient
    3. Consider alternate treatment options
- Resistance Considerations
    1. Consider documented resistance of target species to selected pesticide and/or any other compounds that are in the same class or exhibit similar modes of action. Also consider the possibility of cross resistance.
    2. Consider the use of alternate control options.
- Spill Prevention Procedures
    1. Perform weekly inspections of chemical storage rooms and the warehouse (garage) areas. Maintain buildings to full function ability.
    2. Keep OSHA requirements log (spill response supplies, PPE Locations, chemical list) up to date

- Pesticide Application Equipment Procedures

1. Ground Adulticiding (fogging, spraying)

   a. Operations:

      - A pressurized 15 gallon truck-mounted sprayer is used for ULV (ultra-low volume) adulticiding.
      - Application equipment must be calibrated annually to confirm the Volume Median Diameter is according to the label of the pesticide being used.
      - A visual inspection of spray equipment for leaks or wear in the lines, tanks, and nozzle is done prior to the start up of spray equipment.
      - Routine cleaning and maintenance of the spray system is performed to ensure the system is operating properly.

   b. Maintenance:

      - Daily Checks - Visually check the fog generator each day before use and make any necessary adjustments and /or repairs. Before making any repairs ensure that required PPE is worn.

         1) Check all gasoline hoses, insecticide lines and fittings for cracks, leaks or wear. Replace if needed.
         2) Check all bolts and fasteners and tighten as necessary.
         3) Ensure that pesticide tanks have sufficient chemicals for assigned spray mission.
         4) Check all nozzle parts for wear or physical damage. Replace damaged parts.
         5) Inspect blower air filter for cleanliness and serviceability.
         6) Check engine oil. Add oil as needed.
         7) Check fuel level.
         8) Start engine, listen for any unusual noises and watch for excessive smoke or any engine oil leaks.

   c. Repairs and services - Repairs and services on ULV equipment will be performed by an appointed mechanic only

2. Ground Larviciding

   - Ground larviciding is conducted by the Cache Mosquito Abatement District staff in a number of situations using various products throughout the season.
   - Hand treatments are conducted within the district by licensed personnel using their best professional judgment. These treatments generally take place on a daily basis. Sites are visited weekly and surveyed for the presence of larvae. Some sites may be pretreated where historic data justify such actions. Equipment used during hand treatment work includes small 1 gallon backpack or hand sprayers and ATV-mounted granule spreaders.

Pest Surveillance Procedures

1. Adult Surveillance

    a. Service request inspections are taken from telephone and from telephone messages and emails (on our website). Many of these are simple requests for treatments, although occasionally such calls lead to finding problems needing attention. Technicians generally will check for mosquito larvae and determine if adult populations warrant treatment during these inspections from observed densities.

    b. Gravid trap collections are paramount to our WNV surveillance. This trap type is particularly effective in catching gravid *Culex pipiens* and *Culex tarsalis,* the primary WNV vectors. Fourteen gravid traps are deployed throughout the county each week during the mosquito season.

2. Larval Surveillance

    a. Service request inspections performed by our Field Workers will check for mosquito larvae and determine if adult populations warrant treatment during these inspections

    b. Breeding site inspections are conducted by our Field Workers following flooding events caused by rains, snow melts, or irrigation. Larval surveillance entails locating the larval source (if not already known), sampling for larvae and estimating larval density, determining larval developmental stage(s), and collecting larvae for identification purposes. Other factors considered during larval inspections include the type of environment (pond, ditch, etc.), presence of aquatic vegetation, and if any natural predators (like fish) are present.

3. Disease Surveillance

    a. Mosquito pool analysis is the most useful indicator of the presence of WNV in our service area. Up to 50 adult mosquitoes (RAMP technology) or 100 adult mosquitoes (RT-PCR technology) are grouped to form a single sample for WNV virus analysis.

Assessing Environmental Conditions Procedures

1. General Considerations.

    Climatic conditions are always checked prior to any ground applications. Wind speed, wind direction, and the possibility of impending rain must be taken into consideration whether applying liquid or solid products because of drift, dilution, or chemical breakdown depending on the product being used. Temperature also plays a role in our application methods, especially the timing of application and the choice of products used.

2. Adult mosquito treatments.

    Treatments for adult mosquitoes occur in both urban and rural areas of the district. Applicators are always aware of nearby crops, blooming crops and bee hive locations, and turn spray equipment off when necessary to avoid drift into such areas. Similarly, equipment is also turned off when approaching large bodies of water, such as lakes and ponds, to avoid any adverse reactions to non-target organisms in these environments.

a. Ground Adulticiding Procedures

- Apply when insects are most active and meteorological conditions are conducive to keeping the spray cloud in the air column close to the ground.
- Apply during the cooler hours of the night or early morning when thermal activity is low. Do not apply when ambient temperature is less than 50 F.
- Apply when ground wind speeds are equal to or greater than 1 mph but less than 10 mph.
- Do not apply over bodies of water (lakes, rivers, permanent streams, natural ponds, commercial fish ponds, swamps, marshes or estuaries), except when necessary to target areas where adult mosquitoes are present, and weather conditions will facilitate movement of applied material away from the water in order to minimize incidental deposition into the water body.
- Pesticide is highly toxic to bees exposed to direct treatment on blooming crops or weeds. Do not apply product or allow drift when bees are actively visiting the treatment area, except when applications are made to prevent or control a threat to public and/or animal health determined by a state, tribal or local health or vector control agency on the basis of documented evidence of disease causing agents in vector mosquitoes, or the occurrence of mosquito-borne disease in animal or human populations, or if specifically approved by the state or tribe during a natural disaster recovery effort.
- To minimize hazard to bees, the product is applied half an hour after sunset and before sunrise, limiting application to times when bees and other pollinators are least active.
- Beekeepers are notified at the beginning of the season of areas susceptible to be sprayed during the season based on spraying of previous years. They can choose other locations that will help in protecting their colonies.

3. Larval mosquito treatments.

Two major environmental considerations are tree canopy and the amount of aquatic vegetation present within the treatment site. Tree canopy may deflect or otherwise prevent the penetration of pesticide from reaching the target area. Heavy vegetation within a wetland can interfere with the migration of the larviciding agent through the water column.

B. Pertaining to Other Actions Necessary to Minimize Discharges

<u>Spill Response Procedures</u>

1. The suggested guidelines in the event of a chemical spill are known as the three Cs: Control the spill, Contain it, and Clean it up. This procedure is described in the National Pesticide Applicator Certification core manual and required by the State of Utah Department of Agriculture and Food for certification.

Adverse Incident Response Procedures

1. To help avoid or at least minimize adverse incidents, the Cache Mosquito Abatement District applicators turn off spray equipment when approaching areas with high human activity, such as outdoor sport practices, games, or other events.

2. The district has a courtesy no-spray request policy available on our website for people to request no fogging due to health issues, beekeeping, organic farming, and other concerns. The requests must be renewed each year.

3. The district will also maintain a courtesy call list to inform those without access to the fog schedule when fogging will occur in their area.

Pesticide Monitoring Schedules and Procedures

1. For application by personnel certified/trained in public health pest control or mosquito control, a record for each application must be kept of:

a. Date, time and areas where application occurred.

b. Dilution (if applied) and application rate (speed of application vehicle)

c. A description of insecticide delivery system used for the specific application.

d. Climate factors (e.g., ambient temperature, wind speed/direction) as determined using a reliable means.

e. Employees involved in mixing, loading and applying the pesticides.

f. These records must be kept by the responsible public agency or their designee for a minimum of two years using storage methods that will allow the records to be easily retrieved.

INSECTICIDES – MODES OF ACTION

Most people know that insecticides kill insects. However, the way in which these chemicals work is a mystery to most people. How an insecticide works is called its mode of action. A complete understanding of the mode of action of an insecticide requires knowledge of how it affects a specific target site within an organism. The target site is usually a critical protein or enzyme in the insect, but some insecticides affect broader targets. Although most insecticides have multiple biological effects, toxicity is usually attributed to a single major effect.

Larvicides and Adulticides — Organophosphates

Organophosphorus insecticides affect the nervous system. These insecticides are synaptic poisons. The synapse is a junction between two nerves or a nerve connection point (hence the name synaptic poison). Specifically, organophosphorus insecticides bind to an enzyme found in the synapse called acetylcholinesterase. This enzyme is designed to stop a nerve impulse after it has crossed the synapse. Organophosphorus insecticides bind to and prevent the enzyme from working. Therefore, poisoned synapses cannot stop the nerve impulse. Consequently, continued stimulation of the nerve occurs as observed with pyrethroids. Poisoned insects exhibit tremors and uncoordinated movement.

Larvicides — Growth Regulators

These chemicals are typically referred to as insect growth regulators or IGRs. IGRs act on the endocrine or hormone system of insects. These insecticides are specific for insects, have very low mammalian toxicity, are non-persistent in the environment, and cause death slowly. Most of the currently registered IGRs mimic the juvenile hormone produced in the insect brain. Juvenile hormone tells the insect to remain in the immature state. When sufficient growth has occurred, the juvenile hormone production ceases triggering the molt to the adult stage. IGR chemicals, such as methoprene, mimic the action of juvenile hormone and keep the insect in the immature state. Insects treated with these chemicals are unable to molt successfully to the adult stage, and cannot reproduce normally.

Larvicides — Bacteria

Bacillus thuringiensis var. *israelensis* (*Bti*) is a naturally occurring bacterium that produces a crystalline protein toxin (crystal) and a spore. The larval activity of *Bti* formulations is due to the presence of the protein toxin. The spore has no larvicidal activity. For mosquito larvae, many factors are necessary to produce the toxic effects of *Bti* crystals. If the crystals are available in sufficient quantity, to suffer toxicity and die, a larva must : 1) Capture and ingest the crystals; 2) Possess a digestive tract with a highly alkaline pH; 3) Possess the enzymes capable of liberating the toxic proteins; and 4) Possess the gut membrane receptors compatible with the solubilized toxins. *Bti*-based products are not insecticides of contact. The active ingredient (crystals) must be ingested to show a toxic activity. This very specific mode of action makes it very safe for non-target organisms present in the same environment.

Larvicides/Pupicides

Very refined oil or surfactants can be used as larvicides/pupicides. These products have the ability to kill both larvae and pupae. Using conventional spraying methods, the highly refined oil quickly spreads over standing water habitats. The film reduces the surface tension of the water making it difficult for the mosquito larvae and pupae to attach to the surface which causes them to drown. Emerging mosquitoes are unable to fully emerge and will drown. Mosquito larvicide and pupicide are effective on all species of mosquitoes that breed in standing water and require the air/water interface in their lifecycle. Changing the surface tension also affects the adult mosquitoes. Females are unable to land on the water and lay their eggs; instead, they sink and drown.

ULV Adulticides — Pyrethroids

Pyrethroids are synthetic chemicals whose structures mimic the natural insecticide pyrethrin. Pyrethrins are found in the flower heads of plants belonging to the family Compositae (e.g. chrysanthemums). These insecticides have a unique ability to knock down insects quickly. Synthetic pyrethrins (also known as pyrethroids) have been chemically altered to make them more stable. Pyrethroids are axonic poisons (they poison the nerve fiber). They bind to a protein in nerves called the voltage-gated sodium channel. Normally, this protein opens causing stimulation of the nerve and closes to terminate the nerve signal. Pyrethroids bind to this gate and prevent it from closing normally which results in continuous nerve stimulation. This explains the tremors exhibited by poisoned insects. They lose control of their nervous system and are unable to produce coordinated movement.

Pyrethroids are most of the time used with piperonyl butoxide (PBO) which is a synergist that is usually incorporated within the final products. PBO enhances the effect of pyrethroids by inhibiting an enzyme (cytochrome P450) produced by the insect to break down the pesticides. The PBO allows the insecticides to be effective with less active ingredient than would otherwise be required.

References:

Insecticides Used in the Urban Environment: Mode of Action. SM Valles and PG Koehler, http://edis.ifas.ufl.edu/IN077.

Cognis. http://www.mosquitommf.com/AgniqueBrochureWeb.pdf

Pesticides Used by CMAD

Pesticides used in the *past* or currently in use by the District that are used to control mosquito larvae (larvicides) or adult mosquitoes (adulticides).

Larvicides — Organophosphates

Abate 1% Sand Granules

Larvicides — Growth Regulators

Altosid Pellets

Altosid XR Briquets

FourStar *SBG*, MBG

Larvicides — Pupicides

BVA 2

Golden Bear

Cocobear

Larvicides — Bacteria

Bti

Natular

ULV Adulticides — Pyrethroids

Kontrol 30-30

ULV Adulticides — Organophosphates

Fyfanon