SANTA CLARA COUNTY VECTOR CONTROL DISTRICT
COMPREHENSIVE DESCRIPTION AND ANALYSIS OF PROGRAMS AND SERVICES

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1. INTRODUCTION

1.1 Executive Summary: The Santa Clara County Vector Control District (District), formed in 1989 as a full services dependent special district, has operated programs and provided services that the District has determined were statutorily and categorically exempt from the California Environmental Quality Act. This document serves to evaluate the District's programs and services as of April 2007. The conclusion of the District, upon review of its programs and services, is that the District is still statutorily and categorically exempt from CEQA.

1.2 Purpose and Programs: The purpose of this document is to describe the Santa Clara County Vector Control District's (District) Vector Control Programs and to evaluate whether the District programs and services are exempt under the California Environmental Quality Act (CEQA). This analysis is prepared under CEQA Guidelines sections 15060 and 15061 to evaluate the application of CEQA and the various CEQA exemptions to the District's programs. The District since 1989 has been a regulatory agency authorized by state law to assure the maintenance restoration, enhancement or protection of a natural resource or the environment. The District is one of many local, state and federal agencies involved in managing and regulating the environment. Its activities are undertaken in coordination with other agencies and pursuant to a framework of federal and state regulation.

The District was formed in 1989 as a regulatory agency authorized by Health and Safety Code Section 2000 to conduct effective programs for the surveillance, prevention, abatement and control of mosquitoes and other vectors. The District provides protection from the threats of vector-borne diseases within the boundaries of Santa Clara County. The Service is an essential public service that is vital to public health, safety, and welfare. The District pursues this goal by conducting a "full vector control program" including surveillance, monitoring and control of mosquitoes and other vectors. The five current programs administered by the district are:

- Mosquito Program
- Rodent Program
- Disease Surveillance
- Urban Wildlife Management
- Education and Community Outreach

Each program area is conducted using progressive integrated vector management and control methods that minimize the potential of environmental impacts.

In order to accomplish long-range, intelligent, and environmentally-sound vector control, the management and manipulation of vectors must be accomplished using not just one but all available pest control methods. This dynamic combination of methods into one thoughtful, ecologically sensitive program is referred to as Integrated Pest Management (IPM). The District's mosquito control program employs IPM principles by first determining the species and abundance of mosquitoes using larval and adult surveys followed by deciding what is the most efficient, effective and environmentally sensitive means of control. In some situations, water management or source reduction programs can be instituted to reduce mosquito developmental areas. The District also considers biological control such as the planting of mosquitofish. When these approaches are not practical or otherwise appropriate, then a pesticide-based program may be used to target either larval or adult mosquito stages. Similar integrated pest management principles and practices exist for the rodent and wildlife control programs.

In the following sections, the District analyzes the various IPM practices and considers the application of various CEQA exemptions to the District's programs and services.

2. MOSQUITO AND ARBOVIRUS SURVEILLANCE ACTIVITIES RELATED TO VECTOR CONTROL

2.1 Introduction: the District is dedicated to protecting the public from both the discomfort of mosquito bites and potential mosquito-borne diseases. This responsibility involves temporal and spatial monitoring for abundance of immature (larvae/pupae) and adult mosquitoes and mosquito-borne diseases within Santa Clara County. The practice of monitoring both mosquito densities and the diseases they carry is termed surveillance. Applied properly, surveillance provides the District with valuable information on what mosquito species are present, when they occur, where they occur, how many there are, and if they are carrying diseases that affect humans. Equally important is the use of surveillance in evaluating the effectiveness of control actions in reducing mosquitoes and mosquito-borne human diseases.

2.2 Mosquito Surveillance Methodologies: mosquitoes occur in various habitats throughout Santa Clara County ranging from the San Francisco Bay to the Coastal and Diablo Mountain Ranges. The District is most interested in assessing mosquito abundance in areas where residents have the greatest exposure to mosquito bites near their homes, but also in recreational areas such as parks and other popular sites for outdoor activities. An interesting aspect of sampling mosquitoes is due to their biology: where immature stages develop in water whereas adult mosquitoes are terrestrial. This duality of their life cycle presents vector control agencies with unique circumstances that require separate surveillance strategies for immature and adult mosquito life stages.

2.2.1 Immature stages: immature mosquitoes include the egg stage, four larval instars, and a transitional pupal stage. Mosquito control agencies routinely target the larval and pupal stages to preclude an emergence of adults. Documenting the presence and abundance of the immature stages is usually limited to the larval and pupal stages. Operationally, the abundance of the immatures in any identifiable "developmental" source is measured as the number of immatures per dipper (1.0 pint).

2.2.2 Adult stage: mosquito adults, primarily females, are sampled to determine the direct threat posed by their presence and abundance but also in conjunction to detection of mosquito-borne diseases (e.g., West Nile virus). Various methodologies have been developed to both capture and quantify the relative abundance of mosquito species that affect human welfare. These methodologies consist of various types of traps that are mechanically configured to attract mosquitoes to the trap where they captured by suction and sequestered in an escape-proof net or enclosure.

2.2.2.1 Host-seeking traps: Host-seeking traps modified from the standard CDC-type portable light trap use the chemical carbon dioxide (CO_2 as dry ice) to attract female mosquitoes behaviorally cued to seek a host to blood feed. Essential trap components include a battery power source, low ampere motor with suction-type fan housed in a durable plastic cylinder, and collection bag for holding captured adults. The number of females collected during each night of trap operation is expressed numerically as the number of females per trap night.

2.2.2.2 Light traps: light traps attract mosquitoes using an incandescent lamp (25 watt) where they are pulled in by suction provided by an electric (110v AC) appliance motor/fan combination. Mosquitoes picked up by the suction are directed downward (via screened cone) inside the trap body to a plastic collection jar where they are killed by an insecticide. The standard trap of this type used by most vector control agencies is the New Jersey Light Trap. This trap is considerably larger and less portable than the host-seeking trap and requires a source of 110v AC to operate. Like the host-seeking trap, the number of females collected during each night of trap operation is expressed as the number of females per trap night.

2.3 Arbovirus Surveillance: the District is very concerned with the likelihood and occurrence of mosquito-borne diseases. The viruses actively transmitted by mosquitoes to humans are typically diseases of wild birds, while humans only become exposed as a consequence of an accidental exposure to the bite of an infective mosquito vector. Three viruses of greatest public health concern in California are West Nile virus (WNV) western equine encephalomyelitis virus (WEE) and St. Louis encephalitis virus (SLE). WEE affects predominately young children and WNV and SLE the elderly.

Detecting the presence of these mosquito-borne viruses in nature requires the application of a number of sophisticated methodologies. Two methods of encephalitis virus surveillance (EVS) commonly used by vector control agencies in California involve 1) capturing and testing female vector mosquitoes for the presence of mosquito-borne encephalitis viruses and 2) periodically testing for the presence of encephalitis virus specific antibodies in the blood serum of either sentinel chickens or wild birds that are exposed to infective mosquito bites.

2.3.1 Virus isolations from mosquito vectors: female mosquitoes to be tested for the presence of encephalitis viruses are captured by host-seeking traps. Collections are sorted by species and pooled in lots not exceeding 50 mosquitoes. Pools are subsequently tested to determine if virus is present and it is estimated to what extent the virus has disseminated (minimum infection rate) throughout the vector mosquito population.

2.3.2 Antibody conversion rates in sentinels: in addition to isolating viruses from mosquito vectors captured in the wild, the presence of virus in the environment can also be detected by exposing animals that are not adversely affected by infection, but develop neutralizing antibodies to the specific viral pathogen (antigen). A number of sentinel systems have been developed, and among those evaluated are domestic chickens in caged flocks consisting of about 10 animals. Birds used as sentinels are treated humanely, and provided with ample, shelter, water and feed. The chicken's blood samples (serum) are routinely tested for the presence of virus specific antibody during the course of the season.

2.4 Remote Sensing in Mosquito and Encephalitis Surveillance: recent advances in spectral analysis via remote sensing (RS) by satellite/aircraft photography and video has provided a new technology for identifying potential risk areas of likely mosquito production and encephalitis virus transmission. Potential risk sites, such as backyards in residential zones, identified by RS are validated by ground surveys utilizing standard surveillance technologies. Once verified by ground-based surveillance, these new sites may then be considered for routine surveillance oversight.

2.5 Surveillance Activities and the Environment: the implementation of mosquito and encephalitis virus surveillance actions requires access for the placement of mosquito traps and sentinel birds in the field to physically collect adult mosquitoes and detect the presence of mosquito-borne pathogens. Routine inspection of mosquito developmental sites also requires access to allow vector control personnel to obtain samples of larvae. Vector control personnel involved with surveillance activities also require unencumbered access (employee safety required of Title 8) to potential mosquito development and disease transmission sites to assess the threat posed by existing conditions.

2.5.1 Surveillance Policy: the District policy is to perform essential surveillance activities with the least impact on the environment. Technical staff routinely uses preexisting accesses such as roadways, open areas, walkways, and trails. At times, vegetation management is requested of landowners and agencies to allow for unimpeded ingress/egress to sites by foot or vehicle.

Vector control staff involved with performing surveillance duties are aware of the consequences of their actions in the field. The staff are instructed to be respectful of the environment and associated wildlife, and are to proceed with an attitude to limit their impact to only what is necessary to perform their assigned tasks. Wanton disregard for environmental respect and attendant abuses are not tolerated in the District's vector control surveillance operations. In our vector control work, the District uses, whenever possible, existing roads, driveways and trails. The District strives to minimize any off-road travel. When off-road travel is necessary, District staff are instructed to avoid threatened and endangered fauna and flora or “sensitive habitats” and thus minimize any environmental damage caused by off-road travel.

2.5.2 Non-invasive Sampling: non-invasive sampling is considered a type of sampling that does not directly affect the environment. Low impact methods include the placement of host-seeking traps and light traps. In this situation, existing roads, trails, and clearings can be utilized if acceptable for accommodating sufficient surveillance access. Clearings are necessary for the placement of sentinel chicken coops.

2.5.3 Invasive Sampling: obtaining samples of immature mosquitoes involves removal of some negligible quantities of water. Technicians either will make a count of the immature mosquitoes present or remove a small number for identification at the agency office laboratory. Taking dipper samples also requires the technician to wade into the source and repetitively sample/dip along transacts to assess the extent and magnitude of immature mosquito populations. Trampling of some vegetation can occur, but most sampling actions involve either walking the shoreline or wading through open water gaps that border emergent vegetation (grasses, tules, cattails, etc.) where immature mosquito are most likely to be sampled. Technicians are advised not to penetrate dense vegetation for reasons of safety and unnecessary environmental impact.

2.5.4 Transportation and Access Requirements: normal surveillance necessitates the use of access roads, trails, and clearings to facilitate sampling. Roads allow vehicles to transport needed staff and equipment to specific sites deemed critical.

2.6 Special Use of Birds to Support EVS Activities: placement of sentinel chickens constitute a necessary component of encephalitis virus surveillance (EVS). Therefore, their physical presence is required at sites where virus activity is to be monitored on a routine basis. Sentinel chickens are held in a coop structure covered with welded wire to exclude access by resident wildlife with perhaps the exception of mice and other small rodents. Feed and water is housed within the coop enclosure. Manure is removed periodically to reduce fly production.

2.7 Analysis of CEQA Exemptions: CEQA categorical exemption classes 6 and 9 (CEQA Guidelines sections 15306 & 15309) exempt "basic data collection, research, experimental management, and resource evaluation activities which do not result in a serious or major disturbance to an environmental resource," and "activities limited entirely to inspections, to check for performance of an operation, or quality, health, or safety of a project."

The District's mosquito surveillance and monitoring activities described above constitute the types of inspection and data and information collection activities listed in these exemptions. The District monitors mosquito levels in order to determine and track the quantity, location and spread of mosquitoes, to provide the necessary data to make decisions on control measures, and to assess the effectiveness of its control methods.

Section 2.5 of this assessment demonstrates that the District's surveillance and monitoring activities minimally affect the land and water resources where the data collection occurs, and that the District staff that perform surveillance and monitoring conduct their activities in such a manner as to avoid any significant environmental impacts.

3. BIOLOGICAL CONTROL OF MOSQUITOES

3.1 Introduction: biological control of mosquitoes is the intentional use of mosquito pathogens, parasites or predators to reduce the population size of target mosquitoes. It is one of the principal components of a rational and integrated mosquito control program. Biological control is used as a method of protecting the public from mosquitoes and the diseases they transmit without the use of pesticides and potential problem of pesticide resistance.

Biological control of mosquitoes has become a well-researched strategy and can be traced to observations and ecological studies in the 1940s and 1950s. Early investigations studied the potential effects of predators on mosquitoes. Results of such studies have been adopted in developing strategies to use mosquito predators in providing economical and sustained levels of control.

3.2 Biological Control Agents: biological control agents of mosquitoes include a variety of pathogens, parasites and predators. As a rule, mosquito pathogens and parasites are usually highly specific to their mosquito host, whereas predators are more general in their feeding habits and opportunistically feed on mosquitoes.

3.2.1 Mosquito Pathogens: mosquito pathogens include an assortment of viruses and bacteria. Pathogens are highly host-specific and usually infect mosquito larvae when they are ingested. Upon entering the host, these pathogens multiply rapidly, destroying internal organs and consuming nutrients. The pathogen can be spread to other mosquito larvae in some cases when larval tissue disintegrates and the pathogens are released into the water to be ingested by uninfected larvae. Examples of viruses that can infect mosquitoes are mosquito iridoviruses, densonucleosis virus, nuclear polyhedrosis viruses, cytoplasmic polyhedrosis viruses and entomopoxviruses. Examples of bacteria pathogenic to mosquitoes are *Bacillus sphaericus* and several strains of *Bacillus thuringiensis israelensis*. The two bacteria produce proteins that are toxic to most mosquito larvae. Both are commercially produced as mosquito larvicides and are further discussed in this document as such.

3.2.2 Mosquito Parasites: The life cycles of mosquito parasites are biologically more complex than those of mosquito pathogens and involve intermediate hosts, organisms other than mosquitoes. Mosquito parasites are ingested by the feeding larva or actively penetrate the larval cuticle to gain access to the host interior. Once inside the host, parasites consume the internal organs and food reserves until the parasite's developmental process is complete. The host is killed when the parasite reaches maturity and leaves the host (*Romanomermis culicivorax*) or reproduces *(Lagenidium giganteum*). Once free of the host, the parasite can remain dormant in the environment until it can begin its developmental cycle in another host.

Examples of mosquito parasites are the fungi *Coelomomyces* spp., *Lagenidium giganteum*, *Culicinomyces clavosporus* and *Metarhizium anisopliae*; the protozoa *Nosema algerae*, *Hazardia milleh*, *Vavraia culicis*, *Helicosporidium* spp., *Amblyospora californica*, *Lambornella clarki* and *Tetrahymena* spp., and the nematode *Romanomermis culicivorax*.

3.2.3 Mosquito Predators: mosquito predators are represented by highly complex organisms, such as insects, fish, birds and bats that consume larval or adult mosquitoes as prey. Predators are opportunistic in their feeding habits and typically forage on a variety of prey types. This allows the predators to build and maintain populations at levels sufficient to control mosquitoes, even when mosquitoes are scarce.

Examples of mosquito predators include representatives from a wide variety of taxa: coelenterates, *Hydra* spp.; platyhelminths, *Dugesia dorotocephala*, *Mesostoma lingua*, and *Planaria* spp.; insects, *Anisoptera*, *Zygoptera*, Belostomidae, Geridae, Notonectidae, Veliidae, Dytiscidae and Hydrophilidae; arachnids, *Pardosa* spp.; fish, *Gambusia affinis*, *Gasterosteus aculeatus*; bats; and birds, anseriformes, apodiformes, charadriiformes and passeriformes.

3.2.4 Environmental Relationships in Biological Control: the effectiveness of a mosquito biological control agent lies in its ability to reduce mosquito numbers as quickly as possible. An ideal biological agent 1) feeds preferentially on mosquitoes, 2) exhibits an efficient hunting or parasitizing strategy, and 3) reproduces quickly. These traits determine suitability for practical application.

New mosquito sources initially have few predators and other competing aquatic organisms. Vector control personnel use this knowledge to develop a control strategy that involves integrated pest management techniques.

Since mosquitoes are capable of colonizing sources within days of flooding, initial control efforts attempt to suppress the first generations of mosquitoes until natural predators or competitors can control them. Initial treatment includes the selective use of pesticides and appropriate environmental manipulation, such as vegetation and water management. Once biological control is established in a "managed" source, periodic inspections at timely intervals are adequate to monitor changes in larval abundance. Periodically, the source may require treatments with pesticides when 1) predators are not effective, 2) aquatic and shoreline vegetation provides too much shelter, 3) the water level changes, or 4) water quality does not support predators.

3.2.5 Conservation and Application of Predators: the ability of predators to control mosquitoes is related to four factors: 1) whether mosquitoes are preferred prey, 2) whether the hunting strategy of the predator maximizes contact with mosquitoes, 3) whether the predator consumes large numbers of mosquitoes, and 4) whether the predator is present in sufficient numbers to control mosquitoes. Predator effectiveness is enhanced when proper conditions prevail.

Within a typical aquatic environment that produces mosquitoes, predators are distributed among different niches. For example, the surface of the pond supports water striders, planaria and spiders. Below the water surface, backswimmers, predaceous diving beetles and water scavenger beetles live and feed. If the pond contains vegetation, then the plant surfaces (periphyton) will support *Hydra*, damselfly and dragonfly nymphs, and giant water bug nymphs and adults. The benthos supports dragonfly and damselfly nymphs that feed on organisms associated with silts and organic detritus. Together, the different predators form a spatial network that accounts for predation throughout the pond. Ideally, an adequate variety of vegetation should be present to maintain sufficient levels of predator diversity. Greater potential for an acceptable level of mosquito control exists when more predators are present. Care should be taken so that mosquitoes do not have an advantage when too much or too little vegetation is removed.

Most of the currently registered mosquito larvicides minimally impact predators. Making applications at the lower end of the label rate can further minimize any undesirable impacts from these larvicides. The overall objective of using predators is to reduce the frequency of pesticide applications. This minimizes environmental impact and delays the development of mosquito resistance to pesticides.

Predation on mosquitoes is a natural process that will occur without human intervention. However, the level of mosquito control by natural predators can be increased by the conservation of predators in the environment and by augmentation of the predator population through stocking and habitat enhancement.

3.3 Practical Applications of Biological Control Agents: relatively few biological control agents are currently being used in California, although a number have been studied and tested extensively in the laboratory and field. Many have shown potential, but have not been used for a variety of reasons, including 1) difficulty in mass production, 2) failure to produce a consistent level of control, 3) expense, and 4) restricted application because of environmental concerns. Most agents, particularly predators and parasites, are only effective in association with mosquitofish and larvicides. Currently, the only practical biological control agents available to vector control agencies in California are *Bacillus thuringiensis israelensis*, *Bacillus sphaericus*, *Lagenidium giganteum* and the mosquitofish, *Gambusia affinis*.

3.3.1 Microbial Agents and Mosquito Control: commercial formulations of *Bacillus* *sphaericus* and *Bacillus thuringiensis israelensis* are extensively used as mosquito larvicides. Both are highly selective for mosquitoes and are innocuous to associated non-target organisms and predators. *Bacillus thuringiensis israelensis* is also toxic to blackflies (Simuliidae), which can be a pest and disease vector in flowing waters.

Bacillus thuringiensis israelensis and *Bacillus sphaericus* are often considered chemical control measures because they are available in commercial formulations that consist of granular, powdered or liquid concentrates. The use of these two microbials is also discussed under the larvicides section as “bacterially-derived mosquito control agents”.

3.3.2 *Lagenidium giganteum* and Mosquito Control: *Lagenidium giganteum* is a fungal parasite of mosquito larvae. Motile zoospores enter mosquito larva either when ingested or by penetrating the cuticle. The fungus grows rapidly throughout the host body cavity and once the host dies, zoospores are released that can infect other larvae.

Lagenidium giganteum is a highly specific parasite of mosquito larvae. Other organisms are not susceptible and there is no mammalian toxicity. However, use of *L. giganteum* is limited because of environmental requirements for growth and development of the fungus.

Lagenidium giganteum is available commercially as an aqueous suspension. It contains 40% (wt./wt.) *L. giganteum* (California strain) mycelium (1010 CFU or Colony Forming Units, a concentration measure by cell counts per liter) and 60% inert ingredients. *Lagenidium giganteum* may be applied from ground or air. Label rates range from 9 to 180 fluid ounces per acre. Most treatments will require 20 to 80 fl. oz./acre; a common rate is 25-fl. oz./acre. Zoospores form within 16 hours after application and mortality occurs within 24 to 48 hours.

3.4 Mosquitofish and Mosquito Control: *Gambusia affinis* is the most commonly used biological control agent for mosquitoes in the world. Correct use of this fish can provide safe, effective, and persistent suppression of a variety of mosquito species in many types of mosquito sources. As with all safe and effective control agents, the use of mosquitofish requires a good knowledge of operational techniques and ecological implications, careful evaluation of stocking sites, use of appropriate stocking methods, and regular monitoring of stocked fish. Due to the belief that mosquitofish may potentially impact red legged frog and tiger salamander populations, district policy is to avoid introductions of mosquitofish into their designated critical habitats.

3.4.1 Aquatic Habitats: mosquitofish are used to control mosquitoes in a variety of mosquito sources. These sources include artificial water bodies such as fountains, ornamental ponds, cattle troughs, dairy lagoons, industrial and municipal wastewater ponds, underground storm drains, neglected swimming pools, water troughs, and irrigation and roadside ditches.

Upon stocking, reproduction of mosquitofish is required to achieve adequate control of mosquitoes. In general, suitable habitats promote reproduction and recruitment rather than just sustaining the stocked mosquitofish population. Sources where conditions do not favor population growth may not be suitable for mosquitofish use, or may require stocking at substantially higher rates.

The principal habitat characteristic that affects the successful use of mosquitofish is its relative stability. Mosquitofish usually are not effective in intermittently flooded areas unless a refuge impoundment is provided. Because of this, mosquitofish are more effective against mosquitoes developing in permanent and semi-permanent water, such as *Culex* spp., *Anopheles* spp., and *Culiseta* spp., than against floodwater species, like *Aedes* spp. Mosquitofish are best suited for use in shallow, standing water and are particularly useful in large sources where the repeated use of chemical control is expensive, prohibited or impractical.

Availability of food, other than mosquito larvae, and refugia for young mosquitofish are also important factors affecting the suitability of a site. Mosquitofish survival, growth, and reproduction are highly dependent on diet and feeding rates. Refugia to protect the young mosquitofish from cannibalistic adults is essential for population growth. Vegetation and other submerged structures may also reduce predation on adult mosquitofish by birds, larger fishes, and other predators.

Habitats in which the water quality conditions, particularly temperature, dissolved oxygen, pH, and pollutants, exceed the tolerance limits of mosquitofish are not suitable sites for biological control. In sources with poor but sublethal water quality, feeding, reproductive activity and consequently mosquito control, may be reduced. Use of mosquitofish is sometimes possible in suboptimal environments that inhibit reproduction, but special stocking and monitoring methods may be required.

The presence of piscivorous fishes or other predators in the source habitat may rule out stocking with mosquitofish. High densities of invertebrate and vertebrate predators, such as notonectids and young game fish, which prey on both small mosquitofish and mosquito larvae, can prevent mosquitofish population growth.

3.4.2 Stocking Methods: Stocking methods can have significant effects on the degree of mosquito control achieved. In most cases, the objective is to release the minimum number of fish at the time when conditions within the source promote rapid population growth and at locations which facilitate dispersal throughout the source. The most appropriate methods depend on the type and location of the mosquito source, season, and the degree and duration of control desired.

3.4.3 Stocking Rate: Mosquitofish generally are released at densities lower than those necessary for mosquito control with the expectation that reproduction and recruitment will greatly increase the fish population within a few weeks. The best stocking rate depends primarily on the type of mosquito source, season, and mosquito control objective, for example immediate control versus control later in the season. Understocking can result in inadequate mosquito control whereas overstocking may result in excellent control, but is wasteful of the usually limited fish supply.

Stocking rates are usually reported as fish per acre, or pounds of fish per acre. The number of mosquitofish per pound depends on the population structure of the sample (e.g., a mixed population of adults and juveniles versus a sample containing only mature females), source (e.g., cultured vs wild-caught fish), and even season (early versus late in the breeding season). In general, for a mixed population, there are approximately 600-1,300 fish/lb.; the most common estimate is 1000 fish/lb.

In general, for early season stocking of mosquito sources that contain healthy populations of food organisms and adequate vegetation to provide shelter for the small mosquitofish, 0.2-0.5 lb./acre is appropriate.

3.4.4 Stocking Date: date of release of mosquitofish into a mosquito source affects biological control efficacy primarily through its influence on mosquitofish population growth. The age of the source affects its quality; both food and shelter may be sparse in new habitats. In mosquito sources stocked late in the season, population growth is reduced because of the shortened developmental season and declining reproductive stimuli. Stocking date necessarily varies with type of mosquito source but, in general, mosquitofish are released one to three weeks post-flooding.

3.4.5 Stocking Location: a sufficient number of mosquitofish must be stocked where mosquito larvae are present. Although mosquitofish can swim through dense vegetation, dispersal throughout a larger habitat takes more time and is slowed by the presence of additional barriers such as dense emergent vegetation.

3.4.6 Handling Release and Monitoring: Most mosquitofish are released by hand; care should be taken to minimize stress to fish. Abrupt changes in water temperature should be avoided. Fish should be transported in water at a temperature similar to that at the end source. Mosquitofish should not be stocked during extremely hot weather or when water temperature approaches the upper tolerance limits of the fish (>35°C or 95°F).

After stocking, mosquitofish populations are monitored regularly to assess fish density, population growth, and biological control efficacy. A low number of fish may necessitate restocking or alternative mosquito control efforts.

3.5 Environmental Considerations of Mosquitofish Use: many species of larvivorous fish have been evaluated as agents to control mosquitoes, including various species of atherinids, centrarchids, cichlids, cyprinids, cyprinodontids, gasterosteids, and other poecilids. However, mosquitofish are considered best suited from both biological and operational perspectives.

3.5.1 Advantages of Mosquitofish for Biological Control: Mosquitofish possess characteristics that make them efficient predators of mosquito larvae. They thrive in shallow, calm, vegetated waters, which is the same environment where many mosquitoes prefer to lay eggs. Mosquitofish tolerate wide ranges of water temperature and quality. Mosquitofish are surface-oriented predators where mosquito larvae are an accessible prey. The small size of the fish enables them to penetrate vegetated and shallow areas within the mosquito source.

Mosquitofish are live bearers that grow rapidly, mature at a young age, and reproduce quickly. This allows the fish to establish a high population in the source shortly after stocking. In many habitats, seasonal peaks in mosquitofish activity and population growth coincide with mosquito reproduction times. Because of their omnivorous feeding habits, mosquitofish can thrive in habitats where mosquitoes occur intermittently.

Mosquitofish are hardy and easy to handle, transport, and stock. As a result of extensive experimentation in California, mosquitofish can be reliably cultured in large numbers. Problems still exist in some areas with winter survival rates and inadequate supplies of fish in the spring. Because the fish reproduce where they are stocked, long-term control can be achieved by stocking relatively few fish, often in a single application. Compared to pesticides, which require repeated applications, mosquitofish can provide inexpensive and safe long-term control, sometimes within days after application. Although not all introductions are successful, mosquitofish are an effective biological control agent alone and as a component of an integrated pest management program.

3.5.2 Limitations to Use of Mosquitofish for Biological Control: Not all types of mosquito habitats are suitable for stocking with mosquitofish and mosquitofish are not effective in all situations. Since mosquitofish usually are not stocked in numbers sufficient to cause an immediate effect, they do not control mosquitoes as quickly as pesticides do. In some areas, federal, state, or local agency permission is required to stock mosquitofish.

3.5.3 Deciding Whether or Not to Use Mosquitofish: Mosquito control and public health professionals believe the effectiveness and safety of mosquitofish to be ecologically preferable to the application of pesticides or draining of the mosquito source. The use of mosquitofish as a component of an integrated pest management program, particularly in man-made, altered or artificial aquatic habitats, is increasingly more important with the limited availability of registered pesticides and as insect resistance to pesticides increases. As agents for biological control of mosquitoes, mosquitofish deserve consideration, and, in many specific situations, are the best choice.

Though mosquitofish are not native to California, they are now ubiquitous throughout most of the state's waterways and tributaries. In much of the state's wetland areas mosquitofish have become part of the natural ecosystem. Also, much of the aquatic habitat that is highly productive for mosquitoes is disrupted habitat, with flora and fauna that are predominately non-native species. In these areas, stocking of mosquitofish will have minimal impact on non-target species.

Many precautions are taken to minimize the environmental impact in habitats where mosquitofish are introduced. Mosquitofish are not introduced into natural wetland communities that are biologically complex. Mosquitofish are stocked only in careful compliance with federal and state endangered species acts, so as to avoid the potential to adversely affect threatened and endangered fish, amphibians, insects and other wildlife. The considered use of mosquitofish by the District ensures the protection of the environment by augmenting the natural process of predation on mosquito larvae through the use of a natural predator, the mosquitofish.

3.6 Analysis of CEQA Exemptions: CEQA categorical exemption classes 7 and 8 (CEQA Guidelines sections 15307 & 15308) exempt actions taken by regulatory agencies as authorized by state law to assure the maintenance, restoration, enhancement or protection of a natural resource or the environment where the regulatory process involves procedures for the protection of the environment. In order for this exemption to apply, the following elements must be satisfied:

The District must be a regulatory agency authorized by state law to assure the maintenance, restoration, enhancement or protection of a natural resource or the environment.

The District's biological control activities as described above must assure the maintenance, restoration, enhancement or protection of a natural resource or the environment. The District's regulatory processes must involve procedures for the protection of the environment.

The District is a regulatory agency authorized by state law to assure the maintenance restoration, enhancement or protection of a natural resource or the environment.

The District is a local government agency created following state statute, Health and Safety Code division 3, chapter 1 (commencing with section 2000). State law charges the District with the authority and responsibility to take all necessary or proper steps for the control of mosquitoes and other vectors in the District.

The State Department of Health Services (DHS) regulates the District and its employees. Vector control activities are coordinated with DHS pursuant to an annual Cooperative Agreement, under which the District commits to comply with certain standards concerning mosquito control and pesticide use. State law and the Cooperative Agreement require District vector control employees to be certified by DHS as a vector control technician. This certification helps to ensure that the employees are adequately trained regarding safe and proper vector control techniques, including the handling and use of pesticides and compliance with laws and regulations relating to vector control and environmental protection. The District also works in close coordination with the Santa Clara County Agricultural Commissioner, including monthly reporting of its pesticide use.

As explained below, the District is one of many local, state and federal agencies involved in managing and regulating the environment. Its activities are undertaken in coordination with other agencies and pursuant to a framework of federal and state regulation.

CEQA does not define “regulatory agency”. The CEQA Guidelines do define "public agency" to include the District. (CEQA Guidelines section 15379.) To "regulate" means to govern according to or subject to certain rules and restrictions. (New Webster Dictionary.)

The District, as authorized by state law, and through its Board Trustee and staff, governs the control of mosquitoes and vectors in the environment within the District's boundaries. This action is subject to and done in accordance with District criteria regarding vector control that guide when, where, whether and how to control vectors (using biological control and other integrated pest management techniques), and also various federal and state laws that regulate vector control and environmental protection. As such, the District qualifies as a regulatory agency.

The District's Biological Control Activities as Described above Assure the Maintenance and Protection of a Natural Resources and the Environment: biological control, and principally the use of mosquitofish, controls the level of mosquito larvae in aquatic habitats. The mosquitofish effectively control the larvae in aquatic habitats that otherwise could produce substantial numbers of adult mosquitoes. Mosquitofish act as a natural predator of mosquitoes to better control their levels in the current District environment. This control method maintains aquatic habitats and protects the adjacent environment in a condition more safe, healthful and comfortable for humans.

The District has many aquatic habitats that act as mosquito and vector developmental sites near populated areas. Without ongoing and effective vector control, substantial mosquito and other vector activity would significantly and adversely effect the human environment. The District's mosquito control program, including the biological and chemical control components, is essential to maintain the vectors in the environment at a tolerable level. The District's program will never alleviate all mosquitoes. Rather, it is a resource maintenance program aimed at striking a balance to allow comfortable and healthful human existence within the natural environment, while protecting and maintaining the environment. History has shown us that the control and abatement of vectors are necessary for our human environment to continue to be habitable.

The District's Regulatory Process Involves Procedures for the Protection of the Environment: There are numerous measures and procedures inherent in the District's integrated vector control management practices that protect and avoid impacts on the environment:

As explained above, the integrated pest management principles followed by the District involve the careful design and selection of the appropriate mosquito control method in a particular circumstance in order to avoid environmental effects.

- The District regularly coordinates with other resource agencies (e.g., California Department of Fish and Game, U.S. Fish and Wildlife, Santa Clara Valley Water

District, Regional Water Quality Management Boards and Midpeninsula Open Space District) regarding its vector control activities, especially in and around sensitive habitat areas.

- The District strictly complies with the state and federal Endangered Species Act so as to avoid any impacts to an endangered or threatened species or its habitat.
- The District is an active member of the Mosquito and Vector Control Association of California, a statewide association representing the interests of vector control districts. The Association, and its member districts, participates in the U.S. Environmental Protection Agency's Pesticide Environmental Stewardship Program to encourage and further greater environmental stewardship by vector control.
- The District has adopted and enforces an integrated pest management plan, employee injury and illness prevention plan, code of safe conduct, emergency response plan, and hazard communication program. Compliance with these plans better ensures safe and careful vector control activities, thereby helping to protect the environment from damage, e.g., by a pesticide spill.

4. PHYSICAL CONTROL AND SOURCE REDUCTION

4.1 Introduction - Description of activities: physical control, also known as source reduction, environmental manipulation, or permanent control, is one part of the District's Integrated Pest Management (IPM) program. Physical control is usually the most effective of the mosquito control techniques available and is accomplished by eliminating mosquito developmental sites. This can be as simple as properly discarding old containers that hold water capable of producing mosquitoes such as *Aedes sierrensis* or *Culiseta incidens*, or as complex as offering consultation to landowners designing and developing a regional storm water drainage system to eliminate standing water in developed areas that can produce *Culex pipiens*. Source reduction is important in that its use can virtually eliminate the need for pesticide use in and adjacent to the affected habitat. Source reduction is appropriately touted for its effectiveness and economic benefits.

4.2 Mosquito Producing Habitats to Consider for Source Reduction:

4.2.1 Freshwater Lakes. Ponds and Retention Areas: Description of sites. Typical sites in California include the margins of reservoirs with shallow water and emergent vegetation, artificial ponds for holding drinking water for livestock and retention ponds created for holding of rainwater. Sites known as best management practices (BMP) including retention ponds have been constructed within freeway interchanges and others have been built in cities and towns to retard the effects of stormwater runoff of contaminants into creeks and the bay. Natural lakes are usually not a problem because most of the water is deep, and there may be little emergent vegetation.

Typical mosquito species. There are a number of species of mosquitoes that exploit this type of habitat. In lower elevations in California, *Culex* species such as *Cx. tarsalis* and *Cx. stigmatosoma* may be found. *Culiseta inornata* and *Cs. incidens* also will breed in small ponds. *Aedes washinoi* is a persistent problem along large river valleys. Larvae of this species are found in borrow pits, flooded quarries, and other ponds of freshwater.

4.2.2 Freshwater swamps and marshes: Description of sites: Mitigation marshes constructed with the purpose of offsetting habitat destruction due to construction projects within golf courses, large-scale housing projects and Santa Clara Valley Water District jurisdictions may create mosquito developmental sites. Within federal and state property, a number of marshes have been created and operated to provide aquatic habitats for flora and fauna, especially waterfowl. Some of these marshes can be drained and re-filled periodically depending upon the presence of hydrological control structures and under certain circumstances can produce large populations of mosquitoes.

Typical mosquito species: *Culex tarsalis*, *Cx. erythrothorax*, *Cx. pipiens*, *Cs. inornata* and *Anopheles freeborni* are the most common species found in these habitats. Depending upon the management practices for the marsh or swamp, floodwater *Aedes* such as Ae. washinoi can become a serious problem, especially in those cases where fields and marshes are periodically drained and re-flooded.

4.2.3 Salt marshes: Description of sites. In California's not so distant past, extensive coastal salt marshes produced enormous *Aedes* broods, making coastal human habitation virtually impossible. The vast salt marshes that formerly existed around the San Francisco Bay have mostly been converted to salt ponds and more recently are undergoing conversion back to functioning salt marsh habitat. Within federal and state property, a number of marshes have been created and operated to provide aquatic habitats for wildlife, especially waterfowl. Some of these marshes can be drained and re-filled periodically depending upon the presence of hydrological control structures and under certain circumstances can produce large populations of mosquitoes. Sometimes it is feasible to perform several of the source reduction efforts described below, and have greatly reduced salt-marsh mosquito production in these marshes through management that relies upon artificial manipulation of the frequency and duration of inundation.

Typical mosquito species: In northern California, *Ae. squamiger* is the primary saltmarsh developing mosquito, with *Ae. dorsalis* occurring sporadically. *Ae. squamiger* is a winter breeder and has a single generation per year. *Ae. dorsalis* adults occur in the spring and summer, and may have several generations per year.

4.2.4 Temporary standing water: Description of sites. There are several species of mosquitoes that can breed in water that stands only 1 to 2 weeks. Such habitats include irrigation tail water as well as standing water in irrigated pastures. Many mosquito species are found in these sources. Pastures and other agricultural lands are enormous mosquito producers, frequently generating huge broods of *Aedes* and *Culex* mosquitoes.

Typical mosquito species: *Culex tarsalis, Cx. pipiens, Cx. stigmatosoma*, *Aedes melanimon, Ae. nigromaculis* and *Culiseta inornata* are just some of the species that may develop in temporary pools.

4.2.5 Wastewater treatment facilities: Description of sites: aquatic sites in this category include a wide variety of ponds, ditches and other structures designed to handle wastewater of some kind. Included are sewage treatment ponds, ponds managed for denitrification, dairy and confined animal drains and ponds, and storm sewers.

Typical mosquito species:

Culex spp.: Mosquito species found in these types of sources are generally *Culex pipiens, Culex stigmatosoma*, and to a lesser degree, *Culex tarsalis*. *Cx. stigmatosoma, Cx. erythrothorax* and *Cx. tarsalis* are also found in these habitats. Human activities are responsible for establishing the vast majority of the aquatic habitats used by *Cx. pipiens*, the so-called northern house mosquito. A much wider range of larval habitats, including both artificial and natural aquatic systems, is used by *Cx. tarsalis*.

Culex tarsalis, another common mosquito in wastewater, is like *Cx. stigmatosom*a in terms of its range of larval habitats, but its seasonal pattern of abundance is similar to that found in *Cx. pipiens. Culex tarsalis* inhabit not only semi-permanent ponds but also more ephemeral habitats, such as temporary pools in settling or percolation ponds. *Cx. tarsalis* is the species with the greatest impact because it is the dominant *Culex* in California during the summer and fall, occurs in wastewater systems that vary over a wide range of nutrient loads, and is the primary bridge vector of WNV, SLE and WEE.

Aedes spp.: Unlike *Culex*, whose eggs hatch within a few days after being laid in rafts on the water surface, *Aedes* spp. lay their eggs individually on moist substrate with hatching occurring only after the eggs have been flooded. Consequently, *Aedes* are seldom found in wastewater systems where there is little or no variation in surface water levels. However, poorly designed, improperly operated, or inadequately maintained systems often lead to conditions that are ideal for an invasion by floodwater mosquitoes.

4.2.6 Containers: Description of sites: Containers such as flowerpots, cans, treeholes, fountains and tires are excellent habitats for several *Aedes, Culex and Culiseta* species. Abandoned or poorly maintained swimming pools also fall into this category. Typically problems with container breeders occurs during the wetter parts of the year.

Typical mosquito species: Container-inhabiting mosquitoes of particular concern in California include *Aedes sierrensis, Culex pipiens, Culex stigmatosoma, Culex tarsalis, Culiseta incidens* and *Culiseta inornata. Ae. sierrensis* is the most common treehole breeder in California, and is considered the primary vector of dog heartworm here.

4.3 Physical control methods

4.3.1 Source Reduction in Freshwater Habitats: Source reduction for mosquito control in freshwater habitats typically involves providing consultation with landowners or stewards to implement measures such as constructing and maintaining channels (ditches) to reduce mosquito production in areas such as flood plains, swamps, and marshes. The principle that directs source reduction work entails manipulating water levels in low-lying areas to eliminate or reduce the need for spraying (chemical) applications.

Two different mosquito control strategies or approaches are considered when performing freshwater source reduction. One strategy involves reducing the amount of standing water or reducing the length of time that water can stand in low areas following significant rainfall or artificial flooding events. This type of strategy involves advising/requiring landowners to construct channels or ditches with control elevations low enough to allow for a certain amount of water to leave an area before immature mosquitoes can complete their life cycle.

4.3.2 Aquatic Plant Management and The Effects on Mosquito Populations: This section describes the practices used to control mosquitoes and aquatic plants associated with freshwater environments only.

Certain mosquito species use various aquatic plants as a primary habitat for egg deposition and larval development. Because aquatic plants can, at times, produce heavily vegetated stands, the use of conventional mosquito management techniques, such as biological and chemical control, may be ineffective. Therefore, removal of the vegetative habitat may be the only means of reducing these mosquito populations to a desired level. Whenever possible, the District advises landowners to implement vegetation management measures to reduce potential mosquito development and allow District staff access and produce more efficacious treatments in these habitats.

Aquatic plant management can have a positive effect on the control of mosquito populations. A primary goal in reducing mosquitoes that use aquatic plants is to eradicate or, at the very least, manage the aquatic plant communities at the maintenance or lowest feasible level.

Two of the most important aquatic plant species that provide habitat for mosquitoes are bulrush and cattails.

While it can be possible to fill small artificial ponds that produce mosquitoes, it is usually impossible to do so in natural areas (however small), large permanent water bodies, or in areas set aside for stormwater or wastewater retention. In such situations, other options that are effective in controlling mosquitoes include periodic drainage, providing deepwater sanctuary for larvivorous fish, minimizing emergent and standing vegetation, and maintaining steep banks. *Aedes, Culex, Culiseta* and *Anopheles* mosquitoes are frequently produced in these habitats.

Eradication or maintenance level control of aquatic plants is the best method of mosquito control. Physical control methods include the use of equipment or tools to remove aquatic vegetation. Examples would include aquatic harvesters, bucket cranes, underwater weed trimmers, and machetes. Mechanical control is limited to areas that are easily accessible to the equipment. Also, mechanical control can be labor intensive and extremely expensive.

4.3.3 Freshwater Swamps and Marshes: Environmental laws greatly restrict habitat manipulations in these areas (which can produce *Aedes, Culex, Anopheles,* and *Culiseta* species), making permanent control there difficult. Consequently, the District does not usually undertake physical control projects in these areas. If it does so, the District would undertake separate CEQA assessment on a case by case basis.

4.3.4 Temporary standing water: While it can be possible to fill small artificial ponds that produce mosquitoes, it is usually impossible to do so in natural areas (however small), large permanent water bodies, or in areas set aside for stormwater or wastewater retention. In such situations, other options that are effective in controlling mosquitoes include periodic drainage, providing deepwater sanctuary for larvivorous fish, minimizing emergent and standing vegetation, and maintaining steep banks. *Aedes, Culex, Culiseta* and *Anopheles* mosquitoes are frequently produced in these habitats.

Improved drainage is one effective tool for source reduction in such habitats. The second is the use of irrigation practices for those agricultural areas that require artificial watering. Proper water management, land preparation, and adequate drainage are the most effective means of physically controlling mosquitoes in these types of sources. The District provides technical assistance to landowners who are interested in reducing mosquitoes by developing drainage systems on certain lands.

4.3.5 Wastewater treatment facilities: in many parts of California, clean freshwater for domestic, agricultural, or industrial uses are becoming a critical resource. Wastewater recycling and reuse help to conserve and replenish freshwater supplies. California citizens daily produce approximately 100 gallons of wastewater per capita from domestic sources alone. Concern for water quality conditions in lakes, rivers, and marine areas have resulted in the enactment of new state laws that will greatly limit future disposal of wastewater into these aquatic systems. To adjust to these changing conditions, many communities must implement wastewater reuse and recycling programs. Mosquito problems are frequently associated with some of the conventional wastewater treatment operations, and the expanded use of wastewater recycling and reuse may inadvertently create even more mosquito habitats.

Pond management options which are effective in controlling mosquitoes include periodic draining, providing deep water sanctuary for larvivorous fish, working with landowners to identify leaky pipes and by advising management to minimize emergent and standing vegetation and maintain steep banks. The District routinely advises property owners on the best management practices for ponds to reduce mosquito development.

4.3.5.1 Septic Systems: Many households in California, especially in rural areas, use on-site treatment systems, such as septic tanks and associated drain fields. With proper soil porosity, sufficient lateral fields, and low human congestion, these systems are safe and efficient. The wastewater in a properly located and maintained septic tank system will percolate into the subsoil without causing surface water accumulation that may induce mosquito production. Yet, when these systems are placed in locations with inappropriate soil conditions, wastewater will flow laterally, often into nearby swales and ditches.

4.3.5.2 Municipal Treatment Facilities: In California, municipal treatment facilities may be associated with mosquito problems. These can stem from operation of both small (package plants) and large facilities. Package plants may result in mosquito production in holding ponds because they are poorly maintained or operated beyond their capacity. Larger plants may use various methods to improve water quality conditions beyond the levels obtained in secondary treatment process. These methods include spray irrigation, rapid-dry ponds, aquatic plant/wastewater systems, and the use of natural or modified wetlands. Physical control methods include vegetation management, pond maintenance, structure repair, and improvement of pond substrates.

4.3.5.3 Treated Sewage Irrigation Systems: Treated wastewater is used to irrigate commercial landscapes, golf courses, road medians, pastures, sod fields and other types of crops. During the rainy season, these fields may become waterlogged, particularly those in low-lying areas with high water tables or in poorly drained soils. Under these conditions, the continued application of irrigation water will result in the accumulation of surface water, thus providing aquatic habitats for a variety of mosquito species. Physical control methods are employed by landowners, and include proper grading of irrigated lands, and better water management.

4.3.5.4 Wastewater/Aquatic Plant Systems: At some sewage treatment facilities in California, certain species of aquatic plants (e.g., water hyacinths) have been added to human-made ponds containing wastewater for nutrient removal and biomass production. Mosquito problems can be produced in this type of system if the inflow has received an inadequate treatment. Effective nutrient removal requires periodic harvesting of a portion of the standing crop.

4.3.5.5 Stormwater and wastewater management: The management of stormwater and wastewater is very important, and when done without sound engineering, poor construction or improper maintenance, can result in considerable mosquito problems. Because of recent restrictions on the flow of stormwaters into natural waterways, the question of design of stormwater retention facilities has become a critical issue. Physical control measures may be required, but proper design of facilities will be the most important factor. Currently there is a wide range of mosquitoes produced in these facilities including floodwater *Aedes* species in intermittently wet facilities and *Culex*, *Culiseta* and *Anopheles* species associated with permanent or semi-permanent wet facilities. The *Aedes* species are the most pestiferous, and may serve as vectors of viruses that infect humans.

Mosquito production can be engineered out of stormwater and wastewater facilities but not always easily. Permanent water ponds can be kept clean of weeds with a water quality sufficient to support mosquito-eating fish. Dry facilities can be designed to dry down in three days to prevent floodwater mosquito production, but some standing water beyond the three-day period may occur due to intermittent rainfall common during the rainy season.

4.3.5.6 Agricultural and Industrial Wastewater: Many commercial operations have on-site treatment facilities for decreasing nutrient loads from their wastewater, and generally, they use techniques similar to those applied to domestic wastewater. The quantity of wastewater produced at some commercial locations, such as those processing certain crops, may be highly variable during the year. Therefore, the amount of surface water in the holding ponds or fields used in the wastewater treatment may fluctuate considerably, thereby contributing to the production of certain species of floodwater mosquitoes. Wastewater from feed lots and dairy barns is often placed in holding or settling ponds without any prior treatment. Several mosquito species of the genus *Culex* can become extremely abundant in these ponds, especially in the absence of aquatic plant control.

4.3.6 Container habitats:

4.3.6.1 Miscellaneous containers: An artificial container, such as flowerpots, cans, barrels, and tires. A container breeding mosquito problem can be solved by properly disposing of such materials, covering them or tipping them over to ensure that they do not collect water. A container-breeding mosquito problem can be solved by properly disposing of such materials, covering them, or tipping them over to ensure that they do not collect water. The District has an extensive program that addresses urban container breeding mosquito problems through house-to-house surveillance and formalized education programs.

4.3.6.2 Tires: Waste tires have been legally and illegally accumulating in California for the past several decades. The legal accumulations usually take the shape of a somewhat organized pile containing up to several million tires. Illegally dumped tires may be scattered about singly or in piles containing 40 to 50 thousand carcasses. Unfortunately, most of the problem tires are not in large piles, but scattered about, making removal difficult and, at best, labor intensive.

The design of tires makes them ideal developmental sites for several species of mosquitoes, of which, some are very important vectors of disease. Until the mid-1980s, waste tires were considered more of a nuisance and environmental threat than the possible foci of mosquito-borne disease epidemics. This changed in 1985 when a substantial breeding population of *Ae. albopictus* was discovered in Houston, Texas. It is probable that this population arrived from Japan as eggs deposited inside used tires.

Thus far, *Ae. albopictus* has not become established in California, and the dry summers here are not favorable to their establishment. However, their introduction poses a serious threat, and California mosquitoes such as *Culiseta incidens* may develop here in tire carcasses.

For management of used tires, the California Integrated Waste Management Board oversees storage sites with more than 500 tires. That agency also has developed regulations regarding the storage of waste tires with regards to vector control. These regulations include the provision that the local vector control agency be involved with the permit process required to store used tires.

4.4 Analysis of CEQA Exemptions: CEQA categorical exemption classes 1 and 4 (CEQA Guidelines sections 15301 & 15304) provide exemptions for some, but not all, physical control and source reduction activities. Class 1 exempts the operation, maintenance and minor alteration of existing drainage or other facilities involving negligible or no expansion of use. Examples include the maintenance of stream channels and debris clearing to protect fish. Class 4 exempts the minor alteration of land, water and vegetation that do not involve the removal of mature, scenic trees. Examples include minor trenching where the surface is restored and maintenance dredging where the spoil is deposited in an authorized spoils area.

As applied to the District's physical control and source reduction activities described above, the following activities fit within these CEQA exemptions request/require landowners and stewards to: maintain and clear debris from drainage channels and waterways; excavate built up spoil material; remove water from tires and other urban containers; cut, trim, mow and harvest aquatic and riparian plants (but not including any mature trees, threatened or endangered plant species, or sensitive habitat areas); and minor trenching and ditching.

Consistent with the scope of the exemptions, and as applied to vector control's requested activities of landowners, exempt minor trenching and ditching means the following: digging, excavating and expanding ditches, drains and trenches in situations where all of the following conditions are satisfied: the capacity of the new or expanded facility is only negligible or insignificant; the surface area is restored; the spoil, if any, is deposited in an authorized area; and the work does not impact any mature trees, threatened or endangered plant species, or sensitive habitat areas.

Major trenching and ditching and other land alteration/source reduction projects that do not fit the above list of exempt activities generally are not exempt from CEQA. These activities will need to be analyzed on a case-by-case basis with project-specific initial studies or other appropriate environment documents. Likewise, other physical control activities not described above are not exempt from CEQA under the class 1 or 4 exemptions and they too will need to be analyzed on a case-by-case basis.

Aquatic plant management through the use of herbicides is exempt from CEQA as discussed later in the discussion regarding chemical control, section 5.

5. CHEMICAL CONTROL

5.1 Introduction: Mosquito control operations use a combination of two basic chemical control methods to control mosquitoes: adulticiding and larviciding. The District uses only those pesticides registered by the United States Environmental Protection Agency and California Environmental Protection Agency. With the existing federal and state limitations and regulations, the pesticides available for mosquito control, when applied in accordance with legal requirements, are very environmentally sensitive and cause no or very minor and discrete ecological impact.

The Environmental Hazards section on labels of pesticides used for mosquito control instructs applicators about how to avoid and minimize environmental impacts. For example, adulticide labels instruct the applicator to avoid direct application over water or drift into sensitive areas (i.e., wetlands) due to a potentially high toxicity of these compounds to fish and invertebrates. Although there is some variation in the habitats to be avoided, they usually include lakes, streams and marshes. The District staff and duly authorized individuals strictly follow label instructions and carefully monitor environmental and meteorological conditions to maximize effectiveness while avoiding and minimizing non-target exposure and environmental effects.

5.2 Description of Adulticides & Adulticiding Activities: application of insecticides for control of adult mosquitoes (adulticiding) is probably the most visible practice exercised by mosquito control agencies. Insecticides are applied using aerial or ground application techniques. The most common form of adulticiding is the application of insecticide aerosols at very low dosages and using little or no diluent. This method is commonly called the ultra-low-volume (ULV) method. Ground adulticiding is almost exclusively conducted with specially designed ULV equipment. Most aerial applications of adulticides are made with the use of special systems designed specifically for the ULV method.

The efficiency of adulticiding is dependent upon a number of integrated factors. First, the mosquito species to be treated must be susceptible to the insecticide applied. Some California mosquitoes are resistant or more tolerant to some adulticides thus affecting the selection of chemical. Second, insecticide applications must be made during periods of adult mosquito activity. This factor is variable with species. Some species of mosquitoes are diurnal (daytime biting), while others are crepuscular or nocturnal. Adulticiding should be timed when the mosquitoes are active and thus exposed to the drifting aerosol mist.

The chemical application has its own set of conditions that determine success or failure. The application must be at a dosage rate that is lethal to the target insect and applied within the correct droplet size range. It has been shown that droplets within the 10-25 micron range are most effective in controlling adult mosquitoes.

Whether the treatment is ground or aerially applied, sufficient insecticide must be distributed to cover the prescribed area with an effective dose. Ground applications with densely vegetated habitats may require a higher dosage rate than that of open areas. This is purely a function of wind movement and its ability to sufficiently carry droplets to penetrate foliage.

Environmental conditions may also affect the results of adulticiding. Wind determines how the ULV droplets will be moved from the output device into the treatment area. Conditions of no wind will result in the material not moving from the application point. High wind, a condition that inhibits mosquito activity will quickly disperse the insecticide too widely to be effective. Light wind conditions (< 10 mph) are the most desirable, moving the material through the treatment area and are less inhibiting to mosquito activity.

ULV applications are generally avoided during hot daylight hours. Thermal conditions will cause small droplets to rise, moving them away from mosquito habitats and flight zones. Generally, applications are made between sunset and sunrise, depending upon mosquito flight activity. This practice minimizes exposure of non-target species such as bees or butterflies. Some mosquitoes (*Aedes* species) are most active during the daytime. Applications for these species should be made during the period of highest activity provided that meteorological conditions are suitable for application and care is made to avoid non-target impacts.

One notable exception to treatments being made when mosquitoes are up and flying is a residual treatment application. Residual treatments are based on behavioral characteristics of the mosquito species causing the problem. Residual applications use a longer-lasting material and are generally applied with a sprayer to preferred resting areas and vertical surfaces in order to intercept adult mosquitoes hunting for blood meals. Residual treatments are often applied during daylight hours as a large droplet, liquid application and are designed to prevent a rapid re-infestation of a specific area such as recreational areas, parks, special event areas and private residences. Residual applications can help provide control of mosquitoes for up to one week or longer.

5.3 Adulticides: Throughout the discussion of adulticide materials, signal words that may occur on the label of the material are mentioned. Following is an explanation ofthese signal words:

CAUTION. This word signals that the product is slightly toxic. An ounce to more than a pint taken by mouth could kill the average adult. Any product, which is slightly toxic orally, dermal, or through inhalation or causes slight eye and skin irritation, is labeled "CAUTION".

WARNING. This word signals that the product is moderately toxic. As little as a teaspoonful to a tablespoonful by mouth could kill the average sized adult. Any product, which is moderately toxic orally, dermal, or through inhalation or causes moderate eye and skin irritation, will be labeled "WARNING".

DANGER. This word signals that the pesticide is highly toxic. A taste to a teaspoonful taken by mouth could kill an average sized adult. Any product, which is highly toxic orally, dermal, or through inhalation or causes severe eye and skin burning, is labeled "DANGER".

The District periodically uses the following insecticides to control adult mosquitoes: AgrEvo®, "PYRENONE® CROP SPRAY", EPA Reg. No. 4816-490, Active Ingredients:

Pyrethrins, Piperonyl Butoxide

AgrEvo®, "SUSPEND® SC Insecticide", EPA Reg. No. 432-763, Active Ingredients: Deltamethrin

5.3.2 Pyrethrins and Pyrethroids - General Description: Natural pyrethrins (pyrethrum) are extracted from chrysanthemum flower heads grown commercially in parts of Africa and Asia. Synthetic analogues of the natural pyrethrins reached commercial success in the 1950's. Like the natural pyrethrins, 'first generation' synthetic pyrethroids such as phenothrin and tetramethrin are relatively unstable to light. During the 1960's-1970's, great progress was made in synthetic light-stable pyrethroids. These photostable pyrethroids represent the 'second generation' of these compounds.

Pyrethroids exhibit rapid knockdown and kill of adult mosquitoes, characteristics that are considered a major benefit of their use. The mode of action of these compounds relates to their ability to affect sodium channel function in the neuronal membranes.

Synthetic pyrethroids are not cholinesterase inhibitors, are non-corrosive and will not damage painted surfaces. They are less irritating than other mosquito adulticides and have a less offensive odor. In comparison to other adulticides, pyrethroids may be effectively applied at much lower rates of active ingredient per acre. The synthetic pyrethroids are mimics of natural pyrethrum, a botanical insecticide. Natural pyrethrum is used in agricultural areas and has a significantly higher cost.

5.3.2.1 Natural Pyrethrins - Introduction: Natural pyrethrins are compounds that are not photostable. Pyrocide 7396, manufactured by MGK, is a labeled natural pyrethrin, whose label contains a CAUTION statement. It contains 5% pyrethrin with piperonyl butoxide at a 1:5 ratio.

FORMULATIONS AND DOSAGES: Pyrocide 7396 is applied as a ULV spray with a dosage per acre of 0.0025 lbs. of pyrethrins/acre (piperonyl butoxide at 0.0125 IbsVacre).

TARGET SPECIES. Pyrethrins is used against all California mosquitoes.

5.3.2.2 Resmethrin - Introduction: Resmethrin is another of the first generation synthetic pyrethroids used in California. Resmethrin, like permethrin, is photolabile pyrethroids compound produced by AgrEvo and formulated as the active ingredient in products such as Scourge. Resmethrin is similar to the other pyrethroids in providing rapid knockdown and quick kill of aduit mosquitoes. Resmethrin exhibits very low mammalian toxicity, degrades very rapidly in sunlight and provides little or no residual activity.

FORMULATIONS AND DOSAGES: Resmethrin products are available in several concentrations that range from 1.5% to 40% and may or may not contain piperonyl butoxide. Scourge products, containing resmethrin and piperonyl butoxide (a synergist), have a maximum rate of application of 0.007 lbs. per acre of the active ingredient.

Currently, Scourge is a restricted use insecticide with labels that contain the signal word "Caution".

TARGET SPECIES: Resmethrin is used against all California mosquitoes.

5.3.2.3 Permethrin - Introduction: Permethrin, a second-generation pyrethroid, is a photostable pyrethroids compound and formulated as the active ingredient in products such as Aqua-Reslin and Biomist. Permethrin is similar to other pyrethroids in providing rapid knockdown and quick kill of adult mosquitoes. However, permethrin also provides some residual activity when applied directly to surfaces. Permethrin is a general use pesticide with labels that may contain either the signal word WARNING or CAUTION depending on the particular product.

FORMULATIONS AND DOSAGES: Permethrin products are available in various concentrations, from 1.5% to 57% and may or may not be synergized with piperonyl butoxide. Synergized permethrin products may contain piperonyl butoxide in various ratios by weight but the maximum rate of application is 0.007 lbs. per acre of the active ingredient. Permethrin products, if labeled for this use, may be applied at a maximum of 0.1 lbs. of active ingredient per acre for a "barrier" effect, whereas rates up to 0.007 lbs. per acre may be used for vehicle mounted ULV applications.

TARGET SPECIES. Permethrin is used against all California mosquitoes.

5.4 Ground Adulticiding Techniques and Equipment

5.4.1 Adulticide Application from Truck-mounted Equipment (Ground adulticiding): Ground adulticiding is the most commonly used method of controlling adult mosquitoes in California and in some counties is often perceived by the general public as the only method used.

Ground adulticiding generally consists of barrier or residual spraying, and Ultra Low Volume (ULV) aerosol applications. Barrier or residual treatments for adult mosquitoes consists of an application using a material with residual properties generally applied with a compressed air sprayer to the preferred foliage, buildings, or resting areas of the species in order to intercept adult mosquitoes hunting for blood meals.

This technique is often used as a barrier or perimeter treatment and is based on the natural history of and behavioral characteristics of the mosquito species treated.

Cold aerosol generators, cold foggers, and Ultra Low Volume (ULV) aerosol machines were developed to eliminate the need for great quantities of petroleum oil diluents necessary for earlier fogging techniques. These units are based on a design patented by the U.S. Army and are constructed by mounting a vortex nozzle on the forced air blower of a thermal fogger. Insecticide is applied as technical material or at moderately high concentrations (as is common with the pyrethroids) which translates to very small quantities per acre and is therefore referred to as ultra low volume (ULV). In agriculture, this rate is assumed less when 36 oz/acre, but mosquito control ground adulticiding operations rarely exceed one oz/acre. The optimum sized droplet for mosquito control with cold aerosols applied at ground level has been determined to be in the range of 5-20 microns.

The sprayers today use several techniques to meet these requirements. Air blast sprayers are almost universal. They use either high volume/low pressure vortex nozzles or high-pressure air-shear nozzles to break the liquid into very small droplets. Rotary atomizers, ultrasonic and electrostatic nozzles are other forms of atomization equipment. Centrifugal energy nozzles (rotary atomizers) form droplets when the liquid is thrown from the surface of a high speed spinning porous sleeve or disc. Ultrasonic equipment vibrates and throws the droplets off. Electrostatic systems repel the droplets.

5.4.2 Equipment: Ground adulticiding equipment is normally mounted on some type of vehicle, but smaller units are available that can be carried by hand or on a person's back. Pickup trucks are the most common motorized vehicle for conveyance. ATV's, golf carts, and even boats are occasionally utilized for ground adulticiding with various configurations of equipment.

Cold aerosol generators, ULV's in common parlance, are available in a broad range of sizes and configurations. Beecomist, Clarke, Curtis, London Fog and Microgen all produce units for community/county sized operations.

The Leco Model 1600 and HD (recently acquired by Clarke Engineering Technologies), London Fog 18-20, Clarke's Grizzly and Curtis' Maxi-Pro 4 all utilize a large twin cylinder gasoline engine driving a rotary lobed blower. The nozzles on these machines differ, but they all resemble the old Army patent vortices nozzle. The Beecomist Pro-Mist 25 HD is an electric driven rotary atomizer operating off the vehicle's electrical system.

The insecticide metering equipment available on these machines ranges from a simple glass flow-meter and a pressurized tank or electric pump on fixed flow machines to computer controlled, speed correlated, event recording and programmable flow management systems. The fixed flow units are designed to be operated with the vehicle traveling at a constant speed. Most of these use 12-volt laboratory type pumps, which are quite accurate.

Many programs construct their own equipment from off-the-shelf components. Some of these are built up from new pieces while others are fabricated from scavenged equipment. They may be locally made for economic reasons or to customize a certain function for a particular operational need. Unique features, added durability, additional controls or just plain, nothing like it is available, are common reasons. Most of this equipment uses nozzle assemblies manufactured by one of the previously mentioned manufacturers. Some use the truck engine for a power source.

Every manufacturer now produces a mid-range machine in the 8-12 horsepower (or equivalent) class and a few even smaller <6 HP machines. These units are more compact, lighter and typically have smaller appetites for fuel than their larger relatives.

The atomization capabilities of the larger machines in this class are normally sufficient for many of the pesticides now being used, particularly at the 10-MPH rates. All of the flow systems available for the larger units may be fitted to this class machine as well. There are several hand-held, 2-cycle engine, ULV sprayers available that are useful for small area treatments. There are several units configured as backpacks, with the engine/blower mounted on a pack frame connected to a remote nozzle with a hose. These units utilize an orifice to control flow and either aspirating or gravity feed to supply the insecticide.

5.5 Aerial Applications

5.5.1 Techniques for Aerial Applications: Aerial applications may be the only reliable means of obtaining effective control in areas bordered by extensive mosquito production sites or have small, narrow, or inaccessible network of roads. Aerial adulticiding is often the only means available to cover a very large area quickly in case of severe mosquito outbreaks or vector borne disease epidemics.

There are two aerial adulticiding techniques that are used in California: low volume spraying and ULV aerosols. Low volume (<2 GPA) sprays are applied with the pesticide diluted in light petroleum oils or water and applied as a rather wet spray. The size of the droplets reduces drift, thus limiting swath widths, and may not be ideal under certain circumstances for impinging on mosquitoes. The technique is compatible with equipment commonly used for aerial liquid larviciding.

A common aerial adulticiding technique applies the insecticide in a technical concentrate or in a very high concentration formulation as an ultra low volume (ULV) cold aerosol. Lighter aircraft, including helicopters, can be used because the insecticide load is a fraction of the other techniques. If the aircraft are capable of >120 knots, fine droplets can be created by the high speed air stream impacting the flow from hydraulic nozzles. Slower aircraft and most helicopters typically use some variety of rotary atomizers to create the required droplet spectrum. ULV applications can be difficult to accurately place with any regularity. Without the visual cues, drift and settling characteristics can be difficult to access.

The flight parameters differ by program and technique. Some operations fly during hours of daylight so their applications begin either at morning's first light or before sunset and work into twilight. At these times, the pilots should be able to see towers and other obstructions as well as keep track of the spray plume. The aircraft can be flown at less than 200 feet altitude, which may make it easier to hit the target area.

Other operations may be conducted in the dark of the night, typically after twilight or early in the morning before dawn. The aircraft typically are flown between 200 and 300 feet altitude. Swath widths vary from operation to operation but are normally set somewhere between 400-1,200 feet. Most mosquito flight activity is crepuscular so these flights catch the adults at their peak activity. Bees are not active prior to full daylight so should not be at risk from the insecticide.

Swaths are flown as close to perpendicular with the wind as is possible, working into the wind and commonly forming a long, tight S pattern. A number of factor affect the spray-drift offset and settling such as wind speed, droplet size, aircraft wake turbulence, altitude and even characteristics ofthe individual aircraft. Pilots rely somewhat on experience for determining this offset and some use telltale smoke or paper markers for swath alignment.

Aerial applications can be expensive, considering the pesticide costs per acre, the high cost of owning, maintaining or leasing aircraft with the inherent increased salary demands, or contractual services. However, due to the commitments for any spray mission, decisions are given much thought and are scheduled when adult population levels have peaked.

5.5.2 Aircraft Equipment: The aircraft used for aerial adulticiding are as varied as the programs where they are located. Both rotorcraft and fixed wing are utilized.

5.5.2.1 Fixed Wing: Fixed wing aircraft account for most of the aerial acreage adulticided in California.

5.5.2.2 Rotorcraft: Rotorcraft is seeing wider use for adulticiding. Many programs, which operate them for larviciding duties, will change the spray equipment and adulticide with them. Additionally, programs will use them for adulticiding smaller areas, which have difficult obstructions or meandering shapes. They are capable of much quicker turns, are more maneuverable and can be serviced at field sites thus reducing ferry times.

5.5.3 Training and Maintenance: Operators of adulticiding equipment must be trained not only in the proper use and maintenance of the equipment, but also in the proper application of the insecticide which they are using. The pesticide labels specify details of the application including acceptable droplet spectra, flow rates, application rates, areas to avoid and target insects. State Law requires that operators be licensed to apply pesticides through the California Department of Health Services or the California Department of Pesticide Regulation, or be directly supervised by a licensed person.

Pilots operating aircraft spraying for mosquitoes must hold an Aerial Applicators certification issued by the State of California, and must meet continuing education requirements. This requirement insures that those involved with aerial operations keep abreast of the latest developments in aerial application and safety.

5.5.3.1 Guidance Systems and Documentation: Guidance systems such as Loran and GPS are being used to keep the aircraft on the selected target and flying parallel and on even swaths. Even with selective availability (DOD's "dithering" the atomic clock's output which they encode) distorting the GPS position, repeatability (absolute accuracy isn't necessary for parallel swaths) is good enough for adulticiding where drift should smooth the swath irregularities. Differential GPS, which corrects the military's corrupted signal, is available throughout California and avionics grade DGPS receivers became available in 1996. GPS units are being used with moving map displays that can be programmed to display a spray area complete with accurately placed swaths.

The electronics permit a real time snail trail showing where the aircraft is flying and where it has been for the flight crew to monitor their progress. Recording systems are available to log the flight path on data cartridges, which can be read into a GIS system on a desktop PC. This recording can include parameters such as spray on/off, etc. to add an attribute to the flight path recording. These units have historically been very expensive to use. With newer technology and inexpensive pricing, these devises are expected to become integral parts in adult mosquito control programs.

5.5.4 Discussion of Available Approaches: Adulticiding is the only known effective measure of reducing an adult mosquito population in a timely manner. All mosquito adulticiding activities follow reasonable guidelines to avoid affecting non-target species. Timing of applications (when mosquitoes are most active), avoiding sensitive areas, working and coordinating efforts with Fish and Game or USFWS and following label instructions all result in good mosquito control practices. Ground adulticiding can be a very effective technique for controlling most mosquito species in areas economically and with negligible non-target effects. It is the methodology normally recommended for fundamental start-up programs. Initially an agency is not able, or prepared, to invest in a larviciding program where most of the mosquito production sites within flight range of the residents must be treated to produce a discernible improvement.

A benefit of ULV cold aerosols is that they do not require large amounts of diluents for application and are therefore much cheaper and generally environmentally safer. The spray plume is nearly invisible and is applied at very low dosage rates (less than 0.007 lbs. per acre). Applications are made at times when mosquitoes are most active and when other beneficial insects are not, so any impacts that occur are minimal and quickly reversed.

Machines are calibrated at least once a year. Measurements for output and droplet sizes of the pesticides being used are confirmed to maximize efficiency and minimize potential adverse impacts.

It should also be noted that this form of control has been conducted safely for over 40 years without any adverse impacts.

An area of good mosquito control practices that needs to be discussed and distinguishes our industry from agricultural practices is the use of drift to control adult mosquitoes. All aerial (as well as ground) adulticiding, other than residual sprays, relies on a cloud of atomized insecticide particles drifting across the landscape. Mosquitoes, which are in flight and become enveloped in this cloud and are unfortunate enough to have sufficient toxicant impinged on them, die. Without drift, the system will not function. There is a rising concern among certain private landowners, particularly those with organic farming operations, about the uninvited mosquito insecticide drifting over, or depositing onto their lands. The District takes measures to avoid impacts to these concerns. Organic farmland are located and plotted by the district. Adulticiding operations can then be performed in a manner that avoids drift over organic farms. It should be noted that these efforts often result in inadequate control of adult mosquitoes; work is underway with the National and California Organic Standards

Boards that will provide a means for mosquito and vector control districts to perform operations that will not impact an organic grower's certification.

Chemical sensitivity can be a serious concern. This issue is addressed by conducting ULV operations in the early morning and late evenings, when people will least likely be exposed to the pesticide cloud.

The influence of meteorological conditions to spray drift cannot be understated. Air temperature at ground level relative to that above it dictates air stability and consequently, patterns of drift and deposition. Higher temperatures on the ground will cause the spray cloud to become entrained in rising thermal currents interfering with the intended horizontal drift pattern. Wind speed and directionality are important for obvious reasons.

Occasionally, bee keeping operations report losses associated with adulticide treatments. These operations are often located in areas where routine adulticiding is conducted. Such operations are encouraged to notify mosquito control agencies to avoid exposing their colonies either by actions taken by the resident/manager or by mosquito control applicators. Avoiding beehives has been a primary concern of District operations. Locations of hives are identified on maps and technicians are instructed to avoid applying pesticide in a manner that would drift over these areas. Associating bee kills with mosquito control applications may be misleading since bee colonies are susceptible to a variety of diseases and other causes for loss in colony strength and production.

All personnel who apply pesticides receive training at least once a year. This training consists of an annual review of the pesticides the applicator will be handling that year. All applicators are certified by the Department of Health Services on the safe and proper use of pesticides. Applicators must undergo a minimum of 20 hours of continuing education every two years to maintain their certification.

5.6 Larvicides and Larviciding Introduction: Larviciding is a general term for the process of killing mosquitoes by applying natural agents or commercial products designed to control larvae and pupae (collectively called larvicides) to aquatic habitats. Larvicide treatments can be made from either the ground or air. Larviciding, implemented as a malaria control procedure in the early 1900's, has become prominent. Most mosquito control districts in California rely upon larviciding as part of their integrated pest management program.

There may be times when it makes no sense to attempt any larviciding at all. The size and location of the source area may make timely larviciding impossible. Effective larviciding results are not always easy to achieve. Accuracy of the larvicide application is extremely important. Congregated larvae may be easy targets, but missing a relatively small area containing them is also easy and leads to the emergence of many adults. Application timing is important because different materials have different requirements. As with adulticides, dosage rates must be both sufficiently high to kill targeted species and sufficiently low to minimize non-target effects.

A wide variety of aquatic habitats and communities, ranging from small domestic containers to larger agricultural and marshland areas, are treated with larvicides. Natural fauna inhabiting these sites may include amphibians, fish, vertebrates and invertebrates, particularly insects and crustaceans. Frequently, the aquatic habitats targeted for larviciding are temporary or semi permanent. Permanent aquatic sources usually contain natural mosquito predators such as fish and do not require routine treatment, unless vegetation is so dense that it prevents natural predation. Temporary sites such as marshes and flooded agricultural areas produce prolific numbers of floodwater mosquitoes. These sites are generally very low in species diversity due to the time needed for most species to locate and colonize them. While flood water mosquitoes develop during the first week post-inundation, it may take two to three weeks for the first macro-invertebrate predators to become established. Finally, many non-target species exploiting temporary aquatic habitats are capable of recovering from localized population declines via re-colonization from proximal areas.

5.6.1 Larvicides: Throughout the discussion of larvicide materials, signal words on the label are mentioned. Following is an explanation of these signal words:

" CAUTION”. This word signals that the product is slightly toxic. An ounce to more than a pint taken by mouth could kill the average adult. Any product, which is slightly toxic orally, dermal, or through inhalation or causes slight eye and skin irritation, will be labeled "CAUTION".

"WARNING”. This word signals that the product is moderately toxic. As little as a teaspoonful to a tablespoonful by mouth could kill the average sized adult. Any product which is moderately toxic orally, dermally,

"DANGER”. This word signals that the pesticide is highly toxic. A taste to a teaspoonful taken by mouth could kill an average sized adult. Any product, which is highly toxic orally, dermal, or through inhalation or causes severe eye and skin burning, will be labeled "DANGER".

Commercially available and experimental larvicides plus natural control agents available in California is discussed below. Arbitrarily, they are loosely categorized by their modes of entry/action on target/non-target organisms: Contact Pesticides, Surface Active Agents, and Stomach Toxins. Registered trade names and active ingredients of products are used in the discussions.

The District periodically uses the following insecticides to control immature mosquitoes:

1. Sandoz Agro, Inc., "ALTOSID® BRIQUETS", EPA Reg. No. 2724-375-64833, Active Ingredients: Methoprene

2. Sandoz Agra, Inc., "ALTOSID® XR BRIQUETS", EPA Reg. No. 2724-421-64833, Active Ingredients: Methoprene

3. Sandoz Agro, Inc., "ALTOSID® LIQUID LARVICIDE", EPA Reg. No. 2724-392-

64833, Active Ingredients: Methoprene

4. Sandoz Agro, Inc., "ALTOSID® PELLETS", EPA Reg. No. 2724-448-64833, Active Ingredients: Methoprene

5. Golden Bear Oil Specialties, Inc., "MOSQUITO LARVICIDE GB-1111", EPA Reg. No. 071236-1, Active Ingredients: Aliphatic Petroleum Hydrocarbons

6. Sandoz Agro, Inc., "TEKNAR® HP-D LARVICIDE", EPA Reg. No. 2724-365-64833, Active Ingredients: Bacillus thuringiensis subspecies israelensis

7. Abbott Laboratories, "VECTOBAC® 12AS", EPA Reg. No. 275-102, Active Ingredients: Bacillus thuringiensis subspecies israelensis

8. Abbott Laboratories, "VECTOBAC® G", EPA Reg. No. 275-50, Active Ingredients: Bacillus thuringiensis subspecies israelensis

9. Abbott Laboratories, 'VECTOLEX® CG", EPA Reg. No. 275-77, Active Ingredients: Bacillus sphaehcus Serotype H5a5b

5.6.2 Contact Pesticides: As the name implies, this loosely defined group of compounds is effective when mosquito larvae or pupae are exposed to it. Chemicals are absorbed through the insects outer "skin" or cuticle, and may be incidentally ingested or enter the body through other routes. Contact agents are toxins primarily affecting an insect's endocrine system. Endocrine system agents used in this period include many s-methoprene formulations.

5.6.2.2 s-Methoprene - Introduction: s-Methoprene does not produce non-discriminatory, rapid toxic effects that are associated with nervous system toxins. s-Methoprene is a true analogue and synthetic mimic of a naturally-occurring insect hormone called Juvenile Hormone (JH). JH is found during aquatic life stages of the mosquito and in other insects, but is most prevalent during early instar phases. As mosquito larva mature, the level of JH steadily declines until the fourth instar molt, when levels are very low. This is considered a sensitive period when all the physical features of the adult begin to develop. s-Methoprene in the aquatic habitat can be absorbed on contact and the insect's hormone system becomes unbalanced. When this happens during the sensitive period, the unbalance interferes with fourth instar larval development.

One effect is to prevent adults from emerging. Since pupae do not eat, they eventually deplete body stores of essential nutrients and then starve to death. For these and perhaps-other reasons, s-Methoprene is considered an insect growth regulator (IGR).

There have been widely distributed reports regarding the effect methoprene may have on certain amphibians. Reports of frog abnormalities have been widely circulated, but these reports have not stood up to scientific scrutiny.

FORMULATIONS AND DOSAGES: Currently, five s-methoprene formulations are sold under the trade name of Altosid. These include Altosid Liquid Larvicide (A.L.L.) and Altosid Liquid Larvicide Concentrate, Altosid Briquets, Altosid XR Briquets, and Altosid Pellets. Altosid labels contain the signal word "CAUTION".

ALTOSID LIQUID LARVICIDE (A.LL.) & A.L.L. CONCENTRATE: These two flowable formulations have identical components except for the difference in the concentration of active ingredients. A.L.L. contains 5% (wt./wt.) s-Methoprene while A.L.L. Concentrate contains 20% (wt./wt.) s-Methoprene. The balance consists of inert ingredients that encapsulate the s-Methoprene, causing its slow release and retarding its ultraviolet light degradation.

DOSAGES: Use rates are 3 to 4 ounces of A.L.L. 5% and *A to 1 ounce of A.L.L Concentrate (both equivalent to 0.01008 to 0.01344 Ibs. Al) per acre, mixed in water as a carrier and dispensed by spraying with conventional ground and aerial equipment. Because the specific gravity of Altosid Liquid is about that of water, it tends to stay near the target surface. No rate adjustment is necessary for varying water depths when treating
species that breathe air at the surface.

TARGET SPECIES: Liquid formulations are designed to control fresh and saline floodwater mosquitoes with synchronous development patterns. Cold, cloudy weather and cool water slow the release and degradation of the active ingredient as well as the development of the mosquito larvae. Accordingly, formulation activity automatically tracks developing broods.

ALTOSID BRIQUETS: Altosid briquets were the first solid methoprene product marketed for mosquito control beginning in 1978. It is made of plaster (calcium sulfate), 3.85 % (wt./wt.) r-methoprene, 3.85% s-methoprene (.000458 Ib. Al/briquette) and charcoal (to retard ultra violet light degradation). Altosid Briquets release methoprene for about 30 days under normal weather conditions.

DOSAGES: Application should be made at the beginning of the mosquito season, and under normal weather conditions, repeat treatments should be carried out at 30-day intervals. The recommended application rate is one Briquette per 100-sq. ft. in non-flowing or low-flowing water up to 2 feet deep.

TARGET SPECIES: Flood water Aedes and permanent water Anopheles, Culex, and Culiseta larvae are usual targets. Typical treatment sites include storm drains, catch basins, roadside ditches, ornamental ponds and fountains, cesspools and septic tanks, waste treatment and settlement ponds, flooded crypts, transformer vaults, abandoned swimming pools, construction and other man-made and natural depressions.

ALTOSID XR BRIQUETS: It is made of hard dental plaster (calcium sulfate), 1.8-% (wt./wt.) s-methoprene (.00145 Ib. Al/briquette) and charcoal (to retard ultra violet light degradation). Despite containing only 3 times the Al as the "30-day briquette", the comparatively harder plaster and larger size of the XR Briquet change the erosion rate allowing sustained s-methoprene release up to 150 days in normal weather.

DOSAGES: XR Briquets should be applied 1 to 2 per 200-sq. ft. in no-flow or low-flow water conditions, depending on the species.

TARGET SPECIES: Targets are the same as for the smaller briquets. Appropriate treatment sites for XR Briquets include storm drains, catch basins, roadside ditches, ornamental ponds and fountains, cesspools and septic tanks, waste treatment settlement ponds, flooded crypts, transformer vaults, abandoned swimming pools, construction and other man-made and natural depressions, cattail swamps and marshes, water hyacinth beds, pastures, meadows, rice fields, freshwater swamps and marshes, woodland pools, flood plains and dredge spoil sites.

ALTOSID PELLETS. Altosid Pellets were approved for use in April 1990. They contain 4% (wt./wt.) s-methoprene (0.04 Ib. Al/lb.), dental plaster (calcium sulfate), and charcoal. As the Briquets discussed above, Pellets are designed to release s-methoprene slowly as they erode. Under normal weather conditions, control can be achieved for up to 30 days.

DOSAGES: Label application rates range from 2.5 lbs. to 10.0 lbs. per acre (0.1 to 0.4 Ib. Al/acre), depending on the target species and/or habitat.

TARGET SPECIES: The species are the same as listed for the briquette formulations. Listed target sites include pastures, meadows, rice fields, freshwater swamps and marshes, salt and tidal marshes, woodland pools, flood plains, tires and other artificial water holding containers, dredge spoil sites, waste treatment ponds, ditches, and other man-made depressions, ornamental pond and fountains, flooded crypts, transformer vaults, abandoned swimming pools, construction and other man-made depressions, tree holes, storm drains, catch basins, and waste water treatment settling ponds.

ALTOSID XR-G: Altosid XR-G was approved for use in 1997. This product contains 1.5-% (wt./wt.) s-methoprene. Granules are designed to release s-methoprene slowly as they erode. Under normal weather conditions, control can be achieved for up to 21 days.

DOSAGES: Label application rates range from five lbs. to 20 lbs. per acre, depending on the target species and/or habitat.

TARGET SPECIES AND APPLICATION SITES. The species are the same as listed for the briquette formulations. Listed target sites include snow pools, meadows, rice fields, freshwater swamps and marshes, salt and tidal marshes, woodland pools, tires and other artificial water holding containers, dredge spoil sites, waste treatment ponds, ditches, and other natural and man-made depressions.

5.6.3 Surface Active Agents - Introduction: Larvicides in this category include oils and ethoxylated isostearyl alcohol. Unfortunately, none of the currently supported larvicides previously discussed act as pupacides. Therefore, pupal control must be achieved with these products.

Oils were first used as effective anopheline larvicides for malaria control in California at the turn of the century. Commonly used larviciding oils kill larvae and pupae when inhaled into the tracheae along with air at the surface of the water. With low dosages (1 gallon per acre), they can work very slowly, taking 4 to 7 days to provide control. Higher dosage rates are usually used (up to 5 gallons per acre) to lower the kill time and extend the control period.

Districts generally use surface oils in heavily polluted waters, where beneficial organisms are low or nonexistent, in areas with late (non-feeding) instar larvae or pupae, or in areas where other larvicides have failed.

MOSQUITO LARVICIDE GB-1111: This product is petroleum based "napthenic oil." The "napthenic oil" designation characterizes petroleum oil refining processes. The GB stands for Golden Bear and the product is referred to as Golden Bear 1111 or simply GB-1111. Another mosquito control product, GB-1356, was nearly identical to GB1111, but Witco Chemical Company withdrew label support in the early 1990's. The label for GB-1111 contains the signal word "CAUTION".

DOSAGES: GB-1111 contains 99% (wt./wt.) oil and 1 % (wt./wt.) inert ingredients including an emulsifier. The nominal dosage rate is 3 gallons per acre or less. Under special circumstances, such as when treating areas with high organic content, up to 5 gallons per acre may be used.

TARGET SPECIES: GB-1111 is effective on a wide range of mosquito species. Applied to developmental areas, GB-1111 is an effective material against any mosquito larvae and pupae obtaining atmospheric oxygen at the water surface. It can even be effective in treating adult mosquitoes as they emerge.

5.6.4 Stomach Toxins - Introduction: Mosquito control makes use of two stomach toxins whose active ingredients are manufactured by bacteria. These control agents are often designated as Bacterial Larvicides. Their mode of action requires that they be ingested to be effective, which can make them more difficult to use than the contact toxins and surface active agents. Bacteria are single-celled parasitic or saprophytic microorganisms that exhibit both plant and animal properties, and range from harmless and beneficial to intensely virulent and lethal. A beneficial form, *Bacillus thuringiensis* (Bt), is the most widely used (especially in agriculture) microbial pesticide in the world. It was originally isolated from natural lepidopteran (butterflies and moths) die-offs in Germany and Japan. Various Bt products have been available since the 1950's, and in 1976, Dr. Joel Margalit and Mr. Leonard Goldberg isolated from a stagnant riverbed pool in Israel, a subspecies of *B. thuringiensis* that had excellent mosquito larvicide activities. It was named *Bt*. variety *israelensis* (B.t.i.) and later designated *Bacillus thuringiensis* Serotype H-14. Either of these two designations may be found on the labels of many bacterial mosquito larvicide formulations used today. Another species of bacteria, *B. sphaericus*, also exhibits mosquito larvicide properties.

5.6.4.1 BTI (*Bacillus thuringiensis israelensis*) - Introduction: Like a tiny chemical factory capable of only one production run, each B.t.i. organism may produce, if the environmental conditions around it are favorable, five different microscopic protein pro-toxins packaged inside one larger protein container or crystal. The crystal is commonly referred to as delta (d-) endotoxin. If the d-endotoxin is ingested, these five proteins are released in the alkaline environment of an insect larva's gut. The five proteins are converted into five different toxins if specific enzymes also are present in the gut. Once converted, these toxins work alone or in combination to destroy the gut wall. This leads to paralysis and death of the larvae. B.t.i. is grown commercially in large fermentation vats using sophisticated techniques to control environmental variables such as temperature, moisture, oxygen, pH and nutrients. The process is similar to the production of beer, except that B.t.i. bacteria are grown on high protein substrates such as fishmeal or soy flour and the spore and delta endotoxin are the products. At the end of the fermentation process, B.t.i. bacteria exhaust the nutrients in the fermentation machine, producing spores before they break apart. Coincidental with sporulation, the delta endotoxin is produced. The spores and delta endotoxin are then concentrated via centrifugation and microfiltration of the slurry. It can then be dried for processing and packaging as a solid formulation(s) or further processed as a liquid formulations). Since some fermentation medium (e.g. fishmeal) is always present in liquid formulations, they generally smell somewhat like the medium.

FORMULATIONS AND DOSAGES: There are five basic B.t.i. formulations available for use: liquids, powders, granules, pellets, and briquets. Liquids, produced directly from concentrated fermentation slurry, tend to have uniformly small (2-10 micron) particle sizes, which are suitable for ingestion by mosquito larvae. Powders, in contrast to liquids, may not always have a uniformly small particle size. Clumping, resulting in larger sizes and heavier weights, can cause particles to settle out of the feeding zone of some target mosquito larvae, preventing their ingestion as a food item. Powders must be tank mixed before application to an inert carrier or to the larval habitat, and it may be necessary to mix them thoroughly to achieve a uniformly small consistency. B.t.i. granules, pellets, and briquets are formulated from B.t.i. primary powders and an inert carrier. B.t.i. labels contain the signal word "CAUTION". Since fourth instar mosquito larvae quit feeding before becoming pupae, it is necessary to apply B.t.i. before this point in their development. Although the details are poorly understood, evidence suggests that larvae also undergo a period of reduced feeding or inactivity prior to molting from 1st to 2nd, 2nd to 3rd, and 3rd to 4th instar. If we apply B.t.i. at these points in their development, the toxic crystals may settle out before the larvae resume feeding, and with synchronous broods of mosquitoes, complete control failures may result. With asynchronous broods, efficacy may be reduced. Kills are usually observed within 24 hours of toxin ingestion. As a practical matter, apparent failures are usually followed with oil treatments. The amount of toxins contained within B.t.i. products are reported indirectly as the result of at least two different bioassays and are difficult to equate to one another. Prepared volumes of toxins are applied to living mosquito larvae and the resulting mortality produces through formulae numerical measures known as International Toxic Units (ITU's) and Aedes aegypti International

Toxic Units (AA-ITU's). These measures are only roughly related to observed efficacy in the field, and are therefore inappropriate to consolidate and report on like other toxicants.

BTI LIQUIDS: Currently, two commercial brands of B.t.i. liquids are available: Teknar HP-D and VectoBac 12AS.

DOSAGES AND FORMULATIONS: Labels for all three products recommend using 4 to 16 liquid oz/acre in unpolluted, low organic water with low populations of early instar larvae (collectively referred to below as clean water situations). The VectoBac 12 AS (but not Teknar HP-D) label also recommend increasing the range from 16 to 32 liquid oz/acre when late 3rd or early 4th instar larvae predominate, larval populations are high, water is heavily polluted, and/or algae are abundant. The recommendation to increase dosages in these instances (collectively referred below as dirty water situations) also is seen in various combinations on the labels for all other B.t.i. formulations discussed below.

B.t.i. liquid may also be "Duplexed" with the Altosid Liquid Larvicide discussed above. Because B.t.i. is a stomach toxin and lethal dosages are somewhat proportional to a mosquito larvae's body size, earlier instar need to eat fewer toxic crystals to be adversely affected. Combining B.t.i. with methoprene (which is most effective when larvae are the oldest and largest) allows a District to use less of each product than they normally would if they would use one or the other. Financially, most savings are realized for treatments of mosquitoes with long larval development periods, asynchronous broods or areas with multiple species of mosquitoes.

BTI POWDERS: VectoBac TP and Bactimos WP brands of B.t.i. powders are available. The VectoBac TP label recommends using a calculated 3.2 to 6.4 oz (by weight)/acre in clean water, and up to 12.8 oz/acre in dirty water situations. The Bactimos WP label correspondingly recommends using two to 6 oz/acre and up to 12 oz/acre.

BTI SAND GRANULES: Until the latter part of 1996, commercial formulations of B.t.i. sand granules were not available. However, labeling was available for both VectoBac and Bactimos B.t.i. powders to guide end users in making their own "On Site Sand Granules". Sand formulations require coating the particles with oil, such as GB-1111, and then applying dry B.t.i. powder, which will stick to the oil. In California, most target mosquito species graze the water surface or within the water column, and not the bottom. It is desirable to stick the powder to the sand in a way that B.t.i. is released upon contact with the water, and is thus available for the larvae.

BTI CORNCOB GRANULES: Granular formulations use a carrier that is dense enough to penetrate heavy vegetation. There are currently two popular corncob granule sizes used in commercial formulations. VectoBac G are made with 5/8 grit-crushed cob, while VectoBac CG are made with 10/14-grit cob. The 5/8 grit is much larger and contains fewer granules per pound. The current labels of all B.t.i. granules recommend using 2.5 to 10 lb./acre in clean water and 10 to 20 IbVacre in dirty water situations.

BTI PELLETS. Bactimos Pellets is the only extruded B.t.i. product on the market today. They are manufactured using a larval food as the B.t.i. carrier, and the manufacturer claims that this helps attract feeding larvae. The Pellets contain twice the amount of toxic units as Bactimos (corncob) Granules, and the label correspondingly recommends using only half as much by weight in both clean water and dirty water situations.

BTI BRIQUETS (donuts): B.t.i. donuts are a sole source product manufactured by Summit Chemical Company under a Bactimos B.t.i. subregistration. They are a mixture of B.t.i., additives, and cork. They are designed to float and slowly release B.t.i. particles for up to 30 days. They apparently are attractive to raccoons and possibly other wildlife because of their odor, and may sometimes be disturbed or carried off. Donuts may be staked in place to prevent wind from moving them from a littoral zone of a site into open water. The use rate is one donut per 100 square feet in clean water and up to four donuts per 100 square feet in dirty water. Many districts have not found this practical in most larval sites due to their expense and the possibility of them being moved by wind or animals. Homeowners, however, may find practical uses for these in ornamental ponds or other very small habitats.

TARGET SPECIES B.t.i. adversely affects larval stages of insect species in the Order Diptera, Suborder Nematocera, Families Culicidae (Mosquitoes) and Simuliidae (Black Flies). B.t.i. has been shown effective for numerous mosquito species, including members of the mosquito genera *Aedes, Anopheles, Culex, and Culiseta*, commonly targeted in California.

Products containing B.t.i. are ideally suited for use in integrated pest management programs because the active ingredient does not interrupt activities of most beneficial insects and predators. Since B.t.i. has a highly specific mode of action, it is an insecticide of minimal environmental concern. B.t.i. controls all larval instars provided they have not quit feeding, and can be used in almost any aquatic habitat without restrictions. It may be applied to irrigation water and any other water sites except treated finished drinking water. B.t.i. is fast acting and its efficacy can be evaluated almost immediately. It usually kills larvae within 1 hour after ingestion, and since each instar must eat in orderfor the larvae to grow that means B.t.i. usually kills mosquito larvae within 24 hours of application. It leaves no residues, and it is quickly biodegraded. Resistance is unlikely to develop simultaneously to the five different toxins derived from the B.t.i. delta-endotoxin since they have five different modes of action. This suggests that this mosquito larvicide will continue to be effective for many years. B.t.i. labels carry the CAUTION signal word, suggesting the material may be harmful if inhaled or absorbed through the skin. However, the 4-hr inhalation LC 50 in rats is calculated to be greater than 2.1 mg/liter (actual) of air, the maximum attainable concentration. The acute dermal LD 50 in rabbits is greater than 2,000-mg/kg-body weight and is considered non-irritating to the eye or skin. That is equivalent to a 220 Ib. individual spilling more than a half gallon of B.t.i. liquid onto himself or into his eyes. Toxicology profiles also suggest that the inert ingredients (not the B.t.i.) in liquid formulations may cause minor eye irritations in humans. The acute oral LD 50 in rats is greater than 5,000 mg/kg body weight (similar to an individual drinking over 5 quarts) suggesting the material is practically non-toxic in single doses. Common table salt has a LD 50 of 4,000 mg/kg of body weight. B.t.i. applied at label rates has virtually no adverse effects on applicators, livestock, or wildlife including beneficial insects, annelid worms, flatworms, crustaceans, mollusks, fish, amphibians, reptiles, birds or mammals. However, non-target activity on larvae of insect species normally associated with mosquito larvae in aquatic habitats has been observed. There have reported impacts in larvae in the order Diptera, suborder Nematocera, families Chironomidae (midges), Ceratopogonidae (biting midges) and Dixidae (dixid midges). These non-target insect species, taxonomically closely related to mosquitoes and black flies, apparently contain the necessary gut pH and enzymes to activate delta-endotoxin. However, the concentration of B.t.i. required to cause these effects is 10 to 1,000 times higher than normal use rates. Further, studies report these impacts are short-lived, with the population of these species rebounding quickly. Concerning the operational use of B.t.i., timing of application is extremely important.

5.6.4.2 *Bacillus sphaericus* (Bs) - Introduction: *Bacillus sphaericus* is a commonly occurring spore-forming bacterium found throughout the world in soil and aquatic environments. Some strains produce a protein endotoxin at the time of sporulation. It is grown in fermentation vats and formulated for end use with processes similar to that of B.t.i. A standard bioassay similar to that used for B.t.i. has been developed to determine preparation potencies. The bioassay uses *Culex quinquefasciatus* 3rd-4th instar larvae. The endotoxin destroys the insect's gut in a way similar to B.t.i. and has been shown to have activity against larvae of the genus *Culex, Culiseta,* and *Anopheles*. The toxin is only active against the feeding larval stages and must be partially digested before it becomes activated. At present, the molecular action of *B. sphaericus* is unknown. Isolation and identification of the primary toxin responsible for larval activity has demonstrated that it is a protein with a molecular weight of 43 to 55 kD.

VECTOLEX CG: VectoLex CG is the trade name for Abbott Laboratories' granular formulation of *B. sphaericus* (strain 2362). The product has a potency of 50 BSITU/mg (*Bacillus sphaericus* International Units/mg) and is formulated on a 10/14-mesh ground corncob carrier. The VectoLex CG label carries the "CAUTION" hazard classification.

DOSAGES: VectoLex CG is intended for use in mosquito breading sites that are polluted or highly organic in nature, such as dairy waste lagoons, sewage lagoons, septic ditches, tires, and storm sewer catch basins. VectoLex CG is designed to be applied by ground (by hand or truck-mounted blower) or by air at rates of 5-10 Ibs/acre. Best results are obtained when applications are made to larvae in the 1st to 3rd instar. Use of the highest rate is recommended for dense larval populations. Larval mortality may be observed as soon as a few hours after ingestion but typically takes as long as 2-3 days, depending upon dosage and ambient temperature. VectoLex G should be stored in a cool, dry place, in an intact product package. The product can absorb moisture once the package is opened, leading to loss of activity over time. Refrigeration is not necessary.

TARGET SPECIES: *B. sphaericus* is efficacious against larval stage mosquitoes. *Culex* species are the most sensitive to *Bacillus sphaericus*, followed by *Anopheles* and some *Aedes* species. In California, *Culex* spp. and *Anopheles* spp. may be effectively controlled. Several species of *Aedes* have shown little or no susceptibility, and salt marsh *Aedes* species are not susceptible. *Bacillus sphaericus*, in contrast to B.t.i., is virtually non-toxic to blackflies (Simuliidae).

B. sphaericus has demonstrated the unique property of being able to control mosquito larvae in highly organic aquatic environments, including sewage waste lagoons, animal waste ponds, and septic ditches. After a single application at labeled rates, field evaluations have shown VectoLex CG to persist for 2-4 weeks. Field evaluations with VectoLex CG have shown that *Bacillus sphaericus* may undergo limited recycling in certain organically rich environments.

VectoLex CG has been extensively tested and has had no adverse effects on mammals or non-target organisms. *B. sphaericus* technical material was not infective or pathogenic when administered as a single oral, intravenous or intratracheal installation in rats. No mortality or treatment-related evidence of toxicological effects was observed. The acute oral and dermal LD 50 values are greater than 5000 mg/kg and greater than 2000 mg/kg, respectively. The technical material is moderately irritating to the skin and eye. Oral exposure of *B. sphaericus* is practically nontoxic to mallard ducks. No mortality or signs of toxicity occurred following a 9000 mg/kg oral treatment. Birds fed diets containing 20% w/w of the technical material experienced no apparent pathogenic or toxic effects during a 30-day treatment period. Mallards given an intraperitoneal injection of *B. sphaericus* demonstrated toxicological effects including hypoactivity, tremors, ataxia and emaciation. The LD 50 value was greater than 1.5 mg/kg.

Acute aquatic fresh water fish toxicity tests were done on bluegill sunfish, rainbow trout and daphnids. The 96 hour LC 50 and NOEC value for bluegill sunfish and rainbow trout was greater than 15.5 mg/liter; the 48 hour EC 50 and NOEC value for daphnids was greater than 15.5 mg/liter. Acute aquatic saltwater fish toxicity tests were done on sheep head minnows, shrimp and oysters. The 96 hour LC 50 value for both sheep head minnows and shrimp was 71 mg/liter, while the NOEC (no observable effect concentration) value was 22 mg/liter for sheep head minnows and 50 mg/liter for shrimp. The 96-hour EC 50 value for oysters was 42 mg/liter with a NOEC of 15 mg/liter.

Invertebrate toxicity tests were done on mayfly larvae and honeybees. The LC 50 and NOEC value for mayfly larvae was 15.5 mg/liter. Honeybees exposed to I0E4-10E8 spores/ml for up to 28 days demonstrated no significant decrease in survival when compared to controls. Acute toxicity of *B. sphaericus* to non-target plants was evaluated in green algae. The 120-hour EC 50 and NOEC values were greater than 212 mg/liter.

Bacillus sphaericus will not regenerate in salt water, rendering its use impractical for control of salt-water mosquitoes. Cycling is limited to permanent fresh water bodies, and if organic content is very high, recycling may be minimal.

5.6.5 Larviciding Techniques and Equipment: A variety of larviciding equipment is used for both aerial and ground applications, necessitated by the wide range of developmental habitats, target species, and budgetary constraints. There are advantages and disadvantages to each application system and to the aerial and ground treatments themselves.

5.6.5.1 Ground Application Equipment: Most Districts use some type of 4-wheel drive equipment as a primary larvicide vehicle. A chemical container tank, high pressure, low volume electric or gas pump, and spray nozzle are mounted in the back of the bed, with a switch and extension hose allowing the driver to operate the equipment and apply the larvicide from the truck's cab. Additional equipment used in ground applications includes hand held sprayers and backpack blowers. Hand held sprayers (hand cans) are standard one or two gallon garden style pump-up sprayers used to treat small isolated areas. Backpack sprayers are gas powered blowers with a chemical tank and calibrated proportioning slot. Generally a pellet or small granular material is applied with a backpack sprayer or "belly grinder" machine designed to distribute pellets or granules.

5.6.5.2 Aerial larviciding equipment: Aerial larviciding is accomplished via fixed wing or rotary aircraft. Both types of aircraft can apply solids and liquids. A variety of nozzles and metering systems can be adapted depending upon target configuration and size. Many districts use aerial larviciding due to the large developmental areas that require treatment, such as rice fields or wetlands. Some districts have there own aircraft, while other districts contract with agricultural flying services to perform the actual application.

Dependent upon target conditions, liquid or granular applications are used. Granular applications can either be sand, a pellet or a corncob granule supplied by a manufacturer. In some instances, agencies can formulate their own granular materials (e.g., sand mixes). Most granular formulations are applied at 6 to 15 pounds per acre. While granules have less drift and can penetrate vegetative cover, they are generally bulky (e.g., corncob), heavy (e.g., sand) and usually expensive, especially when purchasing pre-mixed material.

With liquid applications, there is still some debate over the ideal droplet size and carrier. Using small droplets or ULV will allow greater payloads and thus be more economical, but the amount of material actually reaching the target area is poorly understood. Wind, temperature, evaporation and droplet movement has a major impact on success or failure of a ULV application. Using large droplets eliminates some of the drift problems of ULV applications but greatly reduces the payload. In addition, it is still not known whether large or small droplets actually have the better penetrating characteristics. Since this is still be researched, there may be differences among districts and the technique used.

In treating the various species of mosquitoes in California, getting complete coverage of the developmental area is critical. Missing just a tiny fraction of the target area can still result in the emergence of huge numbers of biting adults. While many pilots claim they can fly accurate swaths based on their skill alone, experience has shown that this rarely happens. For that reason, some type of guidance system is preferred when performing aerial larviciding over large areas.

5.6.6 Discussion:

ADVANTAGES OF GROUND APPLICATION: There are several advantages of using ground application equipment, both when on foot and when conveyed by vehicles. Ground larviciding allows applications while in close proximity to the actual treatment area and consequently treatments to only those microhabitats where larvae are present. This also reduces both the unnecessary pesticide loads on the environment and the financial cost of it. Both the initial and the maintenance costs of ground equipment are generally less than those for aerial equipment are. Ground larviciding applications are less affected by weather conditions than are aerial applications.

DISADVANTAGES OF GROUND APPLICATION: Ground larviciding is impractical for large or densely wooded areas. There is also a greater risk of chemical exposure to applicators than there is during aerial larviciding operations. Damage may occur from the use of a ground vehicle in some areas. Ruts and vegetation damage may occur, although both these conditions are reversible and generally short-lived. Technicians are trained to recognize sensitive areas and to use good judgment to avoid significant impacts.

ADVANTAGES OF AERIAL APPLICATION: There are several advantages to using both fixed wing and rotary aerial application equipment. It is more economical for large application areas provided the entire site has mosquito development. It is easier to calibrate equipment and operators because the target area is generally mapped and the material is weighed or measured when loading. It is more practical for remote or inaccessible areas such as islands and marshes than is ground larviciding. It may avoid nontarget impacts by reducing physical crushing of sensitive habitats caused by walking or driving a vehicle.

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DISADVANTAGES OF AERIAL APPLICATION: It is generally more expensive than a ground application. To ensure accuracy in hitting the target, either additional manpower for flagging or expensive electronic guidance systems are needed. Application windows can be narrow due to weather conditions. Aerial applications require special FAA licenses, training of staff, and additional liability insurance.

CHOOSING WHEN TO LARVICIDE: The District's general view is that larviciding is typically not as effective or as economical as permanent source reduction or water management, and is usually more effective than adulticiding. When looking at developmental sites and their mosquito production on a case by case basis, this logic appears infallible. However, this view was derived long ago when wetlands were not considered to be as important as they are today, many of the compounds used were different, and costs were in terms of money, manpower, and equipment. It was easy to assume that it was "cheaper in the long run" to move dirt and change the hydrology of an area than it was to apply pesticides. Many districts are being forced to use chemical methods to control mosquitoes in areas where water management is not used or is prohibited.

MANAGING LARVICIDE RESISTANCE: Selecting the proper class of larvicide and the formulation are both important in pesticide resistance management.

One way to encourage resistance is to use sub-lethal dosages. Insects with inherent tolerances for weakly applied pesticides may survive to produce tolerant offspring. Soon, an entire population of tolerant mosquitoes may arise, and then continued use of the very low dose that caused the problem will affect only nontargets. Another way to accomplish the same thing is to depend on slow-release formulations beyond their recommended use period. Release rate studies have shown that the active ingredient are not available "linearly", and that beyond the recommended time limits, they may be sublethal. Districts acknowledge these issues, and take measures to rotate pesticides used on larval sites to avoid this situation.

Currently used mosquito larvicides, when applied properly, are efficacious and environmentally safe. These agents have been successfully integrated into District programs. Compared to the adulticides, there is less concern for the drift of mosquito larvicides, primarily due to application techniques. Mosquito larvicides are usually applied directly into natural and man-made aquatic habitats as liquid or solid formulations, and aerial drift is negligible. Drift in water can result from flushing or rainwater runoff. Under these conditions, dilution greatly reduces the pesticide concentration and consequently reduces exposure to non-targets.

5.7 Analysis of CEQA Exemptions: CEQA categorical exemption classes 7 and 8 (CEQA Guidelines sections 15307 & 15309) exempt actions taken by regulatory agencies as authorized by state law to assure the maintenance, restoration, enhancement or protection of a natural resource or the environment where the regulatory process involves procedures for the protection of the environment. As discussed in section 3 regarding biological control, the District qualifies as a "regulatory agency" under these exemptions.

The remaining issues as applied to chemical control therefore are whether the District's chemical control activities as described above assure the maintenance, restoration, enhancement or protection of a natural resource or the environment, and whether the District's regulatory process involve procedures for the protection of the environment.

The District's chemical control activities as described above assure the maintenance and protection of natural resources and the environment.

The use of pesticides is an effective means to control mosquito populations in the District. The use of larvicides maintains and limits the proliferation of mosquito larvae in aquatic habitats, while adulticiding maintains the terrestrial environment free of harmful levels of mosquitoes. This control method maintains and protects the environment in a condition more safe, healthful and comfortable for humans. The District contains many sources that act as mosquito developmental areas near populated areas. Substantial mosquito activity would significantly and adversely affect the human environment without ongoing and effective vector control. The District's mosquito control program, including chemical control, is essential to maintain the vectors in the environment at a tolerable level. The District's program will never eradicate all mosquitoes. Rather, it is a resource maintenance program aimed at striking a balance to allow comfortable and healthful human existence within the natural environment, while protecting and maintaining the environment. History has shown us that the control and abatement of vectors are necessary for our human environment to continue to be habitable.

The District's regulatory process involves procedures for the protection of the environment.

In addition to the environmental protection measures and procedures inherent in the District's IPM program as discussed in section 3, there are other practices unique to the District's chemical control program that protect the environment:

There are numerous federal and state laws and regulations that strictly control and regulate the storage, transport, handling, use and disposal of the pesticides in order to protect against surface and groundwater contamination and other impacts to the environment and public health, (e.g., Federal Insecticide, Fungicide and Rodenticide Act; Cal. Food & Agric. Code divisions 6 & 7; Cal. Code of Regs, title 3, division 6.) The District and its staff consistently comply with these laws and regulations.

The District uses only pesticides registered by the U.S. Environmental Protection Agency and California Department of Pesticide Regulation. The District then strictly complies with the pesticide label restrictions and requirements concerning the storage, transport, handling, use and disposal of the pesticides.

Consistent with the District's integrated pest management principles, when using pesticides, the District selects the least hazardous material that will meet its goals and the District rarely uses restricted-use pesticides.

Only duly certified and trained vector control technicians apply pesticides. The training includes education on appropriate practices to avoid environmental impacts and assure compliance with regulatory requirements.

The District regularly calibrates its pesticide application equipment to ensure that it emits the proper quantities of material.

6 RODENT PROGRAM

6.1 Introduction: The district has a program to assist residents in resolving issues with domestic rodents infesting their homes. Rodents cause nuisance, sanitation and potentially, disease transmission to residents and their pets. The district provides a service to inspect conditions around homes and provides homeowners a checklist of items and educational material so they may address to exclude and better manage rodent problems.

6.2 Rodent species: Rodent species causing nuisance issues to residents are primarily roof rats (*Rattus rattus*) and less frequently, Norway rats (*Rattus norvegicus*). Sylvatic rodents, such as deer mice (*Peromyscus* sp), woodrats (*Neotoma fuscipes*) and ground squirrels (*Spermophilus beecheyi*) may also cause nuisance to residents living in habitats supporting their survival.

6.3 Site inspection: District technicians provide onsite inspections at residences to review conditions promoting harborage and signs of rodent infestation. The perimeter of home is traveled by foot to view all known issues such as vegetation, fruiting trees, presence of pet food or bird/squirrel feeding as well as access points into the house such as broken vent screens and other openings. Recommendations are provided to the homeowners on how to rodent-proof their homes, and reduce available forage and harborage sites to rodents.

6.4 Rodent baiting: The district occasionally conducts rodent baiting in locations requiring our assistance. Typically these are underground sites, such as sewers, storm drains or catch basins. Secure bait stations or other accepted methods of rodent baiting are conducted in areas where severe rodent infestations are evident.

6.5 Analysis of CEQA Exemptions: The District's rodent control activity using rodenticides are one part of an ongoing Vector Surveillance and Control Project. CEQA categorical exemption classes 7 and 8 (CEQA Guidelines sections 15307 & 15308) exempt actions taken by regulatory agencies as authorized by state law to assure the maintenance, restoration, enhancement or protection of a natural resource or the environment where the regulatory process involves procedures for the protection of the environment. In order for this exemption to apply, the following elements must be satisfied: "The District must be a "regulatory agency" authorized by state law to assure the maintenance, restoration, enhancement or protection of a natural resource or the environment. The District is also under statutory exemption for emergency projects to control vectors which present imminent danger to the health and comfort of the residents of the District.

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7 DISEASE SURVEILLANCE

7.1 Introduction: The district has a vector-borne disease surveillance program that routinely assesses presence of specific pathogens in arthropods, mammals, birds and other host species in order to determine degree of risk to the public. Part of this program is based upon sampling host species such as ticks, mosquitoes, birds, rodents and other host species and analysis of samples either in-house or via outside diagnostic laboratories.

7.2 Disease surveillance sampling: Sampling strategy is based upon the targeted organism. Sampling techniques vary widely but in general attempt to provide information on the density and relative abundance of the vector species as well as the infection/infestation rate of the pathogen or causative agent of disease. Since the mission of the program is to assess risk to humans, attempts are made to sample from areas or environs where people may be risk the greatest exposure or be at greatest risk of transmission.

7.2.1 Ticks Surveillance: Ticks are collected by "flagging" vegetation along trails. The stiff fabric flagging material is dragged for specified distances along the trails to stimulate ticks to "quest" onto the material and from which they are manually removed and placed in vials for transport back to the laboratory. Ticks may be tested for lyme disease, ehrlichia, bartonella, relapsing fever or rocky mountain spotted fever.

7.2.2 Hantavirus Surveillance: Hantavirus surveillance is conducted by placing small box traps (Havahart) traps in suspect areas including peridomestic habitats along the urban fringe or rural areas. The traps are always checked on the subsequent morning to remove any rodents for sampling. Rodents are euthanized and bled. Blood samples are submitted for testing.
iii. Plague surveillance. Plague is sampled from ground squirrel fleas, ground squirrels or other sylvatic rodents suspected of playing a role in transmitting this disease. Ground squirrels are sampled by trapping using larger open wire box traps. Prebaiting of traps for several days prior to actual trapping allows squirrels to acclimate to the traps; on the day of trapping, traps are baited, set and surveyed for trapped squirrels that are retrieved for sampling. Blood samples are sent to the California Department of Health Services, Vector-Borne Disease Section for testing.

7.2.3 Tularemia surveillance: This disease may be sampled from ground squirrels, ticks, and other blood-feeding arthropods. Trapping for squirrels described for plague and tick sampling is also described above.

7.2.4 Analysis of CEQA Exemptions: CEQA categorical exemption classes 6 and 9 (CEQA Guidelines sections 15306 & 15309) exempt "basic data collection, research, experimental management, and resource evaluation activities which do not result in a serious or major disturbance to an environmental resource," and "activities limited entirely to inspections, to check for performance of an operation, or quality, health, or safety of a project."

8 WILDLIFE MANAGEMENT

8.1 Introduction: The Wildlife Program assists residents in resolving conflicts with urban wildlife such as raccoon, skunk and opossum. The program is largely based on education and District outreach through home and yard evaluations to provide residents information and recommendations to minimize human/wildlife interaction. In some rare cases where wildlife has taken refuge within homes and outbuildings and is causing property damage or constituting a health or safety risk, the Urban Wildlife Program attempts to assist residents in removing the animal(s) typically by means of trapping. Current protocol is to have Santa Clara County Animal Control pick up the animal for disposition. The intention of the District's Urban Wildlife Program is to assist in the control of human/wildlife interactions when it may result in a health or safety risk.

The program is not intended to control or significantly reduce the wildlife population.

8.2 Analysis of CEQA Exemptions: The District's physical control activities, trapping, constitute a discrete site-specific project. Physical control activities conducted by Mosquito and Vector Control Districts are generally exempt from further CEQA requirements under the class 1, 4, 7, and 8 categorical exemptions, and under statutory exemptions for emergency projects to control vectors which present imminent danger to the health and comfort of the residents of the District. The District's Urban Wildlife Program education and outreach does not cause a significant effect on the environment, and does not meet the State CEQA guidelines definition of a "Project" and is therefore exempt from CEQA.

9 EDUCATION AND OUTREACH

9.1 Introduction: The primary goal of the District's activities is to prevent vectors from reaching public nuisance or disease thresholds by managing their habitat while protecting habitat values for their predators and other beneficial organisms. Vector prevention is accomplished through public education, including site-specific recommendations on water and land use, and by physical control.

The District's education program teaches the public how to recognize, prevent, and suppress vector breeding and harborage on their property. This part of the project is accomplished through the distribution of brochures, fact sheets, news letters, participation in local fairs and events, presentation to community organizations, contact with technicians in response to service requests, and public service announcements and news releases. Public education also includes a school program to teach future adults to be responsible by eliminating vector breeding sources, and educate their parents or guardians about District services and how they can reduce vector-human interactions.

9.2 Analysis of CEQA Exemptions: Because the education components of the District's Programs do not have the potential for causing a significant effect on the environment, it does not meet the state CEQA guidelines definition of a "Project" and is therefore exempt from CEQA. Furthermore, class 22 categorical exemptions covers the adoption, alteration, or termination of educational or training programs which involve no physical alteration in the area affected or which involve physical changes only in the interior of existing schools or training structures. Therefore the District's educational activities are exempt under the class 22 categorical exemption.

10 DISTRICT FUNDING, PLANNING, AND ADMINISTRATION

The District is funded through benefit assessments levied on all non-exempt parcels. No District funding mechanism or activity meets the State CEQA Guidelines definition of a "project" and therefore, CEQA is not applicable to these activities. Furthermore, CEQA does not apply to the establishment, modification, structuring, restructuring, or approval of rates, tolls, fares, and other charges by public agencies which the public agency finds are for the purpose of meeting operating expenses, purchasing or leasing supplies, equipment, or materials, meeting financial reserve needs and requirements, and obtaining funds for capital projects. Therefore, funding of District programs is statutorily exempt.

Planning and routine administrative activities by the District or its Board are also either "non-projects" or are otherwise statutorily exempt from further review.

11 STATUTORY EXEMPTION - EMERGENCY ACTIONS:

Emergency projects are actions taken due to a sudden, unexpected occurrence involving a clear and imminent danger, to prevent or mitigate loss of or damage to life, health, property, or essential public services [Public Resources Code Secs. 21080(b)(2), (3), (4), 21060.3; Guidelines Secs. 15269, 15359]. Emergency projects can include actions required to prevent or mitigate an emergency [Guidelines Sec. 15269(c)]. CEQA does not require a formal declaration of an emergency to invoke this exemption. Emergency projects conducted by the District may include the control of animals including, but not limited to, mosquitoes, rats, skunks, fleas, mice, ground squirrels, and other animals, in response to known disease activity.

12 CONCLUSION:

After thorough review of all District programs and services the Santa Clara County Vector Control District has determined that under Title 14, California Code of Regulations, Chapter 3, Guidelines for Implementation of the California Environmental Quality Act, Article 19 "Categorical Exemptions, Sections 15300 to 15333, Classes 1, 4, 6, 7, 8, 9, and 22" and "Statutory Exemption for public health emergencies, Public Resources Code Secs. 21080(b)(2), (3), (4), 21060.3; Guidelines Secs. 15269, 15359" that the District's programs and services are exempt from CEQA.

Appendix A: Explanation of Categorical and Statutory Exemptions relating to CEQA Determination

Explanation of Categorical and Statutory Exemptions relating to CEQA Determination

This Appendix A is a summary of Santa Clara County Vector Control District Program areas and their respective categorical and statutory exemptions as found in California Environmental Quality Act (CEQA) Article 19 Section 15300 to 15333 and Public Resources Code Secs. 21080(b)(2), (3), (4), 21060.3; Guidelines Secs. 15269, 15359

The District is a regulatory agency authorized by Health and Safety Code Section 2000 et seq. to conduct effective programs for the surveillance, prevention, abatement and control of mosquitoes and other vectors. This District is one of many local, state and federal regulatory agencies involved in the maintenance restoration, enhancement or protection of a natural resource or the environment. Its activities are undertaken in coordination with other agencies and pursuant to a framework of federal and state regulation.

Mosquito Program	Categorical Exemption Class
Surveillance	6 and 9
Biological Control	7 and 8
Physical Control	1 and 4
Chemical Control	7 and 8
Rodent Program	7 and 8
Urban Wildlife Program	1, 4, 7 and 8
Disease Surveillance	6 and 9
Education/Outreach	22
Public Health Emergencies	Statutory Exemption Public Resources Sections 21080(b)(2)(3)(4), CEQA Guidelines Section 15269

Categorical Exemptions

Categorical exemptions are exemptions from CEQA for a class of projects based on a finding by the Secretary of Resources that the class of projects does not have a significant effect on the environment, except in exceptional circumstances. Categorical exemptions which apply to actions of the District include existing facilities (class 1), minor alterations to land (class 4), information collection (class 6), actions by regulatory agencies for protection of natural resources (class 7), actions by regulatory agencies for protection of the environment (class 8), inspections (class 9) and educational or training programs involving no physical changes (class 22).

Class 1 consists of the operation, repair, maintenance, or minor alteration of existing public or private structures, facilities, mechanical equipment, or topographical features, involving negligible or no expansion of use beyond that previously existing. District activities which are within the scope of this exemption include operation, repair, maintenance, or minor alteration of existing District facilities; public facilities, such as existing drainage works or sewer treatment facilities; and private facilities, such as ornamental fish ponds swimming pools, agricultural waste water ponds; and maintenance of existing landscaping, native growth, and water supply reservoirs.

Class 4 consists of minor public or private alterations in the condition of land, water, and/or vegetation which do not involve removal of mature, scenic trees. District activities which are within the scope of this exemption include new landscaping at District facilities, removal of minor vegetation or sediment in creeks and other natural channels, agricultural irrigation and drainage ditches, other ditches and flood control channels, storm water retention basins, waste water ponds, spreading grounds, and other environments to assist in water flow which prevents breeding of mosquitoes; and removal of minor vegetation to access vector breeding sources or to reduce production of rats and other vertebrate pests.

Class 6 consists of basic data collection, research, experimental management, and resource evaluation activities which do not result in a serious or major disturbance to an environmental resource. District activities which are within the scope of this exemption include collection of animals, such as mosquitoes, skunks, wild birds, fleas, ticks, rats, mice, ground squirrels, etc., for vector borne disease surveillance; placement of sentinel chicken flocks for mosquito-borne disease surveillance; collection of other insects, such as mosquitoes and mosquito predators to determine population density; and most other research activities undertaken by the District.

Class 7 consists of actions taken by regulatory agencies as authorized by state law or local ordinance to assure the maintenance, restoration, or enhancement of a natural resource where the regulatory process involves procedures for protection of the environment. Because District practices involve detailed procedures for protection of the environment, District activities within the scope of this exemption include all vector surveillance and control activities in areas of natural resources, such as jurisdictional wetlands.

Class 8 consists of actions taken by regulatory agencies, as authorized by state or local ordinance, to assure the maintenance, restoration, enhancement, or protection of the environment where the regulatory process involves procedures for protection of the environment. Because District practices involve detailed procedures for protection of the environment, District activities within the scope of this exemption include all vector surveillance and control activities throughout the District.

Class 9 consists of activities limited entirely to inspections, to check for performance of an operation, or quality, health, or safety of a project. District activities within the scope of this exemption include inspections for the presence of vectors throughout the District, and other activities to determine the efficacy of specific control operations.

Class 22 consists of the adoption, alteration, or termination of educational or training programs which involve no physical alteration in the area affected or which involve physical changes only in the interior of existing school or training structures. District activities which are within the scope of this exemption include the District's public education program which includes newsletters, exhibits at city and other local fairs and special events, elementary education program available to public and private schools, and public speaking engagements. In addition, staff training, as required by the California Occupational Safety and Health Administration, California Department of Food and Agriculture, California Environmental Protection Agency Department of Pesticide Regulations, and the California Department of Health Services, is exempt under this class.

Statutory Exemption

Emergency projects are actions taken due to a sudden, unexpected occurrence involving a clear and imminent danger, to prevent or mitigate loss of or damage to life, health, property, or essential public services [Public Resources Code Secs. 21080(b)(2), (3), (4), 21060.3; Guidelines Secs. 15269, 15359]. Emergency projects can include actions required to prevent or mitigate an emergency [Guidelines Sec. 15269(c)]. In the event of an emergency, emergency projects conducted by the District may include the control of animals including, but not limited to, mosquitoes, rats, skunks, fleas, mice, ground squirrels, and other animals, in response to known disease activity.