From: Conlon Joseph
To: Jennings, Jonathan (ECY);
Subject: AMCA Comments To Proposed NPDES Permit
Date: Saturday, March 06, 2010 3:03:39 AM
Attachments: WashingtonPermit.doc
ATT1029271.htm
AMCA Comments.doc
ATT1029272.htm
BMPs for Mosquito Management.doc
ATT1029273.htm

Mr. Jennings,

The American Mosquito Control Association is please to provide comments on the subject draft permit.

There are three attachments to this missive:
1. Cover letter
2. Comments
3. AMCA Document, *Best Management Practices For Integrated Mosquito Management*

It is hoped that these might prove beneficial to your deliberations.

AMCA
THE AMERICAN MOSQUITO CONTROL ASSOCIATION

Individuals enhancing the health and quality of life through the suppression of mosquitoes, other vectors and pests of public health importance.

A Partner in the EPA's Pesticide Environmental Stewardship Program

AMERICAN MOSQUITO CONTROL ASSOCIATION
FOUNDED 1935

March 6, 2010

Comments

WASHINGTON STATE: AQUATIC MOSQUITO CONTROL NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM STATE WASTE DISCHARGE GENERAL PERMIT

1. Problem: S3.B.2. Adulticides whose environmental risks are established and do not rise to an EPA level of concern are not afforded the same consideration as larvicides.

   Comment: AMCA applauds the allowance of larvicide applications despite the permit's acknowledgement of transitory water quality impact. It is unclear why this same level of deference is not given to adulticides whose environmental fates are also transitory as noted in the following references:

   Davis, R.S., R.K.D. Peterson, and P.A. Macedo. 2007. An ecological risk assessment for insecticides used in adult mosquito management. Integrated Environmental Assessment and Management 3: 373-382.

   NYCDOH (New York City Department of Health). 2005. Adult mosquito control programs: environmental impact statement (EIS). New York, NY, USA.

   Schleier III, J.J. 2008. Environmental concentrations, fate, and risk assessment of insecticides used for adult mosquito management, Montana State University, Bozeman, MT.

   Schleier III, J.J., R.K.D. Peterson, P.A. Macedo, and D.A. Brown. 2008. Environmental concentrations, fate, and risk assessment of pyrethrins and piperonyl butoxide after aerial ultralow-volume applications for adult mosquito management. Environmental Toxicology and Chemistry 27: 1063-1068.

   USEPA (U.S. Environmental Protection Agency). 2006b. Reregistration Eligibility Decision (RED) for Malathion. Case No. 0248. Washington D.C. 1-101.

2. Problem: S5A. "Adulticides and their residues used for nuisance mosquito control must not be discharged to waters of the state."

   Comment: The proscription against using adulticides in nuisance mosquito control is unfortunate. Annoyance caused by large numbers of biting mosquitoes can profoundly affect children and infants due to shear number of bites, outdoor recreational activities, tourism, and dairy and livestock production. In addition, many of these "nuisance" species serve as bridge vectors after amplification by ornithophyllic species. Their capacity to transmit virus to humans could be significantly reduced if the numbers of questing female mosquitoes were curtailed early in the season.

3. Problem: S5B2. "The vector mosquito control period, April 1 to October 31 of the same year, is the only time incidental discharge is authorized. The Permittee may request an extension of this period in writing from Ecology if natural population control (die-off) after October 31 is not expected."

   Comment: Given the vicissitudes of rainfall and temperatures that govern mosquito production, it would be exceedingly difficult to predict die-off in any particular season in order to provide enough lead time to draft a written extension request and receive an affirmative reply. The need to specify a vector control period in the permit is unclear. Response flexibility is key to effective vector-borne disease control. Our perception is that there is an inordinate amount of bureaucratic inertia built into overly conservative response algorithms that can allow viral amplification and transmission to occur while the chain of command sorts out responsibilities and the meaning of threat levels. This is not to promote control options unconnected to risk, but rather that those responsible for outbreak control be aware of the time-sensitive nature of vector-borne disease transmission.

   This provisions of this permit should recognize that public health officials may be conversant with the epidemiology of a great many diseases yet not fully understand the nuances of vector bionomics that affect effective and efficient control. Other officials may be, for whatever reason, inordinately pesticide-averse and be unwilling or unable to recognize the documented efficacy of vector control. This is within the professional purview of the Mosquito Control District.

   Problem: S5C. "The Permittee may only use Malathion and Naled in case of documented pyrethroid resistance development in a specific vector mosquito population."

   Comment: The permit does not list prallethrin or etofenprox as authorized adulticides, ostensibly because DoE has not conducted a full assessments of potential risks associated with these products. As a condition of their registration EPA has conducted such assessments and deemed them fully meeting environmental fate and effects criteria. It would seem prudent for DoE to provide some deference to EPA's expertise on these products so that availability of fully

registered adulticide products is not artificially and unjustifiably abridged.

Given the weight of evidence demonstrating deposition levels and environmental effects well below levels of concern in the malathion and naled risk assessments from EPA and other peer-reviewed studies noted above, AMCA finds the relegation of these products to resistance management status to be unjustified. Both malathion and naled are frontline adulticides widely used by vector control entities throughout the United States for the past 40 years without any notable impacts on the environment or human health when used according to label specifications. Particularly problematic is the provision that they are to be used only when pyrethroid resistance is demonstrated. In the development of pyrethroid resistance, far more insecticide load will have occurred in achieving adequate control than if malathion and naled had been utilized, where appropriate, in the first place.

4. Problem: S5B. "A Permittee that is an organized mosquito control district (chapter 17.28 RCW) may use adulticides to control vector mosquitoes provided it: conducts mosquito surveillance, mosquito disease testing, monitors other disease indicators (such as dead birds, equine disease cases, or human health cases) and follows available DOH vector control guidance (e.g. the West Nile Outbreak Response Plan where the trigger for adulticiding is Alert Level 3)."

   Comment: Confirmation of mosquito-borne disease via test results will take valuable time and may result in increased virus amplification in host avians, further spread via mosquitoes migrating into the jurisdiction from outlying areas, and transmission of mosquito-borne disease. Organized mosquito control districts are uniquely positioned, via their application of sustained integrated mosquito management programs, to determine when mosquito populations require control efforts.

5. Problem: S7. Monitoring requirements

   Comment: Monitoring requirements for both larvicides and adulticides are unspecified. It would seem prudent to require at least visual monitoring of adverse effects as is proposed by EPA in order to conform to the Clean Water Act provisions.

The AMCA understands that the FACT SHEET FOR THE AQUATIC MOSQUITO CONTROL NPDES GENERAL PERMIT will not be revised after DoE publishes the public notice. Nonetheless, this document provides the rationale for permitting requirements and must be accurate if the final permit language and conditions are to be fully valid. A number of problems in this document are of concern to us.

FACT SHEET FOR THE AQUATIC MOSQUITO CONTROL NPDES GENERAL PERMIT

1. Problem: Page 13 – "Of those cases, 12,088 were reported as meningitis/encephalitis, 16,765 were West Nile fever, and 771 were unspecified reports. 1161 mortalities due to the neuroinvasive form of WNV have been reported separately. For comparison, Centers for Disease Control and Prevention (CDC) lists seasonal influenza cases at 5-10% of the US population with 200,000 hospitalized and 36,000 mortalities from flu related issues annually."

   Comment: This appears to be included in the draft rather gratuitously to downplay the problem of West Nile Virus compared to influenza in terms of case numbers and outcomes. While this data is factually correct, it is irrelevant in the context of vector-borne disease control. Each one of the 1161 fatalities has a name, case history, and the anguish of families associated with it. In addition, each one could have been prevented through utilization of proper methods of reducing human/vector contact – one of which is adulticiding. Adulticiding is a method endorsed by both the CDC and EPA as a means to prevent disease transmission, but would not be allowed in the permit until either human disease or established zoonoses are documented. This effectively precludes prevention of disease spread by infective adult mosquitoes during intrinsic and extrinsic incubation periods until virus is isolated. In effect, humans are being used as sentinels along with mosquitoes and other viral hosts.

2. Problem: Page 13 – "Even if mosquitoes do not transmit disease when they bite mosquito bites can cause other effects such as irritation, redness, itching, pain, secondary infections and allergic reactions."

   "MCDs may also apply adulticides, but ordinarily only when adult populations become so large that they cause extreme annoyance to many people or when the threat of disease transmission to humans or economically important (horses or cattle) livestock is high."

   Comment: Despite this admission that mosquito bites in and of themselves can produce health issues, the Permit does not allow adulticiding as a means to preclude this health problem. Yet, in the second paragraph it mentions MCDs applying adulticides for nuisance control – expressly forbidden in the permit.

3. Problem: Page 13 – "Public agencies accomplish mosquito control in two ways, by using larvicides and adulticides."

   Comment: Integrated mosquito management (IMM) techniques used by MCDs utilize a great number of preventive/control strategies beyond larvicides and adulticides.

4. Problem: Page 14 – "IPM is an ecologically based strategy that relies heavily on natural mortality factors and seeks control tactics that are compatible with or disrupt the natural factors as little as possible."

   Comment: Integrated mosquito management (see attached document entitles Best Management Practices for Integrated Mosquito Management) does not rely heavily on natural mortality factors. The demonstrable failure of natural mortality factors is the reason mosquito problems exist in the first place. Indeed, IMM welcomes natural mortality factors, but augments them with various source reductions, use of biological control (mosquito fish, etc), repellents, larvicides and adulticides – all of which (even the biorational controls) are decidedly "unnatural", because they are introduced into the natural setting.

5. Problem: Page 19 – "The National Marine Fisheries Service (NMFS) completed a biological opinion on the effects of EPA~~"~~'s malathion re-registration decision to endangered Pacific Salmon in 2008. NMFS concluded that EPA re-registration of malathion would jeopardize the existence of 27 endangered populations and adversely modify critical habitat for 25 endangered pacific salmonids."

   Comment: It should be noted that EPA criticized the NMFS BIOP on a number of grounds, calling onto question its methodology, utilization of modeling parameters composed of illegal applications and misuses, lack of demonstrated adverse effects over 40 years of observation predicted by these faulty models, and a host of transparency issues regarding data acquisition.

6. Problem: Page 21 – "Pyrethroids are toxic to beneficial insects such as butterflies, moths, and bee~~"~~s. Insects of similar size (midges) may see an increase in mortality after pesticide application. Larger insects may also be affected. LD_{50} mortality is seen in *Apis ~~M~~mellifera* (the domestic honeybee) at an average of 0.08 micrograms(ug)/bee permethrin.(36,40) . EPA lists toxicity to bees from permethrin for dermal exposure at LD_{50} = 0.13 ug/bee and oral exposure at LD_{50} = 0.024 ug/bee.

   Comment: The data is true, but label specifications regarding timing of applications reduces potential exposures to these pesticides and reduces the risk below EPA levels of concern.

7. Problem: "Ecology must approve the use of Naled after consultation between Ecology, DOH, WDFW and WSDA in response to a public health emergency or pesticide resistance. This limits the amount and times that temephos may be

discharged to surface waters to only times when human health becomes a priority."

Comment: The term "Temephos" should be replaced with Naled. The amount of consultation called for would be extremely time-consuming and potentially delay essential vector-control measures. The consultation process is no doubt vital, but should be streamlined to eliminate unnecessary delays. Furthermore, the vector biology and control expertise of the local MCD is totally ignored in this scenario. The local MCD is in the best position to determine and evaluate mosquito populations densities and fluctuations in order to ascertain potential risk.

8. Problem: Page 32 – "The larvicide use conditions included in the 2010 Permit are largely unchanged from the permit issued in 2007. Ecology made one substantive change. Ecology removed the permit condition that authorized the use of new active ingredients not included in the issued permit for three reasons:

   Adding new active ingredients to an issued permit is a major modification of the permit conditions. Ecology must notify the public when it issues major modifications using a public involvement process (173-226-230 WAC).

   Since Ecology issued the first Permit in 2002, it has not added any active ingredients to the permit at the request of Permittees outside the permit development process. If Permittees request additional active ingredients after issuance of the 2010 Permit, they must request that Ecology re-open and modify the existing permit to include those active ingredients. Inclusion of new active ingredients will depend on Ecology's review of the literature available about the specific active ingredient.

   Ecology does not currently have the resources to review risk assessments outside of the permit development process."

   Comment: The addition of EPA registered larvicides to a permit, while a "major modification", should certainly not be discouraged or prohibited. The larvicides in question have already undergone environmental fate and effects risk assessment by the full resources of the Agency as a precondition of their registration. It seems counter-productive to discourage inclusion of newer tools that have been fully vetted by a national regulatory authority. For instance, spinosad, a newly registered larvicide derived from certain bacteria, is not on the list, but is a perfectly reasonable substitute for any of the larvicides mentioned in the permit. Additionally, etofenprox, a newly registered adulticide, is not mentioned in the permit. As a formulation not requiring the synergist piperonyl butoxide, etofenprox would be an ideal substitute for any of the pyrethroids recommended in the permit.

9. Problem: Page 33 – "Monitoring for adulticides is a difficult and costly task. Entities can monitor deposition of adulticides by using fiber pads placed in an

application area. Adulticide that falls out of the air column in the application area deposits on the pads, which the entity can then collect and analyze for the presence and concentration of adulticide. Monitoring of actual deposition to a water body is especially difficult where the water body is a river or stream (moving water). By the time the entity completes application the potentially polluted water has already moved down stream, mixing and diluting along the way. This makes any sample taken at an application site meaningless."

Comment: EPA is not requiring this level of monitoring in its general permit and it is unclear why DoE is requiring it. AMCA understands DoE's right to set more stringent standards than EPA, but it's not clear the rationale for monitoring deposition via GC/MS if there is no evidence of adverse impact. Furthermore, the dilution effects you mention would underscore this.

Best Management Practices
for
Integrated Mosquito Management

American Mosquito Control Association

December 2, 2009

OVERVIEW OF INTEGRATED MOSQUITO MANAGEMENT

Integrated Pest Management (IPM) was first conceived as a means of achieving sustained, effective control of agricultural pests through concomitant employment of a wide range of control methodologies. IPM has been in widespread usage for many years and its success as a general strategy has led to usage of the term to describe an increasing number of approaches to control strategies – often leading to misunderstanding of its actual conceptual framework. To clarify the concept in terms of its relationship to the unique nature of mosquito prevention/control methodologies, we use the term Integrated Mosquito Management (IMM) in lieu of IPM.

Integrated Mosquito Management is a comprehensive mosquito prevention/control strategy that utilizes all available mosquito control methods singly or in combination to exploit the known vulnerabilities of mosquitoes in order to reduce their numbers to tolerable levels while maintaining a quality environment. IMM does not emphasize mosquito elimination or eradication. Integrated mosquito management methods are specifically tailored to safely counter each stage of the mosquito life cycle. Prudent mosquito management practices for the control of immature mosquitoes (larvae and pupae) include such methods as the use of biological controls (native, noninvasive predators), source reduction (water or vegetation management or other compatible land management uses), water sanitation practices as well as the use of EPA-registered larvicides. When source elimination or larval control measures are not feasible or are clearly inadequate, or when faced with imminent mosquito-borne disease, application of EPA-registered adulticides by applicators trained in the special handling characteristics of these products may be needed. Adulticide products are chosen based upon their demonstrated efficacy against species targeted for control, resistance management concerns and minimization of potential environmental impact.

Full implementation of modern-day IMM entails significant expenditure of resources that may be beyond the capabilities of many mosquito control programs subject to significant budget constraints. IMM requires a thorough understanding of mosquitoes and their bionomics by control personnel; careful inspection and monitoring for their presence and conditions favoring their development; and prevention of oviposition and human/mosquito contact through effective public education, sanitation and facility maintenance. All mosquito control programs should strive to employ these IMM components to the extent possible, but resource availability may limit what any individual program can do.

In IMM programs, all intervention measures are driven by a demonstrated need based on surveillance data and action thresholds. Applying any mosquito control measure on a pre-determined schedule absent a documented need is not acceptable practice in any IMM program.

INTRODUCTION

Since the need for mosquito control was recognized as a critical component of public health initiatives in the early twentieth century, increased knowledge of mosquito biology has driven the formulation of a variety of methodologies designed to successfully reduce both mosquito nuisance levels and mosquito-borne disease transmission. As the technologies and knowledge base from which these methodologies were derived have matured, they have been increasingly seen as mostly complementary or synergistic in nature, providing optimal control as part of an overall strategy. This has ultimately evolved into a strategy termed Integrated Mosquito Management (IMM). IMM has been developed to encourage a balanced usage of cultural and insecticidal methodologies and habitat manipulations in order to maximize control while minimizing adverse environmental impacts. IMM is knowledge-based and surveillance-driven, and when properly practiced is specifically designed to accomplish the following:

1. Protect human, animal and environmental health.
2. Promote a rational use of pesticides.
3. Reduce environmental contamination to soil, ground water, surface water, pollinators, wildlife and endangered species as a result of mosquito control activities.
4. Utilize biological controls (native, noninvasive predators) to conserve and augment other control methods.
5. Utilize source reduction (elimination, removal or reduction of larval mosquito habitats) where practical and prudent.
6. Use target specific pesticides at the lowest effective rates to the extent possible.
7. Emphasize the proper timing of applications.
8. Minimize pesticide resistance problems.

The circumstances necessitating formation of a mosquito control program, however basic, are unique for each jurisdiction in terms of available resources, topography, hydrology, and the bionomics of the mosquito species to be controlled. For this reason, considerable judgment must be exercised in allocation of limited resources to extract the maximum benefit for both the citizenry and the environment. It must be emphasized that program funding and other extrinsic factors will dictate the extent to which individual programs can implement the Best Management Practices (BMPs) described herein.

To assist in this calculation, the following document will outline a series of BMP program elements that constitute a fully integrated approach to mosquito management. These BMPs should be viewed as minimums that should be performed in concert with any general or individual National Pollution Discharge Elimination System (NPDES) permits that might be issued for mosquito control activities falling within the scope of Clean Water Act (CWA) requirements.

The extent and manner to which control agencies meet or exceed these BMPs should be ultimately based on the best professional judgment of mosquito control program personnel, often undertaken in consultation with local health and government authorities in addition to resources available. It is important to emphasize that adherence to these BMPs to the maximum extent practicable is to be considered the necessary minimum to undertake or

perform for purposes of regulatory compliance with general or individual NPDES permits for mosquitocide use.

Best Management Practices for Mosquito Management

Best Management Practices (BMP) should form the fundamental approach to mosquito management for all mosquito control programs. It is acknowledged that individual agencies/entities charged with mosquito management responsibilities may not have the resources to practice all of the specific sub-elements discussed herein. Nevertheless, agencies should strive to adhere to these BMPs to the maximum extent practicable, given resource availability. Programs are encouraged to maintain documentation as to how they intend to employ the 9 BMP components listed below in a Pesticide Discharge Management Plan PDMP) as part of their operative NPDES permit.

1. **Surveillance** – Is the backbone of all IMM programs. Identifies problem species and population trends in order to direct and evaluate control methods.

    a. Determine species to ensure that the most appropriate control methodologies are chosen.

        i. Visually check jurisdiction for potential oviposition habitat and larval populations present that could contribute to unacceptable adult mosquito populations and determine if larval control is appropriate within resource constraints.

            1. Rural - swamps, salt & freshwater marshes, woodland pools, flooded fields/ pastures, roadside ditches, storm water retention ponds, tree holes, rice fields, etc.

            2. Urban - flower pots, tires, trash containers holding water, gutters, tree holes, septic ditches, roadside ditches, lawn swales, non-functional swimming pools, stagnant bird baths, street catch basins, junk yards, depressions in tarp covers, etc.

        ii. Determine population levels of adult mosquitoes using professionally acceptable techniques, including service requests, trap or collection data (if applicable) and/or landing rate counts (when appropriate), to establish needs for action.

    b. Monitor fluctuations in mosquito populations.

2. **Mapping** – Utilize maps of appropriate scale to continually monitor major sources of larval/adult mosquitoes in addition to documenting areas where control measures have been instituted. These maps should define treatment areas and can be used as appropriate in the PDMP.

3. **Set Action Thresholds** – Decisions to initiate control measures should be based on the analysis of either larval or adult mosquito surveillance or other available field data. Programs must establish a mechanism on which decisions to institute control measures are based.

    a. Determine which methodology shall be used to determine if and when control measures are instituted.

        i. For control of immature stages of mosquitoes, this methodology can consist of numbers of larvae and pupae observed in dip counts or observation of their presence in water sources.

ii. For adult mosquito control this methodology can consist of:

1. Number and pattern of citizen's service requests.

2. Visual – numbers of mosquitoes landing on inspector/applicator within 1-minute periods. When practicable, landing rate counts should be taken near or at times of peak mosquito activity for the species of concern. Performance of landing rate counts is only advised in areas or at times without significant mosquito-borne disease activity.

3. Counts of adult female mosquitoes collected.

b. Determine threshold values that trigger routine control measures. These values are meant to be for guidance only due to the myriad other factors that can influence when control operations are instituted – particularly in incipient disease scenarios or mosquito-borne disease prevention.

4. **Physical Control or Source Reduction** –Source reduction (the elimination, removal or modification of larval mosquito habitats) typically is the most effective and economical long-term method of mosquito control, but this may not be practicable for many larval habitats. Source reduction can be as simple as overturning a discarded bucket or disposing of a waste tire or as complex as habitat modification through Open Marsh Water Management techniques. These efforts often minimize and/or eliminate the need for mosquito larviciding in the affected habitat in addition to greatly reducing the need for adulticiding in nearby areas.

   a. Determine feasibility of removing or modifying oviposition sites.

   b. Encourage proper water management by public/private agencies responsible for storm water retention/detention structures and ditch and impoundment maintenance.

   c. Maintain familiarization with jurisdiction health nuisance abatement policy.

5. **Biological Control** – These control methodologies are often resource-intensive and may not be advisable or practicable for many programs. Nonetheless, their feasibility should be explored.

   a. Stocking of certain species of native, non-invasive fish known to be predators of mosquito larvae, if allowed by applicable state or local authorities, may provide significant reductions in larval mosquito populations in basic programs where management of large perennial oviposition sites is to be the primary control strategy.

   b. Utilization of bats, birds, dragonflies and other putative predators of mosquitoes can be both ecologically problematic and ineffective as a primary control strategy and is therefore not recommended as a major component of any control strategy.

6. **Public Health Mosquitocides** – Handling, disposal, personal protective measures and applications must be made in full accordance with product label specifications.

   a. Larvicides – Often may be the primary control method in natural or man-made wetlands (salt marshes or tidal wetlands, riverine bottomlands, woodland pools, freshwater marshes, meadow swales, roadside ditches, stormwater management ponds, etc.). These can also be a primary control method in locations where mosquito populations are determined to be arising from defined, concentrated sources in urban areas or in close proximity to houses. Due to continual influx of adult mosquitoes from outlying areas, larviciding programs may have limited visible effect on mosquito populations in jurisdictions lacking resources to adequately larvicide outlying production areas.

i. Several materials in various formulations registered by EPA are labeled for mosquito larviciding. Choice of active ingredient and formulation chosen will depend on site-specific factors and resistance management, and may include:

1. Biological larvicides

a. Microbial larvicides

b. Growth regulators and chitin synthesis inhibitors

c. Alcohol-derived monomolecular surface films

2. Chemical larvicides

a. Organophosphates

b. Oils – petroleum and mineral-based

ii. Larvicides should minimize impacts to non-target organisms and must, in many instances, be capable of penetrating dense vegetative canopies. Larvicide formulations (e.g., liquid, granular, solid) must be appropriate to the habitat being treated, accurately applied and based on surveillance data or preemptively applied to known oviposition sites.

iii. Larvicide application equipment should be calibrated and maintained per equipment manufacturer's specifications and timetable, or per instructions from product registrant.

b. Adulticides – Adulticides are applied so as to impinge upon the mosquito target in flight or at rest on vegetation. Adulticiding based on surveillance data is an extremely important part of any IMM program, and may form the primary treatment method for many programs where comprehensive larviciding is not practical.

Adulticides utilized in basic programs are typically applied as an Ultra-Low-Volume (ULV) spray where small amounts of insecticide are dispersed by aircraft or truck-mounted equipment. In some jurisdictions, adulticides may also be applied via "thermal fogs", utilizing heat to atomize droplets. Adult mosquitoes may also be targeted by "barrier treatments", which involve application of a residual insecticide to vegetation where mosquitoes are known to rest.

i. Adulticides should only be applied when established spray thresholds have been exceeded.

ii. Non-residual adulticides applied to the air column in order to impinge upon mosquitoes in flight should only be applied when the target species is active.

iii. Adulticides should be applied strictly according to label specifications. This will produce minimal effects on non-target organisms and promote efficacy. Adulticides should not be applied in rainy or windy conditions.

iv. Adulticides should only be applied by personnel trained or certified in their usage and handling, or when operating under the supervision of an individual having met the necessary certification requirements.

v. Adulticides labeled for mosquito control in part may include:

1. Organophosphates

2. Natural pyrethrins
3. Pyrethroids
4. Pyrethroid derivatives

vi. Adulticides should be applied at label rates that are efficacious as determined by monitoring. Applying doses lower than those that provide adequate control can in fact result in the need for additional adulticide treatments and might encourage development of insecticide resistance.

c. Adulticide application equipment should be calibrated and maintained per equipment manufacturer's specifications and timetable, or per instructions from the product registrant to ensure performance meets product label specifications.

7. **Monitoring for Efficacy/Resistance** – Resistance management techniques attempt to minimize the risk of mosquitoes becoming resistant to the existing chemicals and should be practiced in even basic programs.

   a. Basic resistance management techniques can include:

      i. Utilizing physical control/source reduction and biological control methodologies to the maximum extent practicable.

      ii. Avoiding the use of the same class of chemical against both immature and adult mosquitoes.

      iii. Applying pesticide at the rate recommended on the label. Do not underdose.

      iv. Utilizing a different chemical class at the beginning and end of treatment season.

      v. Assessing susceptibility at the beginning and sometime during the mosquito season.

   b. Resistance management can also involve utilizing surveillance methods following larvicide or adulticide applications to continually check for control efficacy.

8. **Education & Community Outreach** – IMM is knowledge-based and involves a concerted effort by both control personnel and the community to manage mosquito populations based upon informed decision-making.

   a. Education of the general public should be encouraged to enlist resident's support in disposing of (or modifying) oviposition habitat, proper screening methods and proper application of personal protective measures such as repellents to minimize human/mosquito contact.

   b. Mosquito control programs should keep their constituents informed of surveillance and control activities to the maximum extent practicable.

   c. Mosquito control personnel are strongly encouraged to maintain and upgrade their professional knowledge through continuing education training and/or attendance at professional conferences.

9. **Record-keeping** – Operators/applicators should record the following for each application and maintain the records for the time specified by the lead regulatory agency:

a. Applicator’s name, address and pesticide applicator certification number (if applicable)

b. Application date and time of day

c. Product name and EPA registration number

d. General location of application and approximate size of area treated

e. Amount of material applied

f. Rate of application