FACT SHEET FOR THE
AQUATIC MOSQUITO CONTROL NPDES GENERAL PERMIT

DRAFT February 3, 2010

DEPARTMENT OF ECOLOGY

EXECUTIVE SUMMARY

This fact sheet is a companion document to the 2010 Aquatic Mosquito Control General Permit (Permit) and explains the nature of the proposed discharges, the Washington State Department of Ecology's (Ecology) decisions on limiting the pollutants in the receiving water, and the regulatory and technical basis for these decisions.

The challenge of the Permit issued in 2010 is the attempt to strike a balance between the health of the environment and human health and meet federal and state regulatory requirements. Both are extremely important issues and very complex. To meet this challenge, Ecology worked with an advisory group of individuals who work as professionals in mosquito control, human health, and state regulatory fields while drafting the 2010 Permit.

Ecology has maintained that in order to *discharge* pesticides to waters of the state, coverage under a National Pollution Discharge Elimination System (NPDES) permit is required. The Sixth Circuit Court ruled in *National Cotton Council et al. v. EPA* that the discharge of pesticides and their residues to waters of the state requires NPDES permit coverage. Ecology has covered discharges of larvicides under the Permit since 2002. Updating the PERMIT was a necessary step that Ecology had to take in order to address discharges of adulticides to waters of the state that occur during control of vector mosquitoes.

The 2010 Permit continues to cover larvicide use (the larvicides remain the same from 2007), but now also covers the use of adulticides to control vector mosquitoes when human health is at risk. The draft 2010 Permit includes the following adulticides: natural pyrethrins, several pyrethroids (permethrin, resmethrin, sumithrin (d-phenothrin), a synergist (Piperonyl Butoxide), and two organophosphate pesticides for emergency use only (Malathion and Naled).

The natural pyrethrins and pyrethroids have a low toxicity to humans and other mammals, but pose a high risk to aquatic organisms and non-target insects. If the Permittees follow the Permit, application BMPs and FIFRA label requirements, they will minimize the risk to aquatic organisms while still controlling vector mosquitoes when they present a human health risk.

Table of Contents

INTRODUCTION

Since 2001, and based on the *Headwaters v. Talent Irrigation District* ruling, the Washington State Department of Ecology (Ecology) has maintained discharges of pesticides to waters of the state require coverage under a National Pollution Discharge Elimination System (NPDES) permit. The Aquatic Mosquito Control General Permit (Permit) has covered *discharge* of *larvicides* since 2002 but has not covered discharges from *adulticide* use. Until the issuance of the 2010 Permit, Ecology had prepared a draft administrative order allowing discharge of adulticides to waters of the state in case of a human health emergency due to *West Nile Virus*.

Ecology has updated the Permit in order to address discharges of adulticides to waters of the state that occur during control of *vector mosquitoes* in response to the court decision described below. Clean Water Act (CWA) and Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) label requirements appear to be in conflict after the January 2009 *National Cotton Council et al., v. EPA* ruling from the Sixth Circuit Court. FIFRA labels allow for incidental discharges to waters of the state during the proper application of adulticides. CWA requirements do not allow Ecology to exempt "incidental" discharges from permitting requirements. If a discharge of *pollutants* to the waters of the state occurs, regardless of the amount, a permit must cover it. The CWA does not prohibit discharges, just discharges without a permit. In the case of adulticides, incidental discharges do occur, therefore applicators must obtain a NPDES permit. This is where the CWA and FIFRA requirements must work together. The CWA, through the permitting process, informs applicators (*Permittees*) how much pesticide they may discharge during pesticide applications and not cause unacceptable harm to the environment.

The challenge of the Permit issued in 2010 is Ecology's attempt to strike a balance between the health of the environment and human health. Both are extremely important issues and very complex. To meet this challenge, Ecology worked with an advisory group of individuals (some of whom are Permittees) who work in the fields of mosquito control, human health, and state environmental and pesticide regulation while drafting the 2010 permit.

This fact sheet, a companion document to the draft Permit, provides the legal and technical basis for permit issuance (WAC 173-226-110). Ecology proposes to issue an updated Permit to allow the use of larvicides and adulticides for controlling mosquitoes in Washington State.

This fact sheet explains the nature of the proposed discharges, Ecology's decisions on limiting the pollutants in the receiving water, and the regulatory and technical basis for these decisions. WAC 173-226-130 specifies public notice of the draft permit, public hearings, comment periods, and public notice of issuance before Ecology can issue the general permit. This fact sheet, the application for coverage, and draft permit are available for review (see Appendix A - Public Involvement- for more detail on public notice procedures). Permittee's and other interested parties are part of a permit advisory group that reviewed the preliminary permit draft. Ecology has corrected errors and omissions identified during review before going to public notice.

After the public comment period closes, Ecology will summarize and respond to substantive comments. These comments may cause Ecology to revise some of the permit language and requirements. The summary and response to comments will become part of the file for this permit and parties submitting comments will receive a copy of Ecology's response.

Ecology will **not** revise the original fact sheet after it publishes the public notice. Appendix C (Response to Comments) will summarize comments and any resultant changes to the Permit.

AQUATIC PESTICIDE LEGAL HISTORY

The Federal Clean Water Act (CWA)[23]

The Federal Clean Water Act (FCWA, 1972), and later modifications (1977, 1981, and 1987), established water quality goals for the navigable (surface) waters of the United States. One of the mechanisms for achieving the goals of the Clean Water Act is the National Pollutant Discharge Elimination System of permits (NPDES permits), which is administered by the Environmental Protection Agency (EPA). The EPA has delegated responsibility to administer the NPDES permit program to the State of Washington based on Chapter 90.48 RCW that defines Ecology's authority and obligations in administering the discharge permit program.

The Federal Insecticide, Rodenticide and Fungicide Act (FIFRA)[25]

The Federal Insecticide, Fungicide, and Rodenticide Act of 1979 (FIFRA), as administered by the United States Environmental Protection Agency (EPA) and the Washington State Department of Agriculture, requires that all persons who apply pesticides classified as restricted use be certified according to the provisions of the act or that they work under the supervision of a certified applicator. Commercial and public applicators must demonstrate a practical knowledge of the principles and practices of pest control and safe use of pesticides, which they accomplish by means of a "core" examination. In addition, applicators using or supervising the use of any restricted use pesticides purposefully applied to standing or running water (excluding applicators engaged in public health related activities) must pass an additional exam to demonstrate competency as described in the code of federal regulations (40 CFR 171.4). Any person wishing to apply pesticides to waters of the state must obtain an aquatic pesticide applicator license from the Washington State Department of Agriculture, or operate under the supervision of a licensed applicator.

Headwaters, Inc. v. Talent Irrigation District (March 2001)[13]

Headwaters, Inc. and Oregon Natural Resources Council filed a Clean Water Act citizen suit against the Talent Irrigation District (TID) for applying aquatic herbicide into a system of irrigation canals. These canals discharged water into a creek causing a fish kill.

The Ninth Circuit Court in *Headwaters, Inc. v. Talent Irrigation District* found that the applicator should have obtained coverage under a National Pollutant Discharge Elimination System (NPDES) permit prior to application of aquatic pesticides to an irrigation canal in Oregon. The decision addressed residues and other products of aquatic pesticides.

Reversing a district court's opinion, the Ninth Circuit held that application of the pesticide in compliance with the labeling requirements of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) did not exempt TID from having to obtain a NPDES permit, and that the irrigation ditches were "waters of the United States" under the Clean Water Act.

League of Wildlife Defenders et al. v. Forsgren (November 2002)[15]

In the 1970's, the Douglas Fir Tussock Moth defoliated approximately 700,000 acres of Douglas Fir in Idaho, Oregon and Washington. In response to this outbreak, the United State Forest

Service (USFS) developed a system to predict tussock moth outbreaks and control them via aerial spraying of insecticides.

The League of Wildlife Defenders filed suit against the USFS for failing to obtain a NPDES permit under the CWA for the application of insecticides directly above *surface waters*. The USFS argued that any discharge of insecticides was nonpoint pollution, and that the discharges fell under federal exemptions (40 CFR 122.3) for silviculture activities.

The Ninth Circuit Court reversed a district court's opinion upon appeal. It held that aerial spraying (from an aircraft fitted with tanks) directly to, and over, surface water is a point source of pollution, and requires an NPDES permit.

Fairhurst v. Hagener (September 2005)[14]

The Montana Department of Fish, Wildlife, and Parks (Department) began a ten-year program to re-introduce threatened native westslope cutthroat trout into Cherry Creek. This project used antimycin to remove non-native rainbow and Yellowstone cutthroat trout from Cherry Creek over several years, after which it would reintroduce native trout.

The Department was sued under the citizen suit provision of the CWA for failing to obtain a NPDES permit before applying antimycin to surface waters. During summary judgment, the district court decided in favor of the Department. On appeal, the Ninth Circuit court affirmed the district court's opinion. The Ninth Circuit opined that: "A chemical pesticide applied intentionally, in accordance with a FIFRA label, and with no residue or unintended effect is not "waste, and thus not a "pollutant" for the purposes of the Clean Water Act. Because the Department's application of antimycin to Cherry Creek was intentional, FIFRA compliant, and without residue or unintended effect, the discharged chemical was not a "pollutant" and the Department was not required to obtain a NPDES permit."

EPA Final Rule: Application of Pesticides to Waters of the U.S. in Accordance with FIFRA (November 2006)[24]

Environmental Protection Agency (EPA) issued a final rule in 2006 entitled "Application of Pesticides to Waters of the United States in Accordance with FIFRA." This rule replaced a draft interpretive statement issued by EPA in 2003 concerning the use of pesticides in or around waters of the United States. The rule states that any pesticide meant for use in or near water that is applied in accordance with the EPA-issued FIFRA label, is not a pollutant under the Clean Water Act. Therefore such applications are not subject to NPDES permitting.

After EPA issued the rule, Ecology met with stakeholders to seek input on how Ecology should regulate use of aquatic pesticides. Ecology also provided the public with a three-week comment period. Stakeholders affiliated with each of the seven affected permits (mosquito, noxious weeds, aquatic plants, irrigation, oyster growers, fish management, and invasive moth) sent comments to Ecology. The majority of comments requested that Ecology continue to issue joint NPDES/state permits to regulate aquatic pesticide applications.

A pesticide applied to the water according to state law is a form of pollution. To apply a pesticide in the water, state law requires that the applicator obtain a short-term modification of

the water quality standards from Ecology. Currently, the only legal vehicle for implementing that modification is a permit. State law only defines two types of permits for surface water discharges: National Pollutant Discharge Elimination System (federal) and State Waste Discharge (state). Until 2001, Ecology issued modifications using an administrative order. This process was challenged in court and is currently not a viable regulatory option. Ecology decided that Washington would continue to use NPDES permits to control the use of aquatic pesticides in and around Washington state waters until the federal courts made a decision on the appeal of the EPA rule. These permits help the state protect human health and the environment by:

- Ensuring pesticides with the lowest risk are used.
- Reducing amounts of pesticides applied.
- Tracking pesticide use.
- Requiring public notifications and postings when waters are treated.
- Monitoring levels of pesticides in the water after treatment.

Ecology believes that these permits provide the best protection of water quality, human health, and the environment at this time. Ecology has taken steps to minimize the regulatory and administrative burden on Permittees while ensuring that the permits comply with federal and state laws and court decisions.

Northwest Aquatic Eco-Systems v. Ecology (June 2007)[17]

In February 2006, the Pollution Control Hearings Board (PCHB) issued a final order in case #05-101, *Northwest Aquatic Ecosystems vs. Ecology, WTC*. This case focused on a number of issues, one of which was whether an NPDES permit is required for the use of federally registered pesticides since the Ninth Circuit Court ruled in *Fairhurst vs. Hagener*.

The Board ruled that: "Northwest Aquatic also renewed its summary judgment argument that the Board should rule NPDES permit coverage is not needed for the application of aquatic pesticides, when they are applied in accordance with the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). Northwest Aquatic bases this argument on the recent federal court decision in *Fairhurst v. Hagener*, 422 F.3d 1146 (9th Cir. 2005). The Board ruled on summary judgment that the *Fairhurst* decision does not provide a blanket exemption for the application of aquatic pesticides. Identified conditions must be met before a pesticide can be considered outside the category of a pollutant under the Clean Water Act. The pesticide must:

(1) Be applied for a beneficial purpose,
(2) Be applied in compliance with FIFRA,
(3) Produce no pesticide residue, and
(4) Produce no unintended effects (*Fairhurst*, 422 F.3d at 1150).

Northwest Aquatic failed to provide any evidence specifically addressing how the use of diquat and endothall on the proposed sites would meet the four factors identified in *Fairhurst.* In the absence of such evidence, *Fairhurst* provides no basis for the Board to conclude a NPDES permit is not required for the proposed pesticide applications."

National Cotton Council et al. v. EPA (January 2009)[16]

In November 2006, EPA issued a final rule under the CWA that determined that pesticides applied in accordance with the FIFRA label are exempt from NPDES permitting requirements.

Petitioners filed for review of EPA's final rule in 11 of the 12 federal circuit courts that are able to hear regulatory arguments. The federal courts combined the petitions into one case within the Sixth Circuit Court.

In its opinion, the Sixth Circuit made several findings. First, it agreed with the Ninth Circuit (*Fairhurst v. Hagener*) that if a chemical pesticide is intentionally applied to water for a beneficial purpose, and leaves no waste or residue after performing its intended purpose; the discharge would not require a NPDES permit.

Second, the Court found excess pesticides and residues that make their way into waters during and after any pesticide application constitute wastes under the CWA and must have NPDES permit coverage before the discharge occurs.

Finally, the Sixth Circuit determined that because EPA's final rule exempted discharges that the plain reading of the CWA includes as requiring a NPDES permit, the rule cannot stand. After a later motion, the Sixth Circuit granted EPA a stay on the effective date of this ruling for 24 months to allow EPA to develop NPDES permits for pesticide discharges. EPA is developing several general permits for the discharge of pesticides including aquatic plant, larval and aerial mosquito control and intends to issue the permits in 2011.

MOSQUITO BACKGROUND

Mosquitoes are classified as class Insecta, order Diptera, Family Culicidae, and represent more than 200 species in the United States[54]. Mosquitoes from six genera are found in Washington and include *Aedes, Anopheles, Coquilletidia, Culex, Culiseta,* and *Ochlerotatus*[22].

Mosquito Lifecycle[5,54]

The highly variable mosquito life cycle ranges from one to three weeks, depending on factors such as water temperature and food availability. Mosquitoes will breed wherever water can support their larvae. A very small amount of water (such as that trapped in a tire, tin can or hoof print) is necessary to allow successful maturation of mosquitoes, and warmer water causes quicker development of larvae.

Mosquitoes either lay eggs in masses or rafts on the water surface, or deposit their eggs on moist substrates that will later be flooded with water. Mosquito eggs take 24 to 48 hours to develop and hatch, though eggs of species that deposit on moist substrates may sometimes last for months before they hatch due to flooding of the moist area.

Mosquitoes undergo a complete metamorphosis, which involves four stages of development, egg, larva, pupa and adult. The female mosquito lays the eggs directly on water in "rafts" or on moist substrates that may later be flooded with water. The egg hatches into larva, or "wrigglers." During the larval stages, a mosquito feeds and goes through four growth stages called instars. When the larva reaches the fourth instar, it stops feeding and pupates. During the pupa stage, the larva rests and undergoes the many internal changes necessary to mature into an adult mosquito. This period lasts a few hours to a few days, after which an adult mosquito emerges from the pupa.

Adult mosquitoes are most active from dusk until dawn when they search for a meal and a mate. Nectar and other plants juices make up most of the adult mosquitoes diet. Only female mosquitoes need a blood meal in order to produce eggs. After the female mosquito takes a blood meal, it deposits eggs to continue the cycle.

Disease Transmission by Mosquitoes[5,6,7,8,9,10,11,12,21,54]

Female mosquitoes of nearly all species require a blood meal (protein) from vertebrate animals to develop eggs. Several species of mosquito will use humans as blood meal hosts and some of these species can transmit various diseases to humans.

In order for a mosquito to transmit disease to humans, it must first take a blood meal from a host that is carrying a transmittable disease. Most of these hosts are birds and small mammals, making them important to the amplification of diseases in the environment. After taking a blood meal from an infected bird or animal, the mosquito may bite a human, transferring the disease to the human in its saliva. West Nile virus is a good example of this mode of transmission.

Diseases transmitted by mosquitoes and other insects are known as arthropod-borne viruses (arboviral diseases). Globally, the arboviral diseases transmitted by mosquitoes to humans include *West Nile virus*, *encephalitides*, *dengue*, *yellow fever*, *malaria*, and *filariasis* Other pathogens transmitted by mosquitoes include *Dirofilaria immitis*, a parasitic roundworm and the causative agent of dog heartworm. Some of these diseases have been *endemic* or *epidemic* diseases in the United States in the past, but today, only the insect-borne (arboviral) encephalitides and West Nile virus fever occur annually. Dengue occurs periodically in this country, mostly in the far South.

Public Health Impacts From Mosquitoes[6,7,8,9,10,12,21]

Currently, only West Nile virus (WNV), St. Louis Encephalitis (SLE), and Western Equine Encephalitis (WEE) are known to occur (endemic) in Washington based on DOH comments on the preliminary draft PERMIT. These diseases can cause serious, sometimes fatal neurological ailments in people (the WEE virus also causes disease in horses). WEE infections tend to be more serious in infants while SLE can be more serious for older people. WNV can infect anyone, though immunocompromised people or those over 50 have the highest probability of developing a severe form of the disease. These viruses normally infect birds and small mammals in the environment. During such infections, the level of the virus may increase in these infected animals (amplification) facilitating transmission to humans by mosquitoes.

WNV, a much publicized *arboviral* disease in Washington and the U.S, was originally found in the northeastern United States in 1999. Approximately 20 percent of the humans infected with WNV will develop West Nile fever, which has symptoms similar to influenza, and lasts for a few days to several weeks in rare cases. Of those infected with WNV (not WNV fever), approximately **0.7%** will develop a severe form of WNV neuroinvasive disease. The neuroinvasive form of WNV can be meningitis, encephalitis, meningoencephalitis, or poliomyelitis[10] and can leave lasting neurological effects after recovery. Most humans infected with WNV will never develop symptoms.[10]

Close to 30,000 human cases of West Nile virus have been reported in the U.S. as of the end of 2009. 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.[12] 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.[11]

In Washington, the first reports of WNV occurred in 2006. Since then, 42 human cases of WNV have been reported, three of which were meningitis/encephalitis. One death occurred due to the neuroinvasive form of WNV in 2009.[12]

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. Though Ecology found no statistics for allergies to mosquito bites, an article in the Journal of Allergy and Clinical Immunology by the Joint Council of Allergy Asthma and Immunology lists life threatening stinging insect (bees, wasps, and ants) allergies as affecting 0.4-0.8% of children and 3% of adults.[42,43]

MOSQUITO CONTROL

Control/Management Options

Public agencies, such as those that are components of or collaborating with local health departments or are independent districts organized specifically for mosquito control, can best manage mosquitoes using *Integrated Pest Management* on an area wide basis (chapter 17.58 RCW). Washington has approximately 16 *mosquito control districts* (MCDs). Some MCDs are small and have responsibility for mosquito abatement in a few hundred square miles, while the activities of others may encompass one entire county or more.

Public agencies accomplish mosquito control in two ways, by using larvicides and adulticides. *Larvicides* target the pre-adult stages of the mosquito life cycle (egg, larva, and pupa). *Adulticides* target the flying adult mosquitoes. Because mosquito larva are concentrated and relatively immobile in waterbodies, they are easier to target and control than adults. MCDs focus most (80-90%) of their control efforts on mosquito larva. In areas without an MCD, mosquito control is usually limited to larviciding.

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.

Many larvicidal materials currently in use are biological in origin and are highly specific for mosquitoes, with little or no effect on other aquatic organisms. Adulticides commonly used are from the pyrethroid class of chemicals originally derived from the chrysanthemum flower. Other popular adulticides used are organophosphates.

Applicators distribute larvicides by hand or aerially. Hand applications use broadcast spreaders

such as backpack granulators and liquid sprayers used to spread control materials either mounted on ATVs or carried by the applicator. Aerial applications normally use a conventional spray boom to improve coverage with the small volume of spray solution applied per acre. The spray produces a large droplet size at low pressure and low volume. The pilot monitors the flow rate to minimize pressure and controls drift by applying when air temperatures and wind speeds are low. Pilots apply larvicides directly to water in order to target the areas where mosquito larvae are rearing.

Applicators use Ultra Low Volume (ULV) application equipment to apply adulticides from air (aerial ULV) and ground (ground ULV) based vehicles. This equipment produces an invisible aerosol of 30-micron (average) size droplets designed to drift so that it affects the most mosquitoes possible. Applications of adulticides typically occur during the periods when mosquitoes are most active and females are searching for a blood meal host, dusk and dawn.

Control of irrigation water in agricultural areas to avoid excess runoff is an important mosquito control method. Anecdotal evidence suggests that water rights (use it or lose it) also plays a significant role in this issue on the Eastern side of Washington.

Integrated Pest Management (IPM)

The current interests in ecology and environmental impact of mosquito control measures, and increasing issues from pesticide resistance emphasize the need for Integrate Pest Management (IPM). 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. Ideally, an IPM program considers all available control actions, including no action, and evaluates the interaction among various control practices, cultural practices, weather, and habitat structure. This approach uses a combination of resource management techniques to control mosquito populations with decisions based on surveillance. IPM includes the use of pesticides but only after mosquito population monitoring indicates a need.

A good integrated pest management (IPM) program -- featuring monitoring/surveillance for high mosquito populations and disease, resident education and action to maximize natural controls and minimize mosquito breeding sites, larviciding when necessary and adulticiding as a last resort -- can control mosquitoes effectively while reducing pesticide exposure to humans and the environment.

Surveillance methods include studying habitats by air, aerial photographs, and topographic maps, and evaluating larval populations. Mosquito control officials also monitor mosquito traps, and complaint reports from the public. Seasonal records are kept in concurrence with weather data to predict mosquito larval occurrence and adult flights. Many mosquito control programs and local health jurisdictions monitor mosquito-borne diseases by having wild birds, *mosquito pools*, and/or *sentinel chickens* tested for disease.

Source reduction involves eliminating the habitat or modifying the aquatic habitat to prevent mosquitoes from breeding. This measure includes sanitation measures where artificial containers, including discarded automobile tires, which can become mosquito habitats, are collected and properly disposed. Habitat modification may also involve management of impounded water or open marshes to reduce production and survival of the floodwater

mosquitoes. If habitat modification is not feasible, biological control using fish may be possible though approval of Washington Department of Fish and Wildlife (WDFW) is necessary to introduce a non-native species, or a native species outside its natural range.

It is the policy of Department of Ecology Water Quality Program (WQP 1-06 and 1-06A) that larval control should be central to IPM. The underlying philosophy of larval mosquito control is that control is more effective on *concentrated, immobile* and *accessible* larvae populations. This emphasis focuses on habitat management and controlling the immature stages before the mosquitoes emerge as adults. This policy reduces the need for widespread pesticide application in urban areas. Pesticides are applied in areas prone to mosquito larvae rather than being dispersed more widely, which ideally should have less environmental impact than adulticiding.

IPM larval control often includes applying biological or chemical larvicides with selective action and moderate residual activity to the aquatic habitats. To have the maximum impact on the mosquito population, larvicides are applied during those periods when immature stages are concentrated in the breeding sites before the adult mosquitoes emerge and disperse.

Fish and game specialists and natural resources biologists should be involved in planning IPM control measures whenever delicate ecosystems could be impacted by mosquito control practices.

Mosquito Control Programs

Mosquito control activities can be important to the public health, and responsibility for carrying out these programs rests with state and local governments, health departments, and vector or mosquito control districts. Modern mosquito control programs in the U.S. are multifaceted and include surveillance, source reduction, and a variety of larval and adult mosquito control methods following IPM strategies. In Washington, mosquito control is provided by mosquito control districts, cities, counties, municipalities (Public Utility Districts) and commercial applicators depending on the region and resources available.

PESTICIDE INFORMATION

Larvicides

The PERMIT authorizes the discharge of several larvicidal active ingredients when an entity is working to control mosquitoes. The active ingredients included for use the permit are Bacillus sphaericus (H-5a5b), Bacillus Thuringiensis israelensis, Methoprene, Monomolecular surface films, Malathion, and Temephos.

Active Ingredient	Use
Bacillus sphaericus (H-5a5b)	Control for first through third instar larvae. Higher rates are needed for late third and fourth instar larvae. Can have extended residual control even in highly organic aquatic environments.

Bacillus thuringiensis subsp. *israelensis (Bti)*	Control for first, second, and third instar larvae. Higher rates are needed for late third and fourth instar larvae.
Methoprene	First, second, third, and fourth instar larvae control.
Monomolecular surface film POE isooctadecanol	Larvae and pupae control. Okay for potable water.
Petroleum and mineral based oil	Larvae and pupae control. State restricted use. Consult with WDFW before using.
Temephos	State restricted use.
Malathion	State restricted use. Emergency use only.

Bacillus thuringiensis israelensis (Bti)

Bacillus thuringiensis, subspecies *israelensis* (Bti) is a naturally occurring soil bacterium that can effectively kill mosquitoes during the larval stage of development. Bti is an endospore-forming bacterium that is ingested by the actively feeding larvae. When the bacteria Bti encysts, it produces a protein crystal toxic to mosquito larvae. Once the bacteria have been ingested, the toxin disrupts the lining of the larvae's intestine causing it to stop eating and die. Bti is the primary material used for mosquito control because of its low toxicity to non-target species. Bti is highly pathogenic against the first through third larval instars of mosquitoes (family Culicidae), blackflies (Family Simuliidae) and has some virulence against certain other Dipteran Families, especially midges (Family Chironomidae). Bti has been extensively studied for effects on non-target organisms and environmental consequences of use with no reported adverse effects. It is not toxic to bees. According to several studies, when applied at field application rates, Bti has no reported effect on fish and amphibians. Studies have also found no effect on warm-blooded mammals. Labels indicate that direct contact with the products may cause mild eye or skin irritation.

Bti products are available in liquid, pellet, granular, and briquette formulations. The type of Bti formulation influences the activity of the product. Generally, Bti does not persist long after application, with toxicity persisting from 24 hours to over one month when the longer lasting formulations are used.
Larval toxicity can depend on the species, its feeding activity and other possible factors such as UV light, water quality, pH, temperature, agitation, and sedimentation. Commercially available Bti strains are sold under several names, including Aquabac, Bactimos, Bonide Mosquito Beater "Plunks", Healthy Ponds, Sentry, Summit Bti Briquettes, Teknar and Vectobac. A number of Bti products are available for residential use in water bodies, such as lined ornamental ponds, and are sold under various trade names such as Bayer Advanced Garden Mosquito Preventer, Beckett Skeeter Stopper, Mosquito Depth Charges, Mosquito Dunks, Mosquito Bits Quick-Kill, and Spectracide Mosquito Stop.

Bacillus sphaericus (Bs)

Bacillus sphaericus is a naturally occurring (where does it occur), spore-forming bacterium, which produces a protein endotoxin at the time of sporulation. The toxin is only active against the larval stage and must be ingested and digested before it activates. *B. sphaericus* has the

unique property of being able to control mosquito larvae in highly organic aquatic environments such as manure waste lagoons and stormwater catch basins.

B. sphaericus can offer up to six weeks of control in many habitats because the protoxins and spores can remain suspended in the water column for extended periods and due to the recycling of bacteria in dead larvae. Duration of control will depend upon habitat factors such as water depth, flushing, water chemistry and frequency of oviposition to maintain the recycling process. Vectolex, the trade name for *B. sphaericus*, is available in corncob granule, water dispersible granule, and water dispersible pouch formulations.

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

Methoprene

Methoprene is a compound that mimics the action of an insect growth-regulating hormone and prevents the normal maturation of insect larvae. Unable to metamorphose, the mosquitoes die in the pupal stage. Methoprene is classified as a biochemical pesticide because it controls mosquito larvae by interfering with the insect's life cycle rather than through direct toxicity. Methoprene is available in numerous formulations and sold under the product names: Zoecon Altosid, Biosid, and Strike. Formulations labeled for residential use are sold under the names Pre-Strike and Vet-Kem.

Studies indicate that methoprene is of low toxicity and poses little risk to people when used according to label instructions. Methoprene was not shown to have any significant toxicological effects in the standard battery of toxicity studies used to assess human health effects. The pesticide has very low acute oral and inhalation toxicity potential and is not an eye or skin irritant. Methoprene is also of low acute dermal (skin) toxicity and is not a human skin sensitizer.

In laboratory tests, the toxicity of methoprene to birds and fish is low, and it is nontoxic to bees. Field studies involving methoprene have shown that it has no lasting adverse effects on populations of invertebrates or other non-target aquatic organisms when used according to label instructions for mosquito control. Methoprene mosquito control products present minimal acute and chronic risk to freshwater fish, freshwater invertebrates, and estuarine species. Methoprene is not persistent in the environment. It degrades rapidly in water, being susceptible to transformation by sunlight and microorganisms.

Monomolecular Surface Films

Monomolecular surface film (MMF) is a non-petroleum surface oil that acts as a physicochemical agent by altering the mosquito's habitat. It belongs to the alcohol ethoxylate group of surfactants (products meant to increase product efficacy), which are used in detergent

products. MMFs disrupt the cohesive properties of water, which allow mosquitoes to use the water's surface as an interface for breeding. In effect, by making the surface "wetter," MMFs drown mosquitoes.

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

Some species, such as the midge, and some arthropods that require attachment to the water surface have been shown to be affected. MSF is non-toxic to most non-target wildlife. According to EPA, MMFs poses minimal risks to the environment when used according to FIFRA label directions. The green tree frog progressed normally from tadpole to adult through several generations after being exposed to a constant film presence for six months. MMFs are not a skin irritant, is only a mild eye irritant on prolonged or repeated contact, and is considered to be non-toxic by animal tests. As with all pesticides, direct contact should be avoided. The film persistence is dependent on temperature, water flow, amount of bacteria in the water, and the duration and strength of the wind following application. MMFs typically persist on the water's surface for 5-22 days.

Larvicidal Oils

Oils are used to form a coating on top of water to drown larvae, pupae, and emerging adult mosquitoes. Oils are petroleum or mineral based and are typically used as a product of last resort for the control of mosquito pupae, since this stage does not feed but does require oxygen. Oils can persist for 12 to 15 hours and then evaporate within a few days. Larvicide oils, if misapplied, can be toxic to fish and other aquatic organisms. Studies have shown that aquatic invertebrates, amphibians, waterfowl, furbearers and fish may be deleteriously affected. The mosquito control permit requires consultation and agreement of WDFW prior to using these products.

Malathion

Malathion is a broad spectrum, non-systemic organophosphate insecticide. It is used in agriculture, residential, pharmaceutical, and public health programs across the country to control a large number of pests.

Relatively resistant to UL degradation (photolysis), malathion is susceptible to hydrolysis in alkaline conditions. In neutral to alkaline conditions, the half-life of malathion is 1 to 2 weeks and in acidic conditions, the half-life is 107 days. Information included in the EPA revised RED for Malathion indicate that malaoxon (malathion primary metabolite) can remain stable for at least 72 hours, which is long enough to reach domestic drinking water supplies in some areas.

Half-life in soil is 1 to 25 days, depending on microbial activity, with higher activity resulting in a shorter half-life. Malathion does not *adsorb* to soils very well so it somewhat mobile in the soil, and has the potential to leach to groundwater.

Like other organophosphates, it works by disrupting the central nervous system through *cholinesterase inhibition*. Its primary *metabolite* is malaoxon, is also a cholinesterase inhibitor. *Carboxyesterase* activity in the body work to reduce the effects of malathion and malaoxon accumulation. Carboxyesterase are more active in mammals than insects, which can explain the higher toxicity in insects.

Malathion has a low toxicity to mammals, though at high doses a decrease in cholinesterase activity and some respiratory lesions during inhalation tests are seen. Symptoms of malathion poisoning include headache, nausea, vomiting, dizziness, muscle weakness, lethargy and anxiety. Life threatening exposure can cause respiratory distress, diarrhea, tremors, confusion, seizures and coma.

Malathion is highly toxic beneficial insects and aquatic organisms (both vertebrates and invertebrates) during acute and chronic testing. Acute toxicity is not expected in reptiles as they have detoxification efficiency similar to mammals.

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. EPA is required to develop endangered species bulletins at the county level, or include FIFRA label requirements for California, Idaho, Oregon, and Washington that specify:

- Where ground applications are permitted:
- Where aerial applications are permitted
- Winds speeds during application are to be less than 10mph
- Agricultural uses will have a minimum of 20 feet of non-crop vegetation on the downhill side of the application areas immediately adjacent to any surface water that have a connection to salmonid bearing waters.
- Do not apply products when soil moisture is at field capacity of when a weather event is likely to produce run-off from the application site within 48 hours of application
- Report all incidents of fish mortality that occur within 4 days of application and within the vicinity of the application area.

More information about the NMFS biological opinion may be found at http://www.nmfs.noaa.gov/pr/pdfs/pesticide_biop.pdf

Malathion use as a larvicide is restricted under Ecology's aquatic mosquito control permit. It is not permitted for use as an adulticide. Malathion may only be used for control of mosquito larvae with Ecology approval after consultation between Ecology and DOH in response to a public health emergency. This limits the amount and times that malathion may be discharged to surface waters to only times when human health becomes a priority.

Temephos

Temephos is a broad spectrum, non-systemic organophosphate insecticide. It is registered for use only as a mosquito larvicide. It is a *hydrophobic* chemical but does *bioaccumulate*. Nearly 75% of temephos that is bioaccumulated is eliminated over time with no exposure.

Temephos is not very persistent in water, but binds tightly to soils and sediments, though its degredants do not which could lead to continued suspension or re-suspension in water. Half-life in soil is estimated at 30 days.

Like other organophosphates, Temephos works by disrupting the central nervous system through cholinesterase inhibition. It has a lower toxicity to mammals, but cholinesterase inhibition and reduced liver weights are noted in chronic exposure studies. Testing with rat found that while some temephos remained in the body, most of it was eliminated through feces and urine unchanged. Symptoms of poisoning include headache, sweating, nausea, vomiting, dizziness, loss of coordination, difficulty breathing, and death.

Depending on product formulation, temephos is moderately to very highly toxic beneficial insects and aquatic organisms (both vertebrates and invertebrates) during acute and chronic testing. It is also moderately to highly toxic to some species of birds.

Temephos use as a larvicide is restricted under Ecology's Permit. It is not permitted for use as an adulticide. Temephos may only be used for control of mosquito larvae in non-potable, highly polluted water, water with a high organic contentment (such as sewage lagoons, manure lagoons, or pastures, all of which must have no surface water run-off), or in response to pesticide resistance development within a specific population of mosquitoes. Ecology must approve the use of temephos 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.

Adulticides

The Permit authorizes the incidental discharge of several adulticide active ingredients when an entity is working to control vector mosquitoes. Discharges are not allowed for nuisance mosquito applications. The active ingredients included for use the permit are Permethrin, Resmethrin, Sumithrin (d-phenothrin), Natural Pyrethrins, Naled, and Piperonyl Butoxide (PBO).

Pyrethrins and Pyrethroids[28-35,57,59,60]

Natural Pyrethrins are compounds isolated from the chrysanthemum flower (*Chrysanthemum cinerariaefolium)* with insecticidal properties. A number of synthetic derivatives have been created from pyrethrins and are referred to as "pyrethroids." Pyrethroids are more UV stable (resist UV degradation) and cost effective to produce.

As a group, pyrethrins and pyrethroids all have a similar mode of action. These chemicals interfere with nerve cell sodium channels that serve as part of the nervous system communication system, but it is unknown if all pyrethroids alter the same sodium channels.

Pyrethroids have a very low toxicity to humans and other larger mammals. EPA lists pyrethroid compounds as class 3 or 4 depending on exposure route for acute testing. Class 3 pesticides are rated slightly toxic by EPA, while class 4 is practically non-toxic.

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 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.

EPA lists pyrethroids as highly toxic to very highly toxic to aquatic organisms. Results from acute testing of active ingredients on freshwater fish range from LC_{50} 0.28 to 5.1 ppb. Chronic toxicity with freshwater invertebrates lists results for *No Observed Adverse Effect Concentration (NOAEC)* at 0.039 to 0.86 ppb.

Pyrethroids have a high affinity to binding to soils, waterbody sediments and suspended sediments. This high affinity to binding should greatly reduce the likelihood that pyrethroids will leach into groundwater but also reduces the chance for the pyrethroids to degrade due to UV light.

Piperonyl Butoxide [27,57,59,60]

Piperonyl Butoxide is a chemical that is added to many pesticide formulations. It increases the effect of pyrethrins and pyrethroids by acting as a synergist. PBO increases the insecticidal properties by reducing the effectiveness of the detoxification enzyme that works to eliminate pyrethroids from an insects system. This reduces the dose of pyrethroids necessary to cause mortality in mosquitoes other insects and some small mammals (rats, mice).

PBO is only slightly toxic to humans and other larger mammals, though some transient enzyme inhibition is observed. The target organ being the liver, chronic exposure leading to increases in liver weight. PBO also has a low to very low toxicity to birds.

As a single chemical test, PBO is moderately toxic to aquatic organisms. Acute testing of freshwater fish and invertebrates with a LC_{50}'s of 1.9 and 0.51ppm respectively. NOAEC's have also been estimated for PBO at 0.04ppm for freshwater fish and 0.03 for freshwater invertebrates.

PBO is not used as an adulticide or insecticide as a single active ingredient but always in as a synergist for a primary active ingredient.

Naled[29,57,59,60]

Naled is a broad spectrum, non-systemic organophosphate insecticide. It is registered for use as a mosquito adulticide. Naled has one metabolite that is also an organophosphate pesticide registered with EPA: dichlorvos (DDVP).

Like other organophosphates, Naled works by disrupting the central nervous system through cholinesterase inhibition. Symptoms of poisoning include headache, sweating, nausea, vomiting, dizziness, loss of coordination, difficulty breathing, and death.

Naled is moderately to highly toxic to birds, highly toxic to non-target insects (such as honeybees), moderately to very highly toxic to aquatic organisms and moderately toxic to

mammals on an acute basis, with some chronic effects.

Naled use as an adulticide is restricted under Ecology's Permit. It is not permitted for use as a larvicide. Naled may only be used for control of adult in response to pyrethroid resistance development within a specific population of mosquitoes. An example of a specific population would be the population of mosquitoes that breed in a single waterbody. 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.

Pesticide Registration Licensing Information

The purpose of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) is to provide federal control of use, distribution and sale of pesticide products in the U.S. All pesticides used in the United States must be registered (licensed) by EPA. Registration helps insure that pesticides will be properly labeled and that, if used in accordance with label specifications, they will not cause unreasonable harm to the environment.

To register a new pesticide, manufacturers of pesticides must present EPA with technical information supporting the proposed pesticide uses such as risk to humans and the environment, and frequency of use. After review by EPA, a pesticide is registered for narrowly defined uses (e.g. specific crops). Because of the continually increasing knowledge of pesticides and their effects, EPA's goal is to review pesticide registrations every 15 years. More information about FIFRA pesticide registration may be found at http://www.epa.gov/oecaagct/lfra.html#Registration%20of%20New%20Pesticides.

FIFRA requires certification of all persons who apply pesticides classified as restricted use. Commercial and public applicators must pass an examination to demonstrate practical knowledge of the principles and practices of pest control and safe use of pesticides. Applicators using or supervising the use of any *restricted use pesticides* applied to standing or running water (excluding applicators engaged in public health related activities) must pass an additional exam to demonstrate competency as described in the code of federal regulations 40 CFR 171.4.

In addition to FIFRA requirements, the State of Washington requires pesticides be registered for use with the State Department of Agriculture (WSDA), and that pesticide applicators be licensed through WSDA. Any person wishing to apply EPA-registered pesticides to Washington State waters must be licensed as an aquatic pesticide applicator or operate under the direct supervision of a State licensed applicator. For information on Washington State licensing requirements and testing, see the following website: http://www.agr.wa.gov/PestFert/LicensingEd/Licensing.htm. Information about pesticide registration in Washington State may be found at http://www.agr.wa.gov/PestFert/Pesticides/ProductRegistration.aspx#WsdaReg.

REGULATORY INFORMATION

Regulatory Pollution Reduction Requirements

Federal and State regulations require that effluent limits in an NPDES permit must be either technology or water quality-based.

- Technology-based limits are based upon the treatment methods available to treat specific pollutants. Technology-based limits are set by the EPA and published as a regulation, or Ecology develops the limit on a case-by-case basis (40 CFR 125.3, and chapter 173-226 WAC).

- Water quality-based limits are calculated so that the effluent will comply with the Surface Water Quality Standards (chapter 173-201A WAC), Ground Water Standards (chapter 173-200 WAC), Sediment Quality Standards (chapter 173-204 WAC) or the National Toxics Rule (40 CFR 131.36).

- Ecology must apply the most stringent of these limits to each parameter of concern. These limits are described below.

Technology Based Water Quality Protection Requirements

Sections 301, 302, 306, and 307 of the FWPCA established discharge standards, prohibitions, and limits based on pollution control technologies. These technology-based limits are "best practical control technology" (BPT), "best available technology economically achievable" (BAT), and "best conventional pollutant control technology economically achievable" (BCT). Permit writers may also determine compliance with BPT/BAT/BCT using their "best professional judgment" (BPJ).

Washington has similar technology-based limits described as "*all known, available and reasonable methods of control, prevention, and treatment (AKART)*" methods. State law refers to AKART under RCW 90.48.010, RCW 90.48.520, 90.52.040 and RCW 90.54.020. The Federal technology-based limits and AKART are similar, but not equivalent. Ecology may establish AKART:

- For an industrial category or for an individual permit on a case-by-case basis.
- That is more stringent than Federal regulations.
- That includes BMPs such as prevention and control methods (i.e. waste minimization, waste/source reduction, or reduction in total contaminant releases to the environment).

Ecology and the Federal Environmental Protection Agency (EPA) concur that, historically, most discharge permits have determined AKART as equivalent to BPJ determinations.

EPA has regulated the pesticide application industry under the terms of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). EPA developed label use requirements to regulate the use of pesticides. EPA also requires the pesticide manufacturer to register each pesticide, provide evidence that the pesticide will work as promised, and minimize unacceptable environmental harm. The standards for environmental protection are different between the Clean Water Act and FIFRA. It is the intent of this general permit to authorize mosquito control in a manner that complies with all federal and other state requirements. All wastewater discharge permits issued by Ecology must incorporate requirements to implement reasonable prevention, treatment and control of pollutants.

The Washington Pesticide Control Act (Chapter 15.58 RCW) states that “the formulation, distribution, storage, transportation, and disposal of any pesticide and the dissemination of accurate scientific information as to the proper use, or nonuse, of any pesticide, is important and vital to the maintenance of a high level of public health and welfare both immediate and future, and is hereby declared to be a business affected with the public interest. The provisions of this chapter are enacted in the exercise of the police powers of the state for the purpose of protecting the immediate and future health and welfare of the people of the state." Both the state and federal government regulate the pesticides allowed for use under this permit.

Ecology acknowledges that applicators could, with great difficulty, treat the pollutants addressed in this permit due to the diffuse nature and low concentrations that exist after the pesticides have become waste. *The Headwaters Inc. v. Talent* ruling established that aquatic pesticides become waste in the water after the pesticide has performed its intended action and the target organisms are controlled or if excess pesticide is present during treatment. Applicators may need to treat waters where pesticide residues threaten to cause unacceptable environmental harm in some situations, but not routinely.

Surface Water Quality-Based Effluent Limits

The Washington State Surface Water Quality Standards (chapter 173-201A WAC) were designed to protect existing water quality and preserve the beneficial uses of Washington's surface waters. Waste discharge permits must include conditions that ensure the discharge will meet established surface water quality standards (WAC 173-201A-510). Water quality-based effluent limits may be based on an individual waste load allocation or on a waste load allocation developed during a basin wide total maximum daily loading study (TMDL).

Numerical Criteria for the Protection of Aquatic Life and Recreation

Numerical water quality criteria are published in the Water Quality Standards for Surface Waters (chapter 173-201A WAC). They specify the levels of pollutants allowed in receiving water to protect aquatic life and recreation in and on the water. Ecology uses numerical criteria along with chemical and physical data for the wastewater and receiving water to derive the effluent limits in the discharge permit. When surface water quality-based limits are more stringent or potentially more stringent than technology-based limits, the discharge must meet the water quality-based limits.

Numerical Criteria for the Protection of Human Health

The U.S. EPA has published 91 numeric water quality criteria for the protection of human health that are applicable to dischargers in Washington State (40 CFR 131.36). These criteria are designed to protect humans from exposure to pollutants linked to cancer and other diseases, based on consuming fish and shellfish and drinking contaminated surface waters. The Water Quality Standards also include radionuclide criteria to protect humans from the effects of radioactive substances.

Narrative Criteria

Narrative water quality criteria (e.g., WAC 173-201A-240(1); 2006) limit the toxic, radioactive, or other deleterious material concentrations that the facility may discharge to levels below those which have the potential to:

- Adversely affect designated water uses.
- Cause acute or chronic toxicity to biota.
- Impair aesthetic values.
- Adversely affect human health.

Narrative criteria protect the specific designated uses of all fresh waters (WAC 173-201A-200, 2006) and of all marine waters (WAC 173-201A-210,; 2006) in the State of Washington.

Antidegradation

The purpose of Washington's Antidegradation Policy (WAC 173-201A-300-330; 2006) is to:

- Restore and maintain the highest possible quality of the surface waters of Washington.
- Describe situations under which water quality may be lowered from its current condition.
- Apply to human activities that are likely to have an impact on the water quality of surface water.
- Ensure that all human activities likely to contribute to a lowering of water quality, at a minimum, apply all known, available, and reasonable methods of prevention, control, and treatment (AKART).
- Apply three Tiers of protection (described below) for surface waters of the state.

Tier I ensures existing and designated uses are maintained and protected and applies to all waters and all sources of pollutions. Tier II ensures that dischargers do not degrade waters of a higher quality than the criteria assigned unless such lowering of water quality is necessary and in the overriding public interest. Tier II applies only to a specific list of polluting activities. Tier III prevents the degradation of waters formally listed as "outstanding resource waters," and applies to all sources of pollution.

Ecology considered Tier I and Tier II in this permit and determined that the permit does not cover discharges to Tier III waters.

Tier I applies water quality-based limits to point source discharges and is discussed below.

Tier II requirements for general permits are given in 173-201A-320(6) as follows:

(a) Individual activities covered under these general permits or programs will not require a Tier II analysis. (b) The department will describe in writing how the general permit or control program meets the antidegradation requirements of this section.(c) The department recognizes that many water quality protection programs and their associated control technologies are in a continual state of improvement and development. As a result, information regarding the existence, effectiveness, or costs of control practices for reducing pollution and meeting the water quality standards may be incomplete. In these instances, the antidegradation requirements of this section can be considered met for general permits and programs that have a formal process to select, develop, adopt, and refine control practices for protecting water quality and

meeting the intent of this section. This adaptive process must: (i) Ensure that information is developed and used expeditiously to revise permit or program requirements; (ii) Review and refine management and control programs in cycles not to exceed five years or the period of permit reissuance; and (iii) Include a plan that describes how information will be obtained and used to ensure full compliance with this chapter. The plan must be developed and documented in advance of permit or program approval under this section. (7) All authorizations under this section must still comply with the provisions of Tier I (WAC 173-201A-310).

This fact sheet describes how the permit and control program meets the antidegradation requirement.

Evaluation of Surface Water Quality-based Effluent Limits for Numeric Criteria

Ecology made a reasonable potential determination on the application of larvicides approved for use in the draft permit based upon Ecology contracted risk assessments for each larvicide active ingredient. Ecology has determined that application of the approved larvicides will not violate water quality standards or degrade existing uses if applicators follow permit BMPS and FIFRA label requirements

Ecology made a reasonable potential determination on the application of adulticides based upon knowledge of mosquito control practices and published research. It based this decision on calculations using available information. Ecology has determined that the application of adulticides will not violate water quality standards or degrade existing uses if applied as described during discussions with MCDs and during deposition studies (see bibliography) and if applicators follow permit BMPS and FIFRA label requirements.

In summary, Ecology has determined that if applicators properly apply and handle larvicides and adulticides in accordance with the terms and conditions of the general permit, the mosquito control activities will:

- Comply with State water quality standards.
- Maintain and protect the existing and designated uses of the surface waters of the State.
- Protect human health.

New information regarding previously unknown environmental and human health risks may cause Ecology to reopen the general permit.

The short-term water quality exceedance provisions of the draft permit allows the larvicide discharges authorized by the general permit to cause a temporary diminishment of some designated beneficial uses while it alters the water body to protect public health and promote public enjoyment and quality of life. A short-term exceedance only applies to short lived (hours or days) impairments, but short-term exceedances remain available throughout the permit term.

Short term exceedances for the discharge of larvicides may extent over the 5-year life span of the permit (long-term exceedance) provided the Permittee satisfies the requirements of WAC 173-201A-410. The Permittee must develop and implement an integrated pest management (IPM) plan that follows the Administrative Procedures Act (chapter 34.05 RCW) for public involvement and complete a Sate Environmental Policy Act (chapter 43.21C RCW) evaluation

of the proposed activity.

The activities authorized by this general permit do not have a reasonable potential to cause a violation of state water quality standards (WAC 173-201A) so long as Ecology allows the activities under the short-term water quality exceedance provision. The water quality modification provides for an exception to meeting certain provisions of the state water quality standards, such as meeting all beneficial uses all the time. Activities covered under this permit are allocated a temporary zone of impact on beneficial uses, but the impact must be transient (hours or days), and must allow for full restoration of water quality and protection of beneficial uses upon project completion. The conditions of this permit constitute the requirements of a short-term water quality exceedance.

Washington's water quality standards now include 91 numeric health-based criteria that Ecology must consider when writing NPDES permits. The U.S. EPA established these criteria in 1992 in its National Toxics Rule (40 CFR 131.36). Ecology has determined that the Permittee's discharge does not contain chemicals of concern based on existing data or knowledge. Chemicals of concern may be part of the "other ingredients" listed on FIFRA labels. Ecology does not have access to the "other ingredients" because they are proprietary.

Sediment Quality

The aquatic sediment standards (WAC 173-204) protect aquatic biota and human health. Under these standards, Ecology may require a facility to evaluate the potential for its discharge to cause a violation of sediment standards (WAC 173-204-400). You can obtain additional information about sediments at the Aquatic Lands Cleanup Unit website.
http://www.ecy.wa.gov/programs/tcp/smu/sediment.html

Ecology has determined through a review of the discharger characteristics and effluent characteristics that this discharge has no reasonable potential to violate the Sediment Management Standards.

SEPA Compliance

Mosquito control activities have undergone numerous environmental impact evaluations. The draft permit conditions the uses of pesticides to mitigate environmental impacts of concern noted in these evaluations. The conditions of this permit should satisfy any water quality related SEPA concerns.

Endangered Species

EPA has implemented the Endangered Species Protection Program to identify all pesticides that when used may cause adverse impacts on threatened/endangered species and to implement measures that will mitigate identified adverse impacts. When an adverse impact is identified, the Endangered Species Protection Program requires use restrictions to protect endangered/threatened species at the county level. EPA will specify these use restrictions on the product label or by distributing a county specific Endangered Species Protection Bulletin specified on the product label.

Ecology has further limited the application of pesticides for mosquito control in areas identified by WDFW as being critical habitat for state and federal endangered, candidate, threatened and sensitive species. In most cases, applicators may use *Bacillus spp.* based larvicides but must obtain Ecology and WDFW approval before using all other larvicides in critical habitats. Applicators must not use adulticides in critical habitat areas unless Ecology approves the use due to a human health issue.

Based upon annual reporting of pesticide use and other available information, Ecology may further restrict pesticide use to protect endangered, threatened, candidate and sensitive species such as pacific salmonids.

PROPSED PERMIT CONDITIONS

S1. Permit Coverage

Activities Covered Under This Permit

All entities that participate in mosquito control activities that result in discharge of pollutants to waters of the state must have coverage under the Permit as required by Washington laws (90.48.080, 90.48.160 and 90.48.260 RCW, 173-226-020 WAC). The discharges requiring permit coverage may be direct or indirect.

An example of direct discharge is the application of larvicides directly to waters of the state. An indirect example is the incidental discharge of adulticides (for vector mosquito control) to waters of the state for applications that do not directly target surface waters of the state.

Activities covered under a Federal *Experimental Use Permit* must also apply for permit coverage

Activities That May Not Need Coverage Under this Permit

Ecology has determined not to issue permit coverage for retention and detention ponds if:

1. Ecology regulates its discharge under another permit (such as industrial or municipal stormwater permits) and the permit allows chemical treatment.
2. There is no discharge to surface waters within two weeks of treatment.

Ecology has determined not to issue permit coverage for constructed water bodies or upland farm ponds if:

1. The water bodies are five acres or less in surface area, and
2. There is no discharge to surface waters within two weeks of treatment.

Ecology has determined not to issue permit coverage for seasonally dry wetlands if:

1. The wetland is dry at the time of treatment and for two weeks following treatment, and
2. The chemical will not be biologically available when the area is inundated with water.

Ecology has determined not to issue permit coverage for standing water on irrigated fields if:

1. Irrigation is not occurring at the time of application so that there is no direct run-off to surface waters of the state or run off to waters of the state through irrigation return flows.
2. The chemical will not be biologically available during irrigation following application of pesticides.

Ecology believes that the two-week holding time sufficiently allows the dissipation of the pesticide products prior to possible discharge to surface waters. Ecology believes that if applicators meet these conditions, the treatment poses no potential to violate the Water Quality Standards for Surface Waters of The State of Washington (chapter 173-201A WAC).

The draft permit describes these situations so as not to burden Ecology and the mosquito control entities by oversight and permit requirements in situations where Ecology has pre-determined a discharge will not occur.

Geographic Area Covered

The draft Permit applies to the application of pesticides for mosquito control to surface waters anywhere in the State of Washington where Ecology has authority. Ecology defines surface waters of the state as "lakes, rivers, ponds, streams, inland waters, salt waters, wetlands, and all other surface waters and water courses within the jurisdiction of the state of Washington (90.48.020 RCW, 173-201A-020 and 173-226-030 WAC)." Depending on species, mosquitoes have the potential to breed in any water of the state. These sites include, but are not limited to, riparian areas, wetlands, marshes, rivers, year round and seasonal streams, lakes, ponds, wet pastures, brackish areas, and estuaries.

Washington State Department of Health Blanket Permit Coverage

A definition of "Permittee" is not provided in chapter 90.48 RCW, chapters 173-216, 173-220, or 173-226 WAC, nor is one provided in 40 CFR 122 (EPA NPDES Permit Program) or 123 (State NPDES Permit Programs). Based upon the usage of Permittee in federal and Washington State law, Ecology takes the term "Permittee" to mean "the person or entity that discharges or controls the discharge of pollutants to waters of the state (surface or ground) and holds permit coverage allowing that specific discharge."

When Ecology issued the current Permit in 2007, it issued coverage to Washington State Department of Health, and three other separate entities (Columbia Mosquito Control District, Seattle Public Utilities, and Pierce County Public Utility District). Ecology issued DOH blanket coverage for the entire state. DOH contracted with numerous other entities (referred to as "limited agents") to actually perform the pesticide applications for mosquito control. The limited agents under DOH blanket coverage were responsible for applying mosquito control pesticides in compliance with the terms of the permit, but were not directly responsible for permit violations as Permittees, or responsible for the permit fees associated with having a coverage that allows discharge to waters of the state. Ecology has determined that DOH does not meet the definition of Permittee. It is not directly in control of the pesticide discharges (the limited agents are), but because it holds permit coverage is liable for any violations of permit conditions. DOH is also responsible for the permit fees (90.48.465 RCW, chapter 173.224 WAC) associated with

coverage under the permit.

In the draft 2010 Permit, Ecology changed who must obtain coverage. Current limited agents must obtain permit coverage directly from Ecology because they (and not DOH) discharge the pollutants. Ecology has retained the separate permit coverages for Columbia Mosquito Control District, Seattle Public Utilities and Pierce County Public Utility District under the updated 2010 Permit because they meet the definition of Permittee.

After the effective date of the 2010 Permit, limited agents will have 60 days to transfer coverage from DOH. Transferring coverage from DOH after the effective date of the permit limits unnecessary paperwork associated with having limited agents move to separate coverages. To transfer coverage, the limited agents and DOH must fill out and sign the transfer form provided as Permit Appendix C, then submit the completed form to Ecology. Each limited agent must complete a transfer form, or in the case of commercial applicators, for each area that they cover under a different contract.

If limited agents do not transfer their coverage as described above, then they are no longer authorized to discharge any pesticide to waters of the state until it gains coverage under the updated Permit. Should the applicator continue to discharge pesticide to waters of the state without permit coverage, Ecology will consider the discharge as a discharge without a permit (90.48.080 and 90.48.160 RCW and 173-226-020 WAC). The unpermitted applicator will be subject to enforcement activities (90.48.140 and 90.48.142 RCW and 173-226-250WAC), such as fines up to $10,000/day for discharges without Permit coverage.

An applicator that does not complete a transfer or permit coverage from DOH within the 60 days and still wants conduct mosquito control applications must begin the permitting process as a new permittee, completing the required permit coverage application steps (such as SEPA review and public notice) as detailed in Permit Section S2.

S2. Permit Application Requirements

Ecology plans to issue the Permit for a period of 5 years, starting on the effective date of the permit (WAC 173-226-330). Coverage under the Permit will last from the date of coverage to the date of permit expiration, which will be up to 5 years.

New Applicants for Permit Coverage

A *new applicant* is any entity that proposes to discharge pesticide into waters of the state for the purpose of mosquito control, but does not have permit coverage at the time Ecology issued the updated Permit in 2010. New applicants that do not have permit coverage must submit a complete application for permit coverage a minimum of 60 days before applying pesticides that result in discharge to waters of the state.

A new permit applicant must submit a complete application including a Notice of Intent (NOI), a completed SEPA (chapter 197-11 WAC) checklist. An official who has signature authority (173-226-200 WAC) for the entity applying for permit coverage must sign both documents. Ecology must receive the complete application for permit coverage on or before the publication date of the public notice the permit applicant posted in a newspaper of general circulation (173-

226-130 WAC). Ecology considers a newspaper of general circulation as the major newspaper publication for a region.

When Ecology receives s the new applicant's complete application before public notice it can review the application and communicate necessary changes on application documents. Communication (prior to publishing public notice) about document changes can save the applicant money by identifying necessary changes before the applicant publishes public notice and then needs to re-public notice due to substantive changes on the application.

The public has the opportunity to comment on the permit application and the proposed coverage during the 30 days after publication of the public notice (public comment period). Ecology will consider comments about the applicability of the Permit to the proposed activity received during this period. If Ecology receives no substantive comments, it will issue permit coverage on the 61st day following receipt of a complete application.

S3. Discharge Limits

The 2010 Permit includes different discharge limits for larvicides and adulticides. Ecology made these changes because Permittees apply larvicides directly to water, and because it added requirements for adulticide use limiting application to when human health is known to be threatened based on environmental monitoring and mosquito surveillance.

In 2006, Ecology updated the Water Quality Standards for Surface Waters of the State of Washington (Chapter 173-201A WAC). Ecology proposes to change the limits in the 2010 permit to reflect these changes. The standards now allow a temporary exceedance of water quality standards for up to 5 years (the term of a general permit) provided the Permittee has followed certain guidelines. WAC 173-201A-410(2) requires that in order for Ecology to extend the exceedance for up to 5 years, and not limit it to hours or days, the Permittee must develop and implement an integrated pest management plan. The Permittee must develop the plan following the Administrative Procedures Act for public involvement (chapter 34.05 RCW) and must complete a State Environmental Policy Act (Chapter 43.21C RCW and Chapter 197-11 WAC) review of the proposed activity. Permittees who do not meet these requirements must ensure that the short-term exceedance of water quality standards is limited to only hours or days. Because this is a requirement of the permit and state law, the public, through Ecology, may request the integrated pest management plan developed by the Permittee during a public disclosure request. Ecology may also request the plan.

Ecology has determined that adulticides, used in compliance with FIFRA, AKART, and that only generate incidental discharges during vector mosquito control do not have a reasonable potential to violate water quality standards. A temporary exceedance of water quality standards allowed for in Chapter 173-201A WAC only applies to discharges that will otherwise violate water quality standards. Based on Ecology's determination that the potential to violated water quality standards is low, Ecology has not included a temporary exceedance of the water quality standards under 173-201A-410 WAC in the Permit. Any adulticide application for vector mosquitoes covered under this permit must not cause or contribute to a violation of water quality standards.

S4. Larvicide Use

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 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.

Ecology has retained the methoprene use restrictions in Permit Appendix B areas at the request of Washington State Department of Fish and Wildlife.

Experimental Use of Larvicides

Use of larvicides under both federal and state experimental use permits (EUP) is included in the Permit. Federal EUPs are issued only in the context of a research and development effort for a new pesticide not currently registered with EPA (FIFRA Section 3) or for the registration of a new use of a currently registered pesticide (40 CFR 172.2). Research sites may be more than 10 acres of land, but aquatic sites are limited to a total of 1 acre or less for the entire state. Only the holder of the federal EUP may use and apply the pesticide being researched. You can find the full requirements for federal EUPs at http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&sid=908f9afd6be4e31b7d6bc89b84aed27a&rgn=div5&view=text&node=40:23.0.1.1.22&idno=40.

Washington State law (WAC 16-228-1460) requires that State issued individual EUPs have a Federal EUP. State Collective EUPs are limited to 1 acre or less.

S5. Adulticide Use for Nuisance and Vector Control

Nuisance Mosquito Control

The daft permit does not authorize the discharge of any adulticide for *nuisance mosquito control*. Ecology made this decision for several reasons.

FIFRA labels list the ingredients included in a pesticide product formulation as "*active*" and "*inert*," though the use of inert is changing to the use of "*other*." The active ingredient is the chemical in a formulation that provides the pesticidal properties. FIFRA regulations define inert

ingredients as chemicals included in a pesticide formulation to increase the effectiveness of the active ingredient. Therefore, they may have environmental effects, even if not a direct effect. Because these other ingredients are unknown due to their proprietary nature, Ecology cannot determine their affects in the environment for permitting purposes. EPA plans to propose a rule that would require disclosure of all inert/other ingredients in a pesticide formulation to the public. At the time of writing, you can find more information about this rule making at http://www.epa.gov/opprd001/inerts/#disclosure.

Ecology is concerned that inert/other ingredients contained in pesticide formulations could have unknown effects in the environment. Currently, EPA has assessed the risk of the active ingredient in pesticide formulations. This risk assessment does not take into account the "other" or "inert" ingredients that make up a pesticide formulation and the interactions these chemicals (alone or in combination) may have with the environment.

Chemical interactions may have additive, synergistic or negative interactions with each other.

- An additive interaction occurs when the effect of two (or more) different active ingredients added together cause the mortality seen.
- A negative interaction occurs when two (or more) active ingredients inhibit each other's effectiveness resulting in less effect overall.
- A synergistic effect occurs when two (or more) chemicals interact in such a way that additive interaction cannot explain the increase in effectiveness. The interaction of the chemicals would result in a multiplicative increase (by some factor) in effectiveness. An example of synergy is the addition of PBO to pyrethroid-based formulations to increase their effectiveness. PBO blocks the enzyme that would stop the pyrethroid from acting, thereby increasing the effectiveness of the pyrethroid (factor of increase unknown).

The draft permit requires discharges to comply with water quality standards. Because of the unknowns in adulticide formulations, Ecology cannot determine with reasonable certainty that regular applications of adulticides to control nuisance mosquitoes will not cause violations of water quality standards (chapter 173-201A WAC).

In addition, of Ecology includes adulticide use for nuisance mosquitoes that allows a discharge it would need to set effluent limits and include monitoring of the effluent at least once a year. Monitoring for effluent from adulticide applications is a difficult task and water sample analysis for pyrethroids using Gas Chromatography/Mass Spectroscopy costs between $400 and $600 per sample according to Ecology's Manchester Laboratory. Commercial laboratories may charge less. ELISA tests for pyrethroids are available, but have a quantitation range of 1-80 ppb, which is above the level of some acute and chronic environmental effects.

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.

In future permit cycles, Ecology may consider authorizing the limited discharge of adulticides and their residues to waters of the state for nuisance mosquito control. For this to occur, the pesticide *product formulations* proposed for use, including those authorized for use in vector mosquito control, must undergo a risk assessment prior to inclusion in a future permit. Due to resource issues, it is unlikely that Ecology will conduct, or contract out risk assessments for the near future. If other entities choose to pursue a risk assessment, for each pesticide product formulation, they must:

1. Prepare an assessment independent of the risk assessment conducted by EPA on the **active ingredient** during the registration process.
2. Address risks and concerns specific to Washington State.
3. Address the acute and chronic toxicity in the environment from the entire pesticide product formulation on the most sensitive organisms.
4. Include all formulation ingredients in the product, such as:
   a. Active ingredients;
   b. Inert ingredients;
   c. Other ingredients;
   d. Synergists;
   e. Solvents;
   f. All other additives
5. Take into account the ambient or background levels of pesticides in sediments and waters of the state from human activities.
6. Include toxicity testing and an intended use plan explaining how toxic threshold concentrations will be avoided in waters of the state. The toxicity testing and intended use plan must be generally based upon Appendix G of *Laboratory Guidance and Whole Effluent Toxicity Test Review Criteria*, Ecology Publication No. WQ-R-95-80.
7. Include any other information Ecology determines is necessary to evaluate the risk associated with the use of a pesticide product formulation.
8. Use a qualified toxicologist with experience in environmental toxicology.
9. Obtain Ecology approval.

Vector Mosquito Control

Ecology has only authorized the *incidental discharge* of adulticides during *vector mosquito control* in this permit. Incidental discharge is the minimum amount of adulticide deposition possible to surface waters of the state during properly conducted pesticide applications (in accordance with this permit and the FIFRA label) for controlling vector mosquitoes. Ecology made this decision to balance the importance of environmental health and human health.

Ecology is making allowances for the control of mosquitoes that are spreading acknowledged diseases to humans to protect public health. Currently, DOH data shows that only West Nile virus (WNV), St Louis (SLE), and Western Equine Encephalitis (WEE) are endemic in Washington Permit. DOH also commented that diseases could migrate to new locations. Based on these comments, Ecology addressed generic mosquito born disease, not specific diseases, in the draft 2010 Permit. When DOH determines and acknowledges that a disease is mosquito born (specific to a species or several species of mosquitoes), and endemic or epidemic, then Ecology will consider those mosquitoes as vectors for purposes of this permit.

Ecology has not excluded the option of including monitoring or studies through the administrative order process should adulticide use be different from currently available information or if environmental impacts are reported.

Depending on the level of organized mosquito surveillance in an area, the draft permit includes different requirements for meeting the threshold for using adulticides to control vector mosquitoes. Ecology made this decision to reduce the time and steps necessary to move forward with vector mosquito control when public health is threatened.

Areas with a Mosquito Control Districts

The creation of a mosquito control district is a public process outlined in chapter 17.28 RCW. A MCD is actually a quasi-governmental agency that has the authority to tax the public within the jurisdiction of the MCD.

MCDs have the knowledge and experience with mosquito control in their district that allows it to best factor in all the variables to determine when adult vector mosquito control is necessary. The Permit requirements take this knowledge and experience into account, and allow relative autonomy for the MCD to make application decisions based on mosquito surveillance, monitoring of disease indicators in the environment (such as through the vector-borne disease notifications lists through DOH) and within the requirements of the permit.

Prior to the development of the draft permit, Ecology discussed with DOH how to determine when it should allow application of adulticides. DOH suggested Ecology use Alert Level 3 from the West Nile Virus Outbreak Response Plan as the point at which Ecology should allow adulticiding for WNV vector mosquitoes. Attempting to balance human health and environmental health, Ecology included this level as the point at which it would allow adulticiding because the level represents a more significant threat to public health than level 1 or 2.

Areas without MCDs or organized mosquito programs

In areas without a MCD or other organized mosquito surveillance, the Permittee depends on the professional expertise of Washington State Department of Health to look at the environmental factors related to mosquito borne disease to determine if the situation requires intervention by using adulticides.

Experimental Use Permits

Use of adulticides under both federal and state experimental use permits (EUP) is included in the Permit. Federal EUPs are issued only in the context of a research and development effort for a new pesticide not currently registered with EPA (FIFRA Section 3) or for the registration of a new use of a currently registered pesticide (40 CFR 172.2). Research sites may be more than 10 acres of land, but aquatic sites are limited to a total of 1 acre or less for the entire state. Only the holder of the federal EUP may use and apply the pesticide being researched. You can find the full requirements for federal EUPs at http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&sid=908f9afd6be4e31b7d6bc89b84aed27a&rgn=div5&view=text&node=40:23.0.1.1.22&idno=40.

Washington State law (WAC 16-228-1460) requires that State issued individual EUPs have a Federal EUP. State Collective EUPs are limited to 1 acre or less.

S6. Public Notification of Pesticide Use

The intent of any public notice is to make the public aware of those activities taking place that have the possibility of affecting them. The intent of this section of the permit is to inform the public of pesticide use for mosquito control and make the public aware of where they can find accurate information about the use of pesticides. For various reasons, individuals in communities wish to limit their exposure to pesticides. For example, some individuals may need information due to chemical sensitivity, others because of lifestyle choices. All members of the public have the right to know when they are exposed to chemicals, so they can make informed decisions about limiting their exposure.

Ecology adopted the requirements for public notice, posting, and legal notice of pesticide applications from previous public notification requirements in Ecology-issued orders and short-term modifications. In some cases, Ecology based the public notification requirements on EPA FIFRA label requirements. In all other cases, Ecology based the requirements on its best professional judgment and the public's right to know.

The draft permit requires applicators to post notices at all reasonable points of ingress and egress to the treatment areas when applying larvicides with water use restrictions to water bodies that are used for water supply, fish and shellfish harvesting, or water contact activities. Ecology suggests that applicators also post notices at sites that are not directly accessible to the public (e.g. catch basins, storm drains, utility and transportation vaults, etc). Applicators must also make adulticide application area maps available to the public.

S7. Monitoring Requirements

Ecology requires monitoring, recording, and reporting (WAC 173-226-090 and 40 CFR 122.41) to verify that the treatment process is functioning correctly and that the discharge complies with the permit's effluent limits. Permittees with coverage under the Permit must monitor the amount of pesticides it uses and report the information to Ecology in its annual report (permit section S8).

Permittees must also monitor mosquito (surveillance) and other environmental factors to determine when adulticiding for vector mosquitoes is appropriate. Ecology does not currently have a coordinated monitoring program for vector mosquito control. The Permittee describes how it will monitor in its integrated pest management plan and bases monitoring decisions on environmental factors such as mosquito surveillance. Ideally, mosquito surveillance will be central to an environmental monitoring program for mosquito control. Surveillance should include trapping mosquitoes and testing of those mosquitoes for the presence of disease. Adulticiding for vector mosquitoes should only occur when human health is threatened.

The draft permit includes dip sampling and requires applicators to maintain records so that they do not treat water bodies unless mosquito larvae are actually present and so that the appropriate

larvicide is used. Over-treatment could lead to pesticide resistance.

S8. Reporting Requirements

Annual Report

Permittees meet part of the monitoring requirements for the purposes of this permit through annual reporting. The annual report summarizes the amount of pesticides used during the course of a treatment season. It allows Ecology to track how much pesticide applicators use in Washington State for a specific use. Section S8 of the permit contains specific conditions based on Ecology's authority to specify any appropriate reporting and recordkeeping requirements to prevent and control waste discharges (WAC 173-226-090).

Annual reporting also allows Ecology to determine if pesticide use is increasing or decreasing in the State. Depending on the results from annual reporting, Ecology may require the Permittees to conduct a study to determine effects on the environment from pesticides used in mosquito control that addresses Washington specific issues (such as endangered salmonids). One factor that might cause Ecology to consider requiring a study is if actual adulticide use is much higher than the usage estimated by MCDs, or if adulticides use increases significantly without a public health reason.

Records Retention

Ecology based permit condition S8 on its authority to specify any appropriate reporting and recordkeeping requirements to prevent and control waste discharges (WAC 173-226-090). Applicators must keep all records and documents required by the MCGP for 5 years.

Reporting Permit Violations

WAC 173-226-080(1)(d) states that a discharge of any pollutant more frequently or at a level in excess of that authorized is a permit violation. Ecology requires that if a Permittee violates the permit conditions, it must take steps to stop and minimize any violations and report those violations to Ecology. For pesticide applications authorized in the Permit, applicators must report violations to the Aquatic Pesticide Permit Manger and Regional Spills (ERTS Hotline), within 24 hours. This allows Ecology to determine if more action is necessary to mitigate the permit violation.

WAC 173-226-070 allows Ecology to place impose permit conditions to prevent or control pollutant discharges from plant site runoff, spillage or leaks, sludge or waste disposal, or materials handling or storage and allows Ecology to require the use of Best management practices (BMPs). BMPs means schedules of activities, prohibitions of practices, maintenance procedures, and other management practices to prevent or reduce the pollution of the waters of the state. BMPs also include treatment requirements, operating procedures, and practices to control plant site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage. The Permittee must be prepared to mitigate for any potential spills and, in the event of a spill, perform the necessary cleanup, and notify the appropriate Ecology regional office (see RCW 90.48.080, and WAC 173-226-070).

General Conditions

Ecology bases the General Conditions on state and federal law and regulations.

Duty to Reapply

All NPDES permits require the Permittee to reapply for coverage 180 days prior to the expiration date of the general permit in accordance with 40 CFR 122.21(d), 40 CFR 122.41(b), and WAC 183-226-220(2). For the current Permit (2007), only DOH, Columbia Mosquito Control District, Seattle Public Utilities, and Pierce County Public Utility District needed to reapply. All Permittees re-applied in a timely manner.

To reapply for the permit, the Permittee must complete a new NOI, which is the same form Permittees completed in Secure Access Washington (SAW) when originally applying for permit coverage. Update the information included on the electronic NOI to reflect current operations, print, sign and submit the completed NOI to Ecology's Aquatic Pesticide Permits Manager. The permit lists the mailing address under Permit Section S2.D.

PERMIT ISSUANCE PROCEDURES

Permit Modifications

Ecology may modify this permit to impose new or modified numerical limits, if necessary to meet Water Quality Standards for Surface Waters, Sediment Quality Standards, or Water Quality Standards for Ground Waters, based on new information obtained from sources such as inspections, effluent monitoring, or Ecology approved engineering reports. Ecology may also modify this permit because of new or amended state or federal regulations.

Recommendation for Permit Issuance

The general permit meets all statutory requirements for authorizing a wastewater discharge, including those limits and conditions believed necessary to control toxics, protect human health, aquatic life, and the beneficial uses of waters of the State of Washington. Ecology proposes to issue this general permit for five (5) years.

GLOSSARY

All definitions listed below are for use in the context of this permit only.

Active Ingredient: The ingredient in a pesticide product formulation that provides the insecticidal effects. There may be more than one in a product formulation and may be combined with other additives to increase the insecticidal effects.

Adjacent: Something or somewhere near but not necessarily right next to something else.

Adulticide: A pesticide product designed to target adult mosquitoes and applied using ultra-low volume techniques.

Alert Level: Levels assigned by Washington Department of Health to the relative threat of a disease outbreak based on infection rates, time of year, mosquito surveillance and other factors.

All Known and Reasonable Technologies (AKART): All known, available, and reasonable methods of pollution control and prevention as described in 90.48.010, 90.48.520, 90.52.040, and 90.54.020 RCW and 173-201A-020, 173-204-120, 173-204-400, 173-216-020, 173-216-050, 173-216-110, 173-220-130 WAC .

Arbovirus/Arboviral: An arthropod born virus or disease.

Best Management Practices (BMP): Practices, procedures, techniques, equipment, physical controls or any actions that minimize discharges to waters of the state in addition to permit requirements; may be synonymous with AKART. The Ecology publication "Best Management Practices for Mosquito Control" are BMPs.

Blanket Coverage: permit coverage extended to mosquito control entities by Washington Department of Health through their NPDES permit coverage to control mosquitoes in Washington State.

Code of Federal Regulations (CFR): means a codification of the general and permanent rules published in the Federal Register by the Executive departments and agencies of the Federal Governments. Environmental regulations are in Title 40.

Constructed water body: A human-made water body in an area that is not part of a previously existing watercourse, such as ponds, streams, wetlands, etc.

Conveyance: means a mechanism for transporting water of wastewater from one location to another location including, but not limited to pipes, ditches, and channels.

Detention: means the collection of water into a temporary storage device with the subsequent release of water either at a rate slower than the collection rate, or after a specified time period has passes since the time of collection.

Dip/Dipping: The act of scooping up a small amount of water and examining it for the presence/absence of mosquito larvae.

Discharge: The addition of any pollutant to a water of the state.

Discharger: means an owner or operator of any 'facility', 'operation', or activity subject to regulation under chapter 90.48 RCW. An 'entity' or 'mosquito control entity' may be a discharger.

Encephalitis: Inflammation of the brain.

Entity(s): Who is in control of pesticide applications, would apply for permit coverage and includes, but is not limited to Mosquito Control Districts, Commercial Pest Applicators, Cities, Counties, Public Utility Districts, Public Health Districts, Municipalities, State and Local agencies, and any other commercial, private, public, or government entity providing mosquito control.

Environmental Protection Agency (EPA): Means the U.S. Environmental Protection Agency or, where appropriate, the term may also be used as a designation for a duly authorized official of said agency.

Experimental Use Permit: Federal and state permits that allow the use of unregistered pesticides in the context of research and development for registration of the pesticide under FIFRA Section 3, or in the context of research and development for registration of a new use of a currently registered pesticide under FIFRA Section 3. See 40 CFR 172, 15.58.405 RCW, and WAC 16-228-1460.

FIFRA: Federal Insecticide, Fungicide, and Rodenticide Act

FWPCA: Means the Federal Water Pollution Control Act (33 U.S.C. 1251 et seq.), as now or as it may be amended.

General Permit: means a permit which covers multiple discharges of a point source category within a designated geographical rate, in lieu of individual permits being issued to each discharger.

Ground Water: means any naturally occurring water in a saturated zone of stratum beneath the surface of land or a surface water body.

Incidental: The minimum amount of adulticide deposition possible to surface waters of the state during properly conducted pesticide applications (in accordance with this permit and the FIFRA label) for controlling vector mosquitoes.

Individual Permit: means a discharge permit specific to s single point source or facility.

Integrated Pest Management Plan (IPMP): An ecologically based strategy for pest control that incorporates monitoring, biological, physical, and chemical controls in order to manage pests with the least possible hazard to people, then environment and property. IPMP considers all available control actions, including no action. Pesticide use is only one control action.

Larvicide: A pesticide product designed to target mosquitoes in larva and pupa life stages and applied directly to water.

Meningitis: Inflammation of the membranes covering the brain and spinal cord.

Meningoencephalitis: Inflammation of the brain and membrane surrounding it.

Mosquito Control District (MCD): A district organized under the authority of chapter 17.28 RCW for the control of mosquitoes in Washington State.

Mosquito Control Entity: See 'Entity.'

Natural Pyrethrin: Chemicals isolated from the chrysanthemum flower that have insecticidal properties.

New Applicant: An entity or mosquito control entity that proposes to begin discharge of pesticides to control mosquitoes and that does not yet have permit coverage but is beginning the permitting process by submitting a complete application to Ecology.

New Permittee: Permittees who begin mosquito control activities using pesticides after the effective date of this permit. This does not include Permittees who were covered under Washington State Department of Health's blanket NPDES permit coverage unless they fail to transfer permit coverage (section S1.D) within 60 days of the effective date of this permit.

NPDES: means the National Pollution Discharge Elimination System under section 402 of FWPCA.

Nuisance Mosquito Control: The use of IPM, larvicides and adulticides to control mosquitoes that are an annoyance to humans and animals but are not known, in Washington State, to carry disease that may be transmitted to humans.

Open Accessible Areas: Areas that are easily accessible by the public (e.g. wetlands, ponds, lakes, etc.)

Planned Treatments: A schedule of treatment dates developed by the mosquito control entity at the beginning of the treatment season.

Permit: Means an authorization, license, or equivalent control document issued by Ecology to implements chapter 173-200, 173-216 and or 173-226 WAC.

Permittee: Entities that apply for and gain coverage under this permit and have control of or cause the discharge permitted under coverage of this permit.

Pesticide: A chemical formulation that has insecticidal properties and is used to control mosquitoes.

Pesticide Applicator(s): An individual with the appropriate Washington State Department of Agriculture (WSDA) license(s) to apply aquatic (larvicides) and aerial/ground (adulticides) pesticides.

Pesticide Resistance: The build-up of a tolerance to a pesticide by the target insect through survival of individuals who are not impacted by enough pesticide to cause mortality or through genetic variance have natural tolerance. When an insect is pesticide resistant to a specific formula, that formula will have reduced efficacy or sometimes no effect at all.

Poliomyelitis: Inflammation of the spinal cord.

Pollutant: Means any substance discharged that would alter the chemical, physical, thermal, biological, or radiological integrity of the waters of the state of would be likely to create a nuisance or renders such waters harmful, detrimental or injurious to the public health, safety, or welfare, or to any legitimate beneficial use, or to any animal life, either terrestrial or aquatic. Pollutants include, but are not limited to, the following: dredged spoil, solid waste, incinerator residue, filter backwash, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt, pH, temperature, TSS, turbidity, color, BOD5, TDS, toxicity, odor, and industrial, municipal, and agricultural waste.

Product Formulation(s): The active, inert, and other ingredients specific to a brand name pesticide (e.g. Altosid, Permanone, or Trumpet EC).

Pyrethroid: A synthetic chemical insecticide formulated to mimic the action of the natural pyrethrins.

Qualified toxicologist: A person with a PhD in toxicology or in a health or ecological science with an emphasis in toxicology, or a person with a Master's degree in toxicology or a related science with an emphasis in toxicology, who is working in the field of toxicology.

Range: A specific series of dates that anticipates the months of planned treatment. This is a planned range-it can be exceeded if public health concerns arise.

Representative sampling: In a large treatment area, the sites selected within that area that provide statistical significance (as determined by a statistician).

Residue: Any excess pesticide applied during an application and any excess pesticide, all chemicals, and their degredants left behind after a pesticide has completed its purpose.

Secure Access Washington (SAW): The web based application where persons may apply for permit coverage and Permittee's may update information and submit annual reports. SAW is located at https://secureaccess.wa.gov.

Synergist: An additive or other active ingredient that increases the effectiveness of the main active ingredient in a pesticide formulation.

Surface Water(s): means all waters defined as "waters of the United States" in 40 CFR 122.2 within the geographic boundaries of the state of Washington. This include lakes, rivers, ponds, streams, inland waters, salt waters and all other surface waters and watercourses within the jurisdiction of the state of Washington. Also includes drainages to surface waters.

Surveillance: The act of setting traps to monitor for the presence of mosquitoes and to trap wild mosquitoes for mosquito-borne disease testing.

Ultra Low Volume (ULV): A type of pesticide application that uses very small amounts of pesticide per acre (approximately 1 fluid ounce per acre depending on FIFRA label requirements). This type of application creates an invisible fog with particles approximately 30 microns in size that drifts to impact adult mosquitoes.

Upland farm pond: Private farm ponds created from upland sites that did not incorporate natural water bodies (WAC 173-201A-260(3)(f)).

Vector Mosquito Control: The use of IPM, larvicides and adulticides to control mosquitoes that are known carriers, in Washington, of disease that may be transmitted to humans. The current list of endemic diseases in Washington includes West Nile virus, Western Equine Encephalitis, and St. Louis Encephalitis.

Washington Pesticide Control Act: Chapter 15.58 Revised Code Washington (RCW)

Water Supply, Conveyance, Drainage, or Other Restricted Access Systems: Restricted access areas that are accessible only through manholes or other means. Not readily accessible to the public (e.g. water, electrical or transportation vaults, storm drains, catch basins, etc.)

Waters of The State: All surface and ground waters in Washington State as defined by chapter 90.48.020 RCW, 173-201A-020 WAC and 173-226-030 WAC including any future amendments of state law. Also includes drainages to waters of the state.

Water-use Restriction: This refers to any product labeled for restricted water use immediately after treatment (currently applies only to malathion, temephos, and paraffinic white mineral oil).

West Nile Virus (WNV): An arboviral disease of the genus Flaviviridae. It is transmitted by mosquitoes and can have three outcomes: no symptoms, West Nile fever, and WNV neuroinvasive disease.

West Nile Fever: A form of WNV that has symptoms similar to that of seasonal influenza.

WNV Neuroinvasive Disease: A form of WNV that affects the central nervous system and may take the form of meningitis, encephalitis, meningoencephalitis, or poliomyelitis. Can be fatal.

In the absence of other definitions set forth herein, the definition as set forth in 40 CFR Part 403.3 or in chapter 90.48 RCW shall be used for circumstances concerning discharges.

BIBLIOGRAPHY

Books

1. Ebbing, Darrell D. and Gammon, Steven D., *General Chemistry 7th Edition*, Houghton Mifflin Company, Boston, MA, 2002.

2. Garner, Bryan A.; Editor, "*A Handbook of Basic Law Terms*," West Group, St. Paul Minnesota, 1999.

3. Harris, Daniel C., *Quantitative Chemical Analysis 6th Edition*, W. H. Freeman and Company, New York, NY, 2003.

4. Lide, David R. Ph.D. Editor-in-Chief, *CRC Handbook of Chemistry and Physics 83rd Edition*, CRC Press, New York, NY, 2002.

5. Little, V.A., *General and Applied Entomology, Third Edition*, Harper & Row, New York, New York, 1972.

Centers for Disease Control and Prevention (CDC) Publications

6. Gubler, Duane J., Sc.D et al., "*Epidemic/Epizootic West Nile Virus in the United States: Guidelines for Surveillance, Prevention, and Control*," Centers for Disease Control and Prevention Publication, Revision 3, 2003.

7. Hollingsworth, Doneen B. Chair, "Before The Swarm: Guidelines for the Emergency Management of Mosquito-Borne Disease Outbreaks," *The Association of State and Territorial Health Officials*, last accessed November 24, 2009, http://www.cdc.gov/ncidod/dvbid/westnile/astho/wnv_astho.html

8. Moore, C.G. et al., "Guidelines for Arbovirus Surveillance Programs in the United States," Centers for Disease Control and Prevention Publication, April 1993

9. National Center For Infection Diseases, CDC, "Infectious Disease Information," last accessed December 2009. http://www.cdc.gov/ncidod/diseases/list_mosquitoborne.htm

10. Division of Vector-Borne Infectious Diseases, CDC, "West Nile Virus," last accessed December 2009. http://www.cdc.gov/ncidod/dvbid/westnile/qa/symptoms.htm

11. Centers for Disease Control and Prevention, "Seasonal Influenza (flu)," last accessed December 2009. http://www.cdc.gov/flu/about/disease/

12. Division of Vector-Borne Infectious Diseases, CDC, "West Nile Virus Statisitcs, Surveillance, and Control," last accessed December 2009. http://www.cdc.gov/ncidod/dvbid/westnile/surv&control.htm#surveillance

Court Cases

13. *Headwaters et al., v. Talent Irrigation District*. U.S. Ct. of Appeals for the Ninth Cir. Ct. Case No. 99-35373, D.C. No.CV-98-06004-ALA. March 12, 2001. Cases not available online at www.ca9.uscourts.gov before 2005

14. *Fairhurst v. Hagener, Director, Montana Department of Fish, Wildlife & Parks*. U.S. Ct. of Appeals for the Ninth Cir. Ct. Case No. 04-35366, D.C. No.CV-03-00067-SEH OPINION. September 8, 2005.http://www.ca9.uscourts.gov/datastore/opinions/2005/09/07/0435366.pdf

15. *League of Wilderness Defenders et al., v. Harv Forsgren, Regional Forester, Pacific Northwest Region United States Forest Service*. U.S. Ct. of Appeals for the Ninth Cir. Ct. Case No. 01-35729, D.C No.CV-00-01383-RE OPINION. November 4, 2002. Cases not available online at www.ca9.uscourts.gov before 2005

16. *The National Cotton Council of America et al., v. United States Environmental Protection Agency*. U. S. Ct. of Appeals for the Sixth Cir. Ct. Case Nos. 06-4630;07-3180/3181/3182/3183/3184/3185/3186/3187/3191/3236. January 7, 2009. http://www.ca6.uscourts.gov/opinions.pdf/09a0004p-06.pdf

17. State Department of Ecology v Northwest Aquatic Ecosystems, et al., Thurston County Superior Court, Washington, Case No. 07-2-01447-8, November 26, 2008. http://www.ecy.wa.gov/programs/wq/pesticides/permit_documents/112608Order.pdf

Department of Ecology Publications

18. Marshall, Randall, "*Laboratory Guidance and Whole Effluent Toxicity Test Review Criteria*," Water Quality Program, Dept. of Ecology, Publication No. WQ-R-95-80, Revised December 2008.

19. Frank, Ashlea Rives et al, "The Potential Effects on Endangered Species from the Use of Four Insecticides and a Synergist for Adult Mosquito Control in Washington State," *Compliance Services International study sponsored by Washington State Department of Ecology*, CSI Study No. 08709, Ecology RFP 0819 WQ, April 2008, p. 1-34.

20. Anderson, Paul D. and Dugger, Dan, "*Surface Water Monitoring Program for Pesticides in Salmonid-Bearing Streams, 2007 Data Summary, A cooperative Study by Washington State Departments of Ecology and Agriculture*," Dept. of Ecology, Publication No. 08-03-009, April 2008.

Department of Health Publications

21. Washington State Department of Health, "Annex 2, West Nile Virus Outbreak Response Plan, to Appendix 10, Zoonotics Response Basic Plan," *DOH Comprehensive Emergency Management Plan Basic Plan*, February 2009, p. 1-49.

22. DOH info: http://www.doh.wa.gov/ehp/ts/Zoo/WNV/mosqdistribution.pdf

Federal Publications

23. 33 USC 1251 et seq.: Federal Water Pollution Control Act

24. Environmental Protection Agency, "*Application of Pesticides to Waters of the United States in Compliance With FIFRA*," Federal Register, Vol. 71, No. 227, November 27, 2006, p. 68483-68492. http://www.epa.gov/npdes/regulations/pest_final_rule.pdf

25. Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) http://www.epa.gov/oecaerth/civil/fifra/fifraenfstatreq.html

26. Lecky, James H, Director, Office of Protected Resources et al., "*National Marine Fisheries Service Endangered Species Act Section 7 Consultation, Biological Opinion, Environmental Protection Agency Registration of Pesticides Containing Chlorpyrifos, Diazinon, and Malathion*," National Oceanic Atmospheric Administration National Marine Fisheries Service Publication, November 18, 2008. http://www.nmfs.noaa.gov/pr/consultation/pesticides.htm

27. Piperonyl Butoxide Environmental Risk Assessment. Eckel, William P. et al.; EPA-HQ-OPP-2005-0042-0037, December 2004, Revised September 2005.

28. Reregistration Eligibility Decision (RED) for d-phenothrin. Bradbury, Steven, Ph.D., EPA-HQ-OPP-2008-0140, September 2008.

29. Reregistration Eligibility Decision (RED) for Naled. Rossi, Lois A., EPA 738-R-02-008, January 2002.

30. Reregistration Eligibility Decision (RED) for Permethrin. Keigwin, Jr. Richard P., EPA 738-R-09-306, Revised May 2009.

31. Reregistration Eligibility Decision (RED) for Piperonyl Butoxide (PBO). Edwards, Debra, Ph.D., EPA 738-R-06-005, June 2006.

32. Reregistration Eligibility Decision (RED) for Pyrethrins. Edwards, Debra, Ph.D., EPA 738-R-06-004, June 2006.

33. Reregistration Eligibility Decision (RED) for Resmethrin. Edwards, Debra, Ph.D.; EPA 738-R-06-003, June 2006.

34. Reregistration Eligibility Decision (RED) for Malathion. Keigwin Jr., Richard P. et al., EPA 738-R-06-030, Revised May 2009.

35. Science Policy Council Handbook: Risk Characterization. Fowle 3rd, John R. Ph.D. et al., EPA 100-B-00-002, December 2000.

All Reregistration Eligibility Decisions (REDs) complete by EPA are available at http://www.epa.gov/pesticides/reregistration/status.htm

Journal Articles

36. Antwi, Frank B. and Peterson, Robert KD, "Toxicity of δ-phenothrin and resmethrin to non-target insects," *Pesticide Management Science*, Vol. 65, No. 3, March 2009, p. 300-305.

37. Carney, Ryan M. et al., "Efficacy of Aerial Spraying of Mosquito Adulticide in Reducing Incidence of West Nile Virus, California, 2005," *Emerging Infectious Diseases*, Vol. 14, No. 5, May 2008, p.747.

38. Davis, Ryan S. et al., "An Ecological Risk Assessment for Insecticides Used in Adult Mosquito Management," *Integrated Environmental Assessment and Management*, Vol. 3, No. 3, 2007, p. 373-382.

39. Dwyer, F. J. et al., "Assessing Contaminant Sensitivity if Endangered and Threatened Species: Part III. Effluent Toxicity Tests," Archives of *Environmental Contamination and Toxicology*, Vol. 48, 2005, p. 174-183.

40. Helson, B.V. et al., "Laboratory toxicology of six forestry insecticides to four species of bee," *Archives of Environmental Contamination and Toxicology*, Vol.27, No. 1, 1994, p. 107-114.

41. Laetz, Cathy A. et al., "The Synergistic Toxicity of Pesticide Mixtures: Implications for Risk Assessment and the Conservation of Endangered Pacific Salmon," *Environmental Health Perspectives*, Vol. 117, No. 3, March 2009, p. 348.

42. Moffitt, John E., MD and Portnoy, Jay M., MD et al., Chief Editors, "Stinging Insect Hypersensitivity: A Practice Primer," *Journal of Allergy and Clinical Immunology*, Vol.104, No. 5, May 1999, p. 963-980. http://www.jacionline.org/article/S0091-6749(99)70450-1/fulltext

43. Moffitt, John E. MD, Chief Editor, "Stinging insect hypersensitivity: A Practice Parameter Update," *Journal of Allergy and Clinical Immunology*, Vol. 114, No. 4, October 2004 http://www.jacionline.org/article/S0091-6749(04)02165-7/abstract

44. Peterson, Robers K.D. et al.; "A Human-Health Risk Assessment for West Nile Virus and Insecticides Used in Mosquito Management," *Environmental Health Perspectives*, Vol. 114, No. 3, March 2006, p. 366-372.

45. Pierce, R.H. et al., "Aerial and Tidal Transport of Mosquito Control Pesticides into the Florida Keys National Marine Sanctuary," Revista de Biología Tropical (Int. J. Trop. Biol. ISSN-0034-7744), Vol. 53 (Suppl. 1), May 2005, p. 117-125.

46. Reddy, Michael R. et al., "Efficacy of Resmethrin Aerosols Applied from the Road for Suppressing *Culex* Vectors of West Nile Virus," *Vector-Borne and Zoonotic Diseases*, Vol. 6, No. 2, 2006, p. 117-127.

47. Schleier 3rd, Jerome J. et al., "A two-dimensional probabilistic acute human-health risk assessment of insecticide exposure after adult mosquito management," *Stochastic Environmental Research and Risk Assessment*, Vol. 23, No. 5, July 2009, p. 555-563.

48. ---Schleier 3rd, Jerome J. et al., "Environmental Concentrations, Fate, and Risk Assessment of Pyrethrins and Piperonyl Butoxide After Aerial Ultralow-Volume Applications for Adult Mosquito Management," *Environmental Toxicology and Chemistry*, Vol. 27, No. 5, 2007, p. 1063-1068.

49. ---Schleier 3rd, Jerome J. et al., "Equine Risk Assessment for Insecticides Used in Adult Mosquito Management," *Human and Ecological Risk Assessment*, Vol. 14, No. 2, 2008, p. 392-407.

50. ---Schleier 3rd, Jerome J. and Peterson, Robert K. D., "Deposition and Air Concentrations of Permethrin and Naled Used for Adult Mosquito Management," *Archives of Environmental Contamination and Toxicology*, published online June 18, 2009, http://www.springerlink.com/content/l112135726156830/, last accessed Nov 25, 2009.

51. Weston, Donald P. et al., "Aquatic Effects of Aerial Spraying for Mosquito Control over an Urban Area," *Environmental Science & Technology*, Vol. 40, No. 18, 2006, p. 5817-5822.

52. Wilson, Samantha D. MHSc. et al., "West Nile Virus: The Buzz on Ottawa Residents' Awareness, Attitudes and Practices," *Canadian Journal of Public Health*, Vol. , No. , 2005, p. 109-113.

53. The Working Group on Synergy in Complex Mixtures with The Harvard School of Public Health, "Synergy: Positive Interaction Among Chemicals in Mixtures," *The Journal of Pesticide Reform*, Summer 2009, p. 11-14.

Miscellaneous Resources

54. American Mosquito Control Association, "Mosquito Information" http://mosquito.org/mosquito-information/index.aspx, last accessed December 23, 2009.

55. Antonelli, Art et al., *Pest Management for Prevention and Control of Mosquitoes with Special Attention to West Nile Virus*," WSU Extension Puyallup, Pub. No.PLS-121, Revised April 2007.

56. Suffolk County New York Environmental Risk Assessment

Online Resources (Databases)

57. National Pesticide Information Center (NPIC): http://npic.orst.edu/

58. National Institutes of Health Environmental Health and Toxicology: http://sis.nlm.nih.gov/enviro.html

59. The Extension Toxicology Network (Extoxnet): http://extoxnet.orst.edu/

60. US EPA OPP Pesticide Fate Database: http://cfpub.epa.gov/pfate/home.cfm

61. Compendium of Pesticide Common Names (link from EPA: http://cfpub.epa.gov/pfate/Chem_details.cfm): http://www.alanwood.net/pesticides/index_cn_frame.html

Revised Code Washington (RCW)

62. Chapter 15.58 RCW: Washington pesticide control act

63. Chapter 17.28 RCW: Mosquito control districts

64. Chapter 43.21C RCW: State environmental policy

65. Chapter 90.48 RCW: Water pollution control

Technical Resources (Labels and MSDS)

66. Abate: http://www.clarke.com/index.php?option=com_content&view=category&layout=blog&id=78&Itemid=156#anvil

67. Anvil 10+10 http://www.clarke.com/index.php?option=com_content&view=category&layout=blog&id=78&Itemid=156#anvil

68. Di-Brom: http://www.amvac-chemical.com/dibromcon_labels.html

69. Permanone: http://www.bayerprocentral.com/bayer/cropscience/backedbybayer.nsf/id/EN_Vector_Labels_MSDS

70. Pyrocide: http://www.mgk.com/Professional-Pest-Control/Fogging%20Concentrates/Pyrocide-100.aspx

71. Scourge: http://www.bayerprocentral.com/bayer/cropscience/backedbybayer.nsf/id/EN_Vector_Labels_MSDS

72. Trumpet: http://www.myadapco.com/product_adulticides.jsp

73. Permethrin Technical MSDS: http://www.agrisel.com/permethrin.html

74. Permethrin Technical MSDS: http://msds.chem.ox.ac.uk/PE/permethrin.html

Washington Administrative Code (WAC)

75. Chapter 173-201A WAC: Surface water quality standards for Washington State

76. Chapter 173-204 WAC: Sediment Management Standards

77. Chapter 173-205 WAC: Whole effluent toxicity testing and limits

78. Chapter 173-226 WAC: Waste discharge general permit program

79. Chapter 197-11 WAC: State environmental policy act (SEPA) Rules

APPENDIX A: PUBLIC INVOLVEMENT INFORMATION

In order to be considered, all comments about the proposed permit must be received by 5 pm on March 10, 2010 (35 days from the date of public notice)

Ecology has tentatively determined to reissue the Mosquito Control General Permit to mosquito control activities as identified in Special Condition S1., Permit Coverage. The proposed permit will revoke and replace the current permit.

Ecology will publish a Public Notice of Draft (PNOD) on February 3, 2010 in the Washington State Register. The PNOD informs the public that the draft permit and fact sheet are available for review and comment.

The notice will also be mailed to those who currently have coverage under the Aquatic Mosquito Control General Permit and those identified as interested parties, including the Aquatic Mosquito Control General Permit Advisory Group.

Copies of the draft general permit, fact sheet, and related documents are available for inspection and copying between the hours of 8:00 a.m. and 5:00 p.m. weekdays, by appointment, at the Ecology offices listed below or may be obtained from Ecology's website or by contacting Ecology by mail, phone, fax or email.

Permit Website:
http://www.ecy.wa.gov/programs/wq/pesticides/final_pesticide_permits/mosquito/mosquito_index.html

Ecology Headquarters Building Address:
300 Desmond Drive
Lacey, WA 98503

Contact Ecology:

Department of Ecology Water Quality Program Attn: Aquatic Pesticide Permit Manager PO Box 47600 Olympia, WA 98504-7600	Jon Jennings Email: jonathan.jennings@ecy.wa.gov Phone : (360) 407-6283 Fax: (360) 407-6426

Submitting Written and Oral Comments
Ecology will accept written and oral comments on the draft Mosquito General Permit, fact sheet, and application. Comments should reference specific text when possible. Comments may address the following:

- technical issues,
- accuracy and completeness of information,
- the scope of facilities proposed for coverage,
- adequacy of environmental protection and permit conditions, or
- any other concern that would result from issuance of the revised permit.

Ecology prefers comments be submitted by email to: jonathan.jennings@ecy.wa.gov. Written comments must be postmarked or received via email no later than **5pm, March 10, 2010**.

Submit written, hard copy comments to:
Jon Jennings
Department of Ecology
PO Box 47600
Olympia, WA 98504-7600

You may also provide oral comments by testifying at the public hearing.

Public Hearing and Workshops
The public hearing and workshop on the draft general permit will be held at the location below. The purpose of the hearing is to provide an opportunity for people to give formal oral testimony and comments on the draft permit. The purpose of the workshops is to explain the proposed changes to the new permit.

Hearing and Workshop

March 9, 2010 (starts at 1pm)
Moses Lake Fire Department
701 E. Third Ave.
Moses Lake, WA 98837

Issuing the Final Permit

The final permit will be issued after Ecology receives and considers all public comments. Ecology expects to issue the new general permit in May 2010. It will be effective June 2010.

Further information may be obtained by contacting Permit Writer Jon Jennings, at Ecology, by phone at (360) 407-6283, by email at jonathan.jennings@ecy.wa.gov, or by writing to Ecology's Olympia address listed above.

APPENDIX B: LIST OF TECHNICAL CALCULATIONS

Technical Calculation: Reasonable Potential Determination 1-22-2010.xlsx

APPENDIX C: RESPONSE TO COMMENTS

To add after public comment period