(b) The processing and posting of your Notice of Termination consistent with Part 1.2.5.1;

(c) The issuance or denial of an individual permit for a discharge resulting from application of a pesticide that would otherwise be covered under this permit;

(d) A formal permit decision by EPA not to reissue this general permit, at which time EPA will identify a reasonable time period for covered dischargers to seek coverage under an alternative general permit or an individual permit. Coverage under this permit will cease when coverage under another permit is granted/authorized; or

(e) EPA has informed you that you are no longer covered under this permit.

Where EPA fails to issue a final general permit prior to the expiration of a previous general permit, EPA has the authority to administratively extend the permit for permittees authorized to discharge under the prior general permit. However, EPA does not have the authority to provide coverage to facilities not authorized to discharge under that prior general permit.

1.2.5 Terminating Coverage

1.2.5.1 Submitting a Notice of Termination.

The permit requires permittees to use the eNOI system to file Notices of Termination. To terminate coverage under this permit, the permittee is required under the permit to submit a Notice of Termination in accordance with information identified in Appendix E. The permittee's authorization to discharge under the permit terminates at midnight of the day that a complete Notice of Termination is processed and posted on EPA's website (www.epa.gov/npdes/noisearch). The requirement to submit a Notice of Termination applies only to those operators that were required to submit a Notice of Intent to obtain permit coverage. Dischargers automatically covered under this permit as identified in Part 1.2.3 are likewise automatically terminated upon permanent cessation of discharge consistent with any of the criteria identified in Part 1.2.5.2.

EPA requires permittees to file a Notice of Termination to notify EPA that its obligation to manage pesticide discharges is no longer necessary for one of the EPA-approved reasons (as described in Part 1.2.5.2). If EPA determines that the permittee has not satisfied one of the conditions in Part 1.2.5.2 for being able to submit a Notice of Termination (e.g., the permittee continues to have a discharge), then the notice is not valid and the permittee must continue to comply with the conditions of the permit. Likewise, if EPA determines that the Notice of Termination is incomplete, the permittee may be found to be in violation of reporting requirements under Section 308 of the CWA.

1.2.5.2 When to Submit a Notice of Termination.

Once all point source discharges associated with pesticide application have ceased, the permittee must submit a Notice of Termination, as described in Part 1.2.5.1, within 30 days after one or more of the following conditions have been met: (1) a new operator has taken over responsibility for the pest treatment; (2) operations have ceased for which permit coverage had been obtained or there will no longer be discharges from such activities, or (3) permit coverage has been obtained under an individual or alternative general permit for all discharges requiring NPDES permit coverage (unless you obtained coverage under an alternative permit based on an EPA request consistent with Part 1.3, in which case coverage under this permit will terminate automatically once coverage under that alternative permit is obtained and a Notice of Termination is not required).

EPA is requiring a Notice of Termination from operators identified in (3) above – i.e., operators that on their own switch to a different permit – to provide the Agency with clear notice that the operator's discharge is not covered under two NPDES permits. Operators that terminate coverage based on an EPA request consistent with Part 1.3 are not required to submit a Notice of Termination.

1.3. Alternative Permits

EPA Requiring Coverage under an Alternative Permit

EPA may require an individual permit (in accordance with 40 CFR 122.28(b)(3)(ii)) or coverage under an alternative NPDES general permit instead of the PGP. The regulations also provide that any interested party may petition EPA to take such an action. The issuance of the individual permit or alternative NPDES general permit is in accordance with 40 CFR Part 124 and provides for public comment and appeal of any final permit decision. The circumstances in which such an action would be taken are set forth at 40 CFR 122.28(b)(3). EPA notes that discharges of pesticides from some vessels are already covered under the Vessel General Permit and do not require coverage under this general permit (see EPA NPDES Vessels General Permit at http://www.epa.gov/NPDES/vessels).

Permittee Requesting Coverage under an Alternative Permit

After being covered by this permit, the permittee may request to be excluded from such coverage by applying for an individual permit. In this case, the permittee must submit an individual permit application in accordance with 40 CFR 122.28(b)(3)(iii), along with a statement of reasons supporting the request, to EPA at the applicable EPA Regional Office listed in Part 9.2 of the PGP. The request may be granted by issuance of an individual permit or authorization of coverage under an alternative general permit if the reasons are adequate to support the request. Under this scenario, if an individual permit is issued, or authorization to discharge under an alternative general permit is granted, coverage under this permit is automatically terminated under 40 CFR 122.28(b)(3)(iv) on the effective date of the individual permit or the date of authorization of coverage under the alternative general permit.

Part 1.3.2 reminds permittees of their ability to apply for coverage under an individual permit in lieu of coverage under this general permit and describes the steps they must take to exclude themselves from this permit after being authorized under this permit. Cases where an individual NPDES permit may be required, are described fully in 122.28(b)(3)(iii). The following are the pertinent situations for this permit where an individual permit may be necessary:

(A) A Water Quality Management plan containing requirements applicable to such point sources is approved;

(B) Circumstances have changed since the time of the request to be covered so that the discharger is no longer appropriately controlled under the general permit, or either a temporary or permanent reduction or elimination of the authorized discharge is necessary;

(C) The discharge(s) is a significant contributor of pollutants. In making this determination, EPA may consider the following factors:

(1) The location of the discharge with respect to waters of the U.S.;

(2) The size of the discharge;

(3) The quantity and nature of the pollutants discharged to waters of the U.S.; and

(4) Other relevant factors.

EPA may require a permittee to apply for an individual permit only if EPA notifies the operator in writing that a permit application is required. This notice must include a brief statement of the reasons for this decision, an application form, a statement setting a time for the operator to file the application, and a statement that on the effective date of the individual NPDES permit the general permit as it applies to the individual permittee shall automatically terminate. EPA may grant additional time upon request of the applicant.

When an individual NPDES permit is issued to an operator otherwise subject to a general NPDES permit, the applicability of the general permit to the individual NPDES permittee is automatically terminated on the effective date of the individual permit.

Note that an individual permit is required for applications of pesticides to waters impaired for that pesticide, and for applications of pesticides to Tier 3 waters and as such, in these cases, authorization under this general permit would not have been available in the first place.

1.4. Severability

Invalidation of a portion of this permit does not necessarily render the whole permit invalid. EPA's intent is that the permit remains in effect to the extent possible; in the event any part of this permit is invalidated, EPA will advise the regulated community as to the effect of such invalidation.

1.5 Other Federal and State Laws

Part 1.5 of this permit includes the following language: "You must comply with all other applicable federal and state laws and regulations that pertain to your application of pesticides. For example, this permit does not negate the requirements under FIFRA and its implementing regulations to use registered pesticides consistent with the product's labeling. Additionally, there are other laws and regulations that may only apply to federal agencies covered under this permit (e.g., U.S. Coast Guard regulations)."

This part of the permit is intended to clarify that pesticide applicators are still required to comply with other applicable laws and that merely complying with the conditions of this permit may not meet all regulations applicable to the types of activities covered under this permit.

1.6 Federally-Listed Endangered and Threatened Species and Designated Critical

Habitat.

Part 1.6 of the draft permit includes certain requirements specific to the protection of federally-listed endangered and threatened species and its designated critical habitat. Procedures to assist in protecting listed species and critical habitat are currently being considered by EPA in consultation with the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (FWS) under section 7 of the ESA. A more detailed discussion of permit conditions being considered is provided in Part III.10.F of this fact sheet. Based on consultation to date, the PGP includes language that would incorporate as enforceable permit conditions any pre-existing requirements resulting from ESA Section 7 consultation and/or an ESA Section 10 permit that is issued to the operator by FWS and/or NMFS. Operators seeking coverage under this permit do not have a separate obligation to consult with the FWS or NMFS under Section 7 of the ESA prior to submitting an NOI. As the Federal entity issuing this permit, EPA is the entity with an obligation to consult with FWS and NMFS. However, if any pre-existing consultation has been conducted between an operator and the Services and the results of that consultation are relevant to an operator's expected discharge(s), then this permit obliges the operator to comply with any additional conditions or limits on the discharge of pesticide residuals resulting from such consultation. (Such additional consultation might come up in the context of a separate Federal agency action, and the operator might be involved directly if, for example, it was designated as a non-Federal representative to conduct consultation under 50 CFR § 402.08 for a related action.)

2. TECHNOLOGY-BASED EFFLUENT LIMITATIONS

Background

The Clean Water Act (CWA) requires that all point source discharges from existing facilities, or in this case, pesticide applications, meet technology-based effluent limitations[4] representing the applicable levels of necessary control. Additionally, water quality-based effluent limitations (WQBELs) are required by CWA Section 301(b)(1)(C) as necessary where the technology-based effluent limitations are not sufficient to protect applicable water quality standards. See *P.U.D. No. 1 of Jefferson County et. al. v. Washington Department of Ecology*, 511 U.S. 700 (704) 1994._ Water quality-based requirements will be discussed in greater depth in Section III.3 of the fact sheet. The technology-based effluent limitations contained in the PGP are non-numeric and constitute the levels of control that reduce the area and duration of impacts caused by the discharge of pesticides to waters of the U.S. in a treatment area. In addition, these effluent limitations provide for protection of water quality standards, including protection of beneficial uses of the receiving waters inside the treatment area following completion of pest management activities.

[4] *Natural Res. Def. Council, Inc. v. EPA, 673 F.2d 400, 403 (D.C. Cir. 1982)* (noting that "*section 502(11)* defines 'effluent limitation' as ' *any* restriction' on the amounts of pollutants discharged, not just a numerical restriction"; holding that section of CWA authorizing courts of appeals to review promulgation of "any effluent limitation or other limitation" did not confine the court's review to the EPA's establishment of numerical limitations on pollutant discharges, but instead authorized review of other limitations under the definition) (emphasis added). In *Natural Res. Def. Council, Inc. v. Costle, 568 F.2d 1369 (D.C. Cir. 1977)*, the D.C. Circuit stressed that when numerical effluent limitations are infeasible, EPA may issue permits with conditions designed to reduce the level of effluent discharges to acceptable levels.

Types of Technology-Based Effluent Limitations

Technology-based effluent limitations are in many cases established by EPA in regulations known as effluent limitations guidelines, or "ELGs." EPA establishes these regulations for specific industry categories or subcategories after conducting an in-depth analysis of that industry. The Act sets forth different standards for the ELGs based upon the type of pollutant or the type of permittee involved. Where EPA has not issued effluent guidelines for an industry, EPA and State permitting authorities establish effluent limitations for NPDES permits on a case-by-case basis based on their best professional judgment. See 33 U.S.C. § 1342(a)(1); 40 C.F.R. § 125.3(c)(2).

EPA's Authority to Include Non-Numeric Technology-Based Limitations in this Permit

All NPDES permits are required to contain technology-based limitations. 40 CFR §§ 122.44(a)(1) and 125.3. When EPA has not promulgated effluent limitation guidelines for an industry, or if an operator is discharging a pollutant not covered by the effluent guideline, permit limitations may be based on the best professional judgment (BPJ, sometimes also referred to as "best engineering judgment") of the permit writer. 33 U.S.C. § 1342(a)(1); 40 CFR 125.3(c). See Student Public Interest Group v. Fritzsche, Dodge & Olcott, 759 F.2d 1131, 1134 (3rd Cir. 1985); American Petroleum Inst. v. EPA, 787 F.2d 965, 971 (5th Cir. 1986). For this permit, the technology-based limitations are based on BPJ decision-making because no ELG applies.

Under EPA's regulations, non-numeric effluent limitations are authorized in lieu of numeric limitations, where "[n]umeric effluent limitations are infeasible." 40 CFR 122.44(k)(3). As far back as 1977, courts have recognized that there are circumstances when numeric effluent limitations are infeasible and have held that EPA may issue permits with conditions (e.g., best management practices) designed to reduce the level of effluent discharges to acceptable levels. Natural Res. Def. Council, Inc. v. Costle, 568 F.2d 1369 (D.C.Cir.1977).

Through the Agency's NPDES permit regulations, EPA interpreted the CWA to allow best management practices (BMPs) to take the place of numeric effluent limitations under certain circumstances. Federal Regulations at 40 CFR §122.44(k), entitled "Establishing limitations, standards, and other permit conditions (applicable to State NPDES programs ...)," provides that permits may include BMPs to control or abate the discharge of pollutants when: (1) "[a]uthorized under section 402(p) of the CWA for the control of stormwater discharges"; or (2) "[n]umeric effluent limitations are infeasible." 40 CFR § 122.44(k).

Courts have held that the CWA does not require the EPA to set numeric limitations where such limits are infeasible. Citizens Coal Council v. United States Environmental Protection Agency, 447 F3d 879, 895-96 (6th Cir. 2006). The Sixth Circuit cited to Waterkeeper Alliance, Inc. v. EPA, 399 F.3d 486, 502 (2nd Cir. 2005), stating "site-specific BMPs are effluent limitations under the CWA." Additionally, the Sixth Circuit cited to Natural Res. Def. Council, Inc. v. EPA, 673 F.2d 400, 403 (D.C.Cir.1982) noting that "section 502(11) [of the CWA] defines 'effluent limitation' as '*any* restriction' on the amounts of pollutants discharged, not just a numerical restriction."

EPA's Decision to Include Non-Numeric Technology-Based Effluent Limitations in This Permit

As described above, numeric effluent limitations are not always feasible because the discharges pose challenges not presented by other types of NPDES-regulated discharges. The technology-based effluent limitations in this permit are non-numeric based on the following facts:

- The point in time for which a numeric effluent limitation would apply is not easily determinable. For discharges from the application of pesticides, the discharges can be highly intermittent with those discharges not practically separable from the pesticide application itself. For example, the discharge from the application of a chemical pesticide to a water of the U.S. is represented by the residual remaining in the ambient water after the pesticide is no longer serving its intended purpose (i.e., acting as a pesticide against targeted pests in the applied medium). Chemical pesticides applied directly to water are not considered pollutants until some time after actual discharge at which point the pesticides will have performed their intended function for pest control, dissipated in the waterbody, and broken down into other compounds to some extent, etc. This discharge also will have combined with any other discharges to that waterbody (be it from other point sources, non-point source runoff, air deposition, etc). Given this situation, it is not clear what would be measured for a numeric limit or when.

- For discharges from the application of pesticides, there are often many short duration, highly variable, pesticide discharges to surface waters from many different locations for which it would be difficult to establish a numeric limitation at each location. This variability makes setting numeric effluent limitations for pesticide applications extremely difficult. In this situation, requiring the use of standard control practices (i.e., narrative non-numeric effluent limitations), provides a reasonable approach to control pesticides discharges.

- The precise location for which a numeric effluent limitation would apply is not clear. Discharges from the application of pesticide are different from discharges of process wastewater from a particular industrial or commercial facility where the effluent is more predictable and easily identified as an effluent from a conveyance (e.g., pipe or ditch), can be precisely measured for compliance prior to discharge, and can be more effectively analyzed to develop numeric effluent limitations.

- Information needed to develop numeric effluent limitations is not available at this time. To develop numeric technology-based effluent limitations, EPA must fully evaluate factors outlined in 40 CFR 125.3, such as the age of equipment and facilities involved, the process employed, the potential process changes, and non-water quality environmental impacts. In addition, EPA estimates that more than 400 pesticide active ingredients contained in over 3,500 pesticide products may be covered under this permit.

Technology-based effluent limitations in this permit are presented specific to each pesticide use pattern to reflect the variations in procedures and expectations for the use and application of pesticides. These non-numeric effluent limitations are expected to minimize environmental impacts by reducing the discharge of pesticides to waters of the U.S., thereby protecting the receiving waters, including meeting of all applicable water quality standards.

The effluent limitations in this permit are expressed as specific pollution prevention requirements for minimizing the pollutant levels in the discharge. EPA has determined that the combination of pollution prevention approaches and structural management practices required by these limits are the most environmentally sound way to control the discharge of pesticide pollutants to meet the effluent limitations. Pollution prevention continues to be the cornerstone of the NPDES program.

EPA continues to study the efficacy of various types of pollution prevention measures and BMPs; however, for this permit numeric limitations are not feasible.

Control Measures Used to Meet the Technology-Based Effluent Limitations

Just as there is variability in the pesticide applications as described above, there is variability in the control measures that can be used to meet the effluent limitations. Therefore, EPA is not mandating the specific control measures operators must implement to meet the limitations. This is analogous to an industrial situation where discharges to waters of the U.S. are via pipes and a numeric effluent limitation may be specified as a given quantity of pollutant that may be discharged, but EPA would not specify what technology should be employed to meet that limitation. For pesticides, namely mosquitocides, for example, Part 2.2.1.2 of the PGP requires mosquito control operators to consider mechanical/physical methods of control to eliminate or reduce mosquito habitat. How this is achieved will vary by operator: For some, this many be achieved through regular mowing while for others mowing will not be feasible. Thus, a given control measure may be acceptable and appropriate in some circumstances but not in others. In this respect, the non-numeric effluent limitations in this permit are similar to numeric effluent limitations, which also do not require specific control technologies as long as the limitations are met.

Control measures can be actions (including processes, procedures, schedules of activities, prohibitions on practices and other management practices), or structural or installed devices to prevent or reduce water pollution. The key is determining what measure is appropriate for your situation in order to meet the effluent limitation. In this permit, operators are required to implement site-specific control measures to meet these limitations. The permit along with this fact sheet provides examples of control measures, but operators must tailor these to their situations as well as improve upon them as necessary to meet permit limits. The examples emphasize minimization over treatment.

EPA notes that this permit uses both the term “control measures” and “best management practices” or “BMPs”. Use of the term control measure is intended to better describe the range of pollutant reduction practices that may be employed, whether they are structural, non-structural or procedural and includes BMPs as one of the components. The greater breadth of meaning for control measures vis-à-vis BMPs is why EPA uses this term in many parts of the permit.
The approach to control measures in this permit is consistent with the CWA as well as its implementing regulations at 40 CFR 122.44(k)(4). Section 402(a)(2) of the CWA states: “The administrator shall prescribe conditions for such permits to assure compliance with the requirements in paragraph (1) . . . including conditions on data and information collection, reporting and such other requirements as he deems appropriate." (Section 402(a)(1) includes

effluent limitation requirements.) This statutory provision is reflected in the CWA implementing regulations, which state that control measures can be included in permits when, "[t]he practices are reasonably necessary to achieve effluent limitations and standards or to carry out the purposes and intent of the CWA." 40 CFR 122.44(k)(4).

Implementation of Control Measures

Part 2.0 of this permit requires operators to implement control measures to meet the technology-based effluent limitations listed in that Part. It also provides operators with important considerations for the implementation of their specific control measures. Some operators will have to document how such factors were taken into account in the implementation of their control measures (See Part 5). EPA recognizes that not all of these considerations will be applicable to every site nor will they always affect the choice of control measures. If operators find their control measures are not minimizing discharges of pesticide adequately, the control measures must be modified as expeditiously as practicable. See Part 6, Corrective Action.

Control Measures and Technology-Based Effluent Limitations – Definition of "Minimize"

The non-numeric effluent limitations require operators to "minimize" discharges of pesticide. Consistent with the control level requirements of the CWA, the term "minimize" means to reduce and/or eliminate pesticide discharges to waters of the U.S. through the use of control measures to the extent technologically available and economically achievable and practicable.

EPA believes that for many pesticide applications minimization of the discharge of pesticides to waters of the U.S. can be achieved without using highly engineered, complex treatment systems. The specific limits included in Part 2.0 emphasize effective "low-tech" approaches, including using the lowest effective amount of pesticide product, performing regular equipment maintenance and calibration, accurately identifying the pest problem, efficiently and effectively managing the pest problem, and properly using pesticides.

Statutes, Regulations, and Other Requirements

Operators must comply with all applicable statutes, regulations and other requirements including, but not limited to requirements contained in the labeling of pesticide products approved under FIFRA ("FIFRA labeling"). Although the FIFRA label and labeling requirements are not effluent limitations, it is illegal to use a registered pesticide inconsistent with its labeling. If operators are found to have applied a pesticide in a manner inconsistent with any relevant water-quality related FIFRA labeling requirements, EPA will presume that the effluent limitation to minimize pesticides entering the waters of the U.S. has been violated under the NPDES permit. EPA considers many provisions of FIFRA labeling -- such as those relating to application sites, rates, frequency, and methods, as well as provisions concerning proper storage and disposal of pesticide wastes and containers -- to be requirements that affect water quality. For example, an operator, who is a pesticide applicator, decides to use a mosquito adulticide pesticide product with a FIFRA label that contains the following language, "Apply this product at a rate not to exceed one pound per acre." The applicator applies this product at higher than the allowable rate, which results in excess product being discharged into waters of the U.S.

EPA would find that this application was a misuse of the pesticide under the FIFRA label and because of the misuse; the Agency would determine that the effluent limitation that requires the operator to minimize discharges of pesticide products to waters of the U.S. was also violated. Therefore, pesticide use inconsistent with certain FIFRA labeling requirements could result in the operator being held liable for a CWA violation as well as a FIFRA violation.

Technology-Based Effluent Limitations in the PGP

The permit requires the operator to achieve all of the non-numeric effluent limitations delineated in Parts 2.1 and 2.2 as described below.

All operators under Part 2.1 must "minimize" pesticide applications. Under Part 2.2, only those operations required to submit an NOI (i.e., applying pesticides above the annual treatment area threshold) are required to implement IPM and other permit conditions. EPA is not requiring these additional technology-based effluent limitation requirements from permittees who treat areas below the annual treatment area thresholds at this time, because of concerns about potential unintended consequences of such a requirement.

2.1 General Effluent Limitations

Part 2.1 of this permit contains the general effluent limitations that apply to *all* operators, regardless of use pattern. These effluent limitations are generally preventative in nature, and are designed to minimize pesticide discharges into waters of the U.S. All operators, regardless of whether you are required to submit an NOI, are required to minimize the discharge of pesticides to waters of the U.S. by doing the following:

2.1.1 Use the lowest effective amount of pesticide product per application and optimum frequency of pesticide applications necessary to control the target pest, consistent with reducing the potential for development of pest resistance.

- As noted earlier, it is illegal to use a pesticide in any way prohibited by the FIFRA labeling. Also, use of pesticides must be consistent with any other applicable state or federal laws. To minimize the total amount of pesticide discharged, operators must consider lower application rates, frequencies, or both to accomplish effective control keeping in mind pesticide resistance. Using the lowest possible effective rate ensures maximum efficiency in pest control with the minimum quantity of pesticide. The lowest effective application rate also reduces the amount of pesticide available that is not performing a specific pest-control function. Using the lowest possible effective rate and frequency of applications can result in cost and time savings to the user. To minimize discharges of pesticide, operators should base the rate and frequency of application on what is known to be effective against the target pest or necessary for resistance management.

Operators must also consider pest resistance to pesticides when reducing discharges from application of pesticide. Resistance management is an important part of pest control. Some pests can develop resistance to pesticides unless resistance management techniques are adopted by pesticide users. Resistance can result in the loss of effectiveness of pesticides with relatively favorable environmental and human health risks and increase reliance on riskier pesticides. When resistance occurs, users may increase rates and frequency of application in an attempt to maintain pesticide effectiveness. This can lead to the loss of efficacy and increased exposure to the pesticide. Pesticide applicators should be aware of the potential for pest resistance to develop by considering the pest, the pesticide and its mode of action, the number of applications and intervals, and application rates.

Pest resistance develops because intensive pesticide use kills the susceptible individuals in a population, leaving only the resistant ones to reproduce. Several pest management tactics help prevent or delay the occurrence of pesticide resistance. One tactic is to reduce dosages in order to avoid establishing a population of resistant organisms and instead allowing some survivors to pass on genes for susceptibility. Another is to apply pesticides over limited areas to reduce the proportion of the total pest population exposed to the pesticide, thereby maintaining a large pool of individuals still susceptible to the pesticide. A third tactic to prevent development of resistant pest populations is to rotate pesticides with different modes of actions against the pests rather than depend on a single mode of action. See National Pesticide Applicator Certification Core Manual, Chapter 1 – Pest Management for additional information on pesticide resistance.

2.1.2 Perform regular maintenance activities to minimize potential for leaks, spills, or other unintended discharges of pesticides associated with the application of pesticides covered under this permit.

Common-sense and good housekeeping practices enable pesticide users to save time and money and reduce potential for unintended discharges of pesticides to waters of the U.S. Regular maintenance activities should be practiced and improper pesticide mixing and equipment loading should be avoided. When preparing the pesticides for application be certain that you are mixing them correctly and preparing only the amount of material that you need. Carefully choose the pesticide mixing and loading area and avoid places where a spill will discharge into waters of the U.S. Some basic factors operators should consider are:

- Inspect pesticide containers at purchase to ensure proper containment;
- Maintain clean storage facilities for pesticides;
- Regularly monitor containers for leaks;
- Rotate pesticide supplies to prevent leaks that may result from long term storage; and
- Promptly deal with spills following manufacturer recommendations.

2.1.3. Maintain application equipment in proper operating condition by adhering to any manufacturer's conditions and industry practices, and by calibrating, cleaning, and repairing such equipment on a regular basis to ensure effective pesticide application and pest control. You must ensure that the equipment's rate of pesticide application is calibrated to deliver the precise quantity of pesticide needed to achieve greatest efficacy against the target pest.

To minimize discharges of pesticide, operators must ensure that the rate of application is calibrated (i.e. nozzle choice, droplet size, etc.) to deliver the appropriate quantity of pesticide needed to achieve greatest efficacy against the target pest. Improperly calibrated pesticide equipment may cause either too little or too much pesticide to be applied. This lack of precision can result in excess pesticide being available or result in ineffective pest control. When done properly, equipment calibration can assure uniform application to the desired target and result in higher efficiency in terms of pest control and cost. It is important for applicators to know that pesticide application efficiency and precision can be adversely affected by a variety of mechanical problems that can be addressed through regular calibration. Sound calibration practices to consider are:

- Choosing the right spray equipment for the application
- Ensuring proper regulation of pressure and choice of nozzle to ensure desired application rate
- Calibrating spray equipment prior to use to ensure the rate applied is that required for effective control of the target pest
- Cleaning all equipment after each use and/or prior to using another pesticide unless a tank mix is the desired objective and cross contamination is not an issue
- Checking all equipment regularly (e.g., sprayers, hoses, nozzles, etc.) for signs of uneven wear (e.g., metal fatigue/shavings, cracked hoses, etc.) to prevent equipment failure that may result in inadvertent discharge into the environment
- Replacing all worn components of pesticide application equipment prior to application.

2.2. Integrated Pest Management Practices

As noted above, NPDES permits must contain technology-based effluent limitations. In addition to the technology-based effluent limitations described immediately above that apply to all permittees, EPA is requiring certain permittees to also comply with additional technology-based effluent limitation because we have found that IPM is economically achievable for these large applications. Permittees subject to these additional limits are those permittees who exceed the annual treatment area thresholds described in section 1.2.2.1 of the permit. These entities are those who manage large treatment areas as explained in Part III, section 1.2.1. EPA expects that many of these permittees are already performing some of the IPM practices required in these additional technology-based effluent limitations. EPA is not requiring these additional technology-based effluent limitation requirements from permittees who treat areas below the threshold at this time because we are still unclear whether it is economically achievable for small applications to implement IPM and because of concerns about potential unintended consequences of such a requirement, such as an inability to conduct essential public health and safety operations due to a reduction of available funds or manpower. Additionally, operators whose discharges of pesticides to waters of the U.S. are solely from pesticide research and development activities do not have to comply with these additional technology-based effluent limitations to the extent the limits may compromise the research design. EPA is soliciting comment on the applicability of these additional technology-based effluent limitations for all or some of the applicators that fall below the thresholds (e.g., states, governmental agencies, small public entities, and private entities). EPA is also soliciting comment about the impacts such a requirement would have on those entities

The additional technology-based effluent limitations in Part 2.2 are based on integrated pest management (IPM) practices. IPM, as defined in FIFRA, is a sustainable approach to managing pests by combining biological, cultural, physical, and chemical tools in a way that minimizes economic, health, and environmental risks. (FIFRA, 7 U.S.C. 136r-1) IPM is not a single pest control method but, rather, a series of pest management evaluations, decisions and controls. In evaluating available and relevant information, EPA found that some commercial (for-hired applicators) and non-commercial (e.g., state governments, federal governments, local governments, utilities) entities are currently implementing IPM practices or components of IPM to minimize pesticide use. For example, federal agencies are required to implement IPM under 7 USC 136r-1, "Federal agencies shall use Integrated Pest Management techniques in carrying out pest management through procurement and regulatory policies, and other activities." EPA has found that mosquito control operations are performed by local government entities and that they are generally performing IPM.

EPA believes requiring IPM practices in this permit will reduce discharges of pesticide to waters of the U.S. For example, the Metropolitan Water District of Southern California (MWDSC) at Lake Matthews managed the underlying causes of recurring taste and odor problems in the reservoir using IPM. Between 1982 and 1991, the MWDSC was inefficiently escalating the amounts of copper sulfate applied to treat an algae problem, to the point where it was releasing hundreds of tons of the chemical via helicopter each year, increasing the risk of using lake water due to the toxins produced by the dying algae. Introducing the concept of sector monitoring and at-need copper sulfate application allowed for more controlled released of algae-related toxins and avoided overuse of pesticides. After several years of this type of treatment, the benthic algal population diversified and the algal population was manageable such that in some years, pesticides are no longer used.[5]

Part 2.2 of this permit requires operators above the annual treatment area threshold to identify the pest problem; to evaluate and implement efficiently and effectively pest management; and to properly use pesticides. Operators are required to perform each of these permit conditions prior to the first pesticide application covered under this permit and at least once each calendar year thereafter. Below is a general discussion describing the limitations for all use patterns. Following the general discussion are more detailed descriptions of each specific requirement under each use pattern. Requirements for documentation of the specific measures implemented are contained in Part 7, Recordkeeping and Annual Reporting.

Operators required to perform IPM practices will be required to do the following regardless of use pattern:

Identify the Problem

Operators are required to identify the pest problem, identify the target pest, and establish an action threshold. Understanding the pest biology and ecology will provide insight into selecting the most effective and efficient pest management strategies (pesticidal or non-pesticidal methods), and in developing an action threshold. An action threshold is a point at which pest populations or environmental conditions indicate that pest control action must be taken. Action thresholds help determine both the need for control actions and the proper timing of such actions.

[5] Taylor, W., R. Losee, M. Torobin, G. Izaguirre, D. Sass, D. Khiari, and K. Atasi. 2006. Early Warning and Management of Surface Water Taste-and-Odor Events. AwwaRF Report 91102F. AWWA Research Foundation, American Water Works Association, and IWA Publishing.

It is a predetermined pest level that is deemed to be unacceptable. In some situations, the action threshold for a pest may be zero (i.e., no presence of the pest is tolerated). This is especially true when the pest is capable of transmitting a human pathogen (e.g., mosquitoes and the West Nile virus). In areas where aquatic weeds are problematic, it may be preferable to use an aquatic herbicide as a preventive measure rather than after weeds become established. In some situations, even a slight amount of pest damage may be unacceptable for ecological or aesthetic reasons. Sometime pre-emergent pesticide application is needed, as preventive measure to keep aquatic weeds at bay. Action thresholds can vary by pest, by site, and by season. Often the action threshold is expressed as the number of pests per unit area. Action thresholds may be difficult to establish. In a new IPM program, a practical approach is to establish an action threshold for the major pests. As operators gain insight and experience into specific pest management settings, the action levels can be revised up or down.

To identify the problem at a treatment area, operators may use existing data to meet the conditions of the permit. For example, a mosquito district may use surveillance data from an adjacent district to identify mosquito species at their pest management area. Operators may also use relevant historic site data.

Pest Management

Operators are required to implement efficient and effective means of pest management that most successfully minimizes discharges to waters of the U.S. resulting from the application of pesticides. Operators must evaluate both pesticide and non-pesticide methods. Operators must consider and evaluate the following options: no action, prevention, mechanical/physical methods, cultural methods, biological control agents, and pesticides. In the evaluation of these options, operators must consider impacts to water quality, impacts to non-target organisms, pest resistance, feasibility, and cost effectiveness. Combinations of various management methods are frequently the most effective pest management strategies over the long term. The goal should be to emphasize long-term control rather than a temporary fix. For additional information, see discussion under each use pattern.

Pesticide Use

Operators are required to conduct pest surveillance and reduce the impact on the environment. Pest surveillance is important to properly time the need for pest control. To reduce the impact on the environment and non-target organisms, operators are required to apply pesticide when the action threshold has been met. As noted earlier, action thresholds help determine both the need for control actions and the proper timing of such actions. There are additional requirements designed for each use pattern in Sections 2.2.1 through 2.2.4 of the permit. For additional information and other limits on pesticide use, see specific discussion under each use pattern.

2.2.1 Mosquito and Other Flying Insect Pests Control

a. Mosquitoes

Background

There are over 2500 different species of mosquitoes throughout the world with approximately 200 species occurring in the U.S. The total budgets for mosquito control in the U.S. exceed $200,000,000 annually (AMCA 2009). Mosquitoes can be a source of annoyance (e.g., work and leisure activities), a limiting factor in economic development (e.g., residential development and property value), a causal factor in decreased agricultural productivity (e.g., animal weight loss/death and decreased milk production) from irritation and blood loss, and a source of disease transmission (e.g., malaria, encephalitis, yellow fever, dengue, and West Nile Virus). Most of these diseases have been prominent as endemic or epidemic diseases in the U.S. in the past, although today, only the insect-borne (arboviral) encephalitides and West Nile virus fever occur annually and dengue occurs periodically in this country. Thus, control of mosquitoes is an important public health issue. Numerous strategies are used to reduce the impact of mosquitoes but a comprehensive approach using a variety of complementary control methods is necessary for any mosquito control program.

Of major concern is the transmission of microorganisms that cause diseases such as western equine encephalitis and St. Louis encephalitis. Both of these diseases can cause serious, sometimes fatal neurological ailments in people. (Western equine encephalitis virus also causes disease in horses.) Western equine encephalitis infections tend to be more serious in infants while St. Louis encephalitis can be a problem for older people. These viruses normally infect birds or small mammals. During such infections, the level of the virus may increase in these infected animals facilitating transmission to humans by mosquitoes. The West Nile virus, which can also cause encephalitis, was found in the northeastern U.S. for the first time in 1999, and is a good example of this mode of transmission. Over 20,000 human cases of West Nile virus have been reported in the U.S. Symptoms of human illness can range from mild flu-like symptoms to severe encephalitis, meningitis, or acute flaccid paralysis. Over 800 people have died from West Nile virus since its emergence in North America in 1999 (CDC).

Other pathogens transmitted by mosquitoes include a protozoan parasite which causes malaria, and *Dirofilaria immitis*, a parasitic roundworm and the causative agent of dog heartworm. Disease carrying mosquito species are found throughout the U.S., especially in urban areas and coastal or inland areas where flooding of low lands frequently occurs. Even when no infectious diseases are transmitted by mosquitoes, they can be a health problem to people and livestock. Mosquito bites can result in secondary infections, allergic reactions, pain, irritation, redness, and itching.

<u>Mosquito Control IPM Practices</u>

Identify the Problem

Part 2.2.1.1: Prior to the first pesticide application covered under this permit that will result in a discharge to waters of the U.S., and at least once each calendar year thereafter prior to the first pesticide application for that calendar year, you must do the following for each pest management area, as defined in Appendix A. Operators must identify the pest problem in their pest management area prior to the first application covered under this permit. Knowledge of the pest problem is an important step to developing pest management strategies. Re-evaluation of the pest problem is also important to ensure pest management strategies are still applicable. Operators must identify the pest problem at least once each calendar year prior to the first application for that calendar year.

Establish densities for larval and adult mosquito or flying insect pest populations to serve as action threshold(s) for implementing pest management strategies. Operators must develop action thresholds for larval and adult mosquito prior to the first pesticide application covered under this permit. The action thresholds must be re-evaluated at least once each calendar year. As noted in the general discussion above, an action threshold is a point at which pest populations or environmental conditions indicate that pest control action must be taken. Action thresholds help determine both the need for control actions and the proper timing of such actions. It is a predetermined pest level that is deemed to be unacceptable. For example in Maryland, "A collection of more than 10 anthropophagous (human biting) female mosquitoes per night of trap operation is considered to be the level which causes discomfort and/or complaints from the majority of people. The light trap action threshold for ground spraying of adult mosquitoes is 10-20 per trap-night. The action threshold to suppress pest populations of adult mosquitoes by aerial spraying (application of insecticide by an aircraft) is a light trap collection of 100 female mosquitoes. The action threshold for landing rate counts to justify ground spraying for the control of adult mosquitoes is 1 to 3 in 1 minute. The action threshold for aerial spraying is 12 mosquitoes per minute."[6] For larvae control, action thresholds are determined by standard mosquito dipping techniques. For example, in Canyon County Mosquito Abatement District, Idaho[7], they established larvae density action levels for Culex species (primary disease vectors) as Low: 1-5 larvae per dip; Medium: 6-10 larvae per dip; High: > than 10 larvae per dip. The larvae density action threshold can be used to determine how much larval control products are to be used or even if any action is to be taken. In some situations, the action threshold for a pest may be zero (i.e., no presence of the pest is tolerated). This is especially true when the pest is capable of transmitting a human pathogen (e.g., mosquitoes and the West Nile virus).

Identify the target mosquito or flying insect pest species to develop a species-specific pest management strategy based on developmental and behavioral considerations for each species. Knowledge of the developmental biology of mosquitoes is essential to developing pest management strategies for mosquito control. The mosquito undergoes complete metamorphosis and has four distinct stages in its life cycle: egg, larva, pupa, and adult. Depending on the species, eggs are deposited either in permanent water habitats or in temporary/floodwater habitats. Egg deposition in permanent water habitats occurs as individual eggs or as multiple egg rafts deposited directly to the water surface in natural or artificial water-holding containers found in the domestic environment or in naturally occurring pools. Egg rafts may contain 100-200 eggs. A batch laid of single eggs may range from 60-100 eggs. Egg deposition in temporary/floodwater habitats occurs as individual eggs on moist soil (e.g., roadside ditches, depressions, farmland irrigation ditches, etc.) or in other objects (e.g., flower pots, cans, tires, tree holes, etc.) in which periodic flooding will occur. Eggs deposited in permanent habitats will hatch in a few days whereas eggs deposited in temporary/floodwater habitats are resistant to desiccation in the absence of flooding and can withstand drying for extended periods of time (weeks to months) before hatching.

Following egg hatching, typically 2-3 days after laying, mosquitoes go through four larval developmental stages (instars) commonly known as wrigglers. Larval development

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[6] http://www.mda.state.md.us/plants-pests/mosquito_control/mosquito_control_program_description.php
[7] http://www.canyoncountymosquito.com/CCMADMosquitoPesticideUsePlan.pdf

generally is completed in a week or less, depending upon the species and environmental conditions (e.g., crowding, food availability, and water temperature). The first three larval instars continually feed on detritus, algae, bacteria, and fungi. However, some mosquito species are predacious with larva feeding on other mosquitoes and/or small aquatic invertebrates. Late in the fourth larval instar the larvae ceases to feed in preparation for pupation. The pupal stage, commonly referred to as a tumbler, is a non-feeding developmental stage in which the adult form is developed. Following a few hours to several days, dependent upon species and water temperature, the adult emerges from the pupae.

The adult mosquito is the pestiferous stage. Adults emerge from the water surface and after a short period of rest seek out a food source. Both males and females feed on nectar of flowers and other sugar sources as a source of energy. Only female mosquitoes seek out a blood meal as a source of protein and lipids for egg development. However, females of some species are autogenous (i.e., able to use energy reserves carried over from the immature stage to develop the first egg batch). In addition, most mosquitoes have preferred hosts which may include warm and cold blooded animals and birds. Human blood meals are seldom first or second choices with livestock, smaller mammals and/or birds generally preferred. Host seeking and blood feeding activities by mosquitoes are initiated by a complex variety of host and environmental cues (e.g., carbon dioxide, temperature, moisture, smell, color, movement and host preference). Adult feeding activity is generally either crepuscular (early morning, dusk and into the evening) or diurnal (daytime, particularly in relation to cloudy days and shaded areas). Although highly variable by species and environmental conditions, a complete development cycle can occur every one to three weeks. An understanding of the developmental biology of species in a given area provides the basis for developing a pest management strategy aimed at reducing pesticide discharge into waters of the U.S.

Prior to the first pesticide application covered under this permit, operators must ensure proper identification of mosquito species to better understand the biology of the target species and develop a detailed pest management strategy. Due to the great variability in developmental habitats and adult feeding behaviors as discussed previously, proper identification is imperative in designing an effective and efficient pest management strategy. Identification of the target species will aid in development of strategies aimed at both the immature and adult developmental stages. Identification of the target species for a specific area allows 1) identification of potential breeding sites, 2) evaluation of alternative control measures aimed at controlling the immature stages (habitat modification, source reduction, larvicides, biological larvicides, and oils), and 3) assessment of potential for disease transmission.

Identify known breeding sites for source reduction, larval control program, and habitat management. Once species have been identified, mapping is a valuable tool in assessing mosquito habitats and designing control programs for a specific area to minimize pesticide discharge into waters of the U.S. Maps may simply be township/city/county maps but may also include aerial photo assessments, topographic maps, and satellite imagery where available. Mapping is essential to identify mosquito producing areas which can and cannot be controlled using non-chemical preventative measures (e.g., source reduction). Maps should include all potential sites for mosquito development including agricultural areas in the specific area (e.g., hay, pasture, circle irrigation, orchards, rill irrigated field crops, and flood irrigated pastures and farmland). Mapping should also be a priority in a surveillance program utilizing mosquito traps, biting counts, complaints, and reports from the public. Planning in coordination with mapping ensures the best pest management strategy (whether source reduction, biological, or chemical) for each particular species is chosen. Operators must identify known breeding sites prior to the first pesticide application covered under this permit.

Analyze existing surveillance data to identify new or unidentified sources of mosquito or flying insect pest problems as well as sites that have recurring pest problems. As discussed above, mapping is a valuable tool in assessing mosquito habitats and designing control programs. Operators must analyze existing surveillance data to identity any new source of mosquito problems.

In the event there are no data for your pest management area in the past calendar year, see Part 5 for documentation requirements regarding why current data are not available and the data you used to meet the permit conditions in Part 2.2.1.1. Operators may use historical data or neighboring district data to identify the species and establish action thresholds.

Pest Management

Part 2.2.1.2: Prior to the first pesticide application covered under this permit that will result in a discharge to waters of the U.S., and at least once each calendar year thereafter prior to the first pesticide application for that calendar year, you must select and implement, for each pest management area, efficient and effective means of pest management that minimize discharges resulting from application of pesticides to control mosquitoes or other flying insect pests. In developing these pest management strategies, you must evaluate the following management options, considering impact to water quality, impact to non-target organisms, pest resistance, feasibility, and cost effectiveness: No action; Prevention; Mechanical/physical methods; Cultural methods; Biological control agents; and Pesticides.

Operators are required to evaluate and implement a pest management strategy to minimize pesticide discharge into waters of the U.S. prior to the first pesticide application covered under this permit. Pest management strategies will vary by locality, mosquito species, and financial concerns. As noted above, combinations of various management methods are frequently the most effective pest management strategies over the long term. The goal should be to emphasize long-term control rather than a temporary fix. Operators must reevaluate every year prior to the first pesticide application for that calendar year. The following describes the management options that must be evaluated.

No Action. No action is to be taken, although a mosquito problem has been identified. This may be appropriate in cases where, for example, available control methods may cause secondary or non-target impacts that are not justified or no control methods exist.

Prevention. Prevention strategies are program activities which eliminate developing mosquito populations through environmental modification and/or habitat management. For mosquito control, these activities are physical methods such as habitat modification, cultural methods that reduce sources of mosquitoes, and biological control.

Mechanical/Physical Methods. Habitat modification, also known as physical or permanent control, is in many cases the most effective mosquito control technique available and is accomplished by eliminating mosquito breeding sites. Habitat modification activities have the potential to be both effective and economical in some areas and can virtually eliminate the need for pesticide use in and adjacent to the affected habitat. However, the ability to use prevention strategies is dependent upon local authority and restrictions.

Cultural Methods. Cultural methods can reduce sources of mosquitoes and can be as simple as properly discarding old containers that hold water capable of producing *Aedes aegypti*, *Ae. albopictus* or *Culex spp*. or as complex as implementing Rotational Impoundment Management (RIM) or Open Marsh Water Management (OMWM) techniques. RIM is a source reduction strategy that controls salt marsh mosquitoes (e.g., *Ae. taeniorhynchus* and *Ae*. *sollicitans*) at the same time as significant habitat restoration is occurring. Source reduction may include; water management, vegetation management, biological control, and pesticide use in non-waters of the U.S.

Containers provide excellent habitats for development of numerous mosquito species. These may include but are not limited to flowerpots, cans, and tires. Container-inhabiting mosquitoes of particular concern include, *Ae*. *aeypti, Ae*. *albopictus, Cx. p. pipiens,* and *Cx*. *salinarious*. A container-breeding mosquito problem can be solved by properly disposing of such materials, covering them, tipping them over to ensure that they do not collect water, and/or periodic draining. Urban container-breeding mosquito control is best implemented through education and surveillance programs.

Source reduction in freshwater lakes, ponds, and retention areas is more applicable to artificially created areas than natural areas. Artificial ponds can be eliminated as a breeding site simply by filling in the areas, (i.e. habitat modification). However, large permanent water bodies and areas for stormwater or wastewater retention require other methods. Options for these areas include minimizing and/or eliminating emergent and standing vegetation, maintenance of steep banks, and inclusion of deep water areas as sanctuary for larvivorous fish.

Mosquito production from stormwater/wastewater habitats can result in considerable mosquito problems as a result of engineering, poor construction or improper maintenance. However, mosquito populations can typically be managed by keeping such areas free of weeds through an aquatic plant management program and maintaining water quality that can support larvivorous fish. *Culex*, *Coquillettidia*, *Mansonia*, and *Anopheles* mosquitoes are often produced in these habitats.

Pastures and agricultural lands are enormous mosquito producers, frequently generating huge broods of *Aedes*, *Psorophora*, and *Culex* mosquitoes. Improved drainage is one effective tool for source reduction in such habitats. The second is the use of efficient, precision irrigation practices that will result in less standing water for those agricultural areas that require artificial watering.

In coastal areas with extensive coastal salt marshes, there can be tremendous production of *Aedes* mosquitoes, making coastal human habitation virtually impossible. Several source reduction efforts can greatly reduce salt-marsh mosquito production through high-to mid-intensity management that relies upon artificial manipulation of the frequency and duration of inundation.

Biological Control. The use of biological organisms or their byproducts to combat pest insects, such as mosquitoes, is termed biological control, or biocontrol. Biocontrol is utilization of parasites, predators, and pathogens to regulate pest populations. Generally, this definition includes natural and genetically modified organisms and means that the agent must be alive and able to attack the mosquito. The overall premise is simple: Biocontrol agents that attack mosquitoes naturally are grown in the lab and then released into the environment, usually in far greater numbers than they normally occur, and often in habitats that previously were devoid of them, so as to control targeted mosquito species.

One advantage of biocontrol agents is host-specificity which affords minimal disturbance to non-target species and to the environment. However, it is this specificity and the cost of commercializing biocontrol agents that deter development of biocontrol agents. In addition, utilization of biocontrol requires increased capital outlay and start up costs as well as increased training requirements for personnel.

Biocontrol should be considered a set of tools that a mosquito control program can use when it is economically feasible. When combined with conventional chemicals and physical control procedures, biocontrol agents can provide short and, occasionally, long-term control. Biocontrol, as a conventional control method, should aim at the weakest link of the life cycle of the mosquito. In most cases, this is the larval life stage.

Mosquitofish (*Gambusia affinis*) are currently the most extensively used biocontrol agent. These fish, which feed on mosquito larvae, can be placed in a variety of permanent and semi-permanent water habitats. Differences of opinion exist on the utility and actual control benefits derived from *Gambusia* implementation in an Integrated Pest Management (IPM) program with results reported from excellent control to no control at all. Recently, concerns over placing *Gambusia* in habitats where other fish species assemblages are threatened have arisen. Care must be taken in placement of this cosmopolitan species in areas where endemic fish species are sensitive to further environmental perturbation. Additionally, use of endemic fish species in these areas of concern deserves greater attention. An example of this is *Rivulus* fish species. The potential of Rivulus as mosquito predators is currently being evaluated in saltwater habitats, especially in Brevard County, Florida.

In some aquatic habitats, fish function as an excellent mosquito biocontrol mechanism. These typically are permanent habitats where *Culex* and *Anopheles* are the primary mosquito residents and where the mosquito densities are not excessive. However, in habitats such as salt marshes fish are unable to control the sudden explosion of larvae produced by rainfall or rising tides. Here, the mosquito population numerically exceeds what the fish can consume during the brief immature mosquito developmental period. In salt marshes, fish must rely on things other than mosquito larvae for their nutritional needs most of the time, simply because there may be long delays between hatches of larvae. Mosquito larvae present an abundant food source, but only for a few days during their rapid development.

Species of predacious mosquitoes in the genus *Toxorhynchites* have been studied in a variety of urban areas for control of container-inhabiting mosquitoes, such as the Asian tiger mosquito (*Ae*. *albopictus*). *Toxorhynchites* mosquitoes also affect mosquito populations that develop in the treehole environment; however, their introduction into urban container habitats has proven unsuccessful.

In specific containers, *Toxorhynchites* may consume a large number of prey mosquito larvae, such as *Aedes aegypti* and *Ae. albopictus*. However, this predator does not disperse well enough to impact the vast number of natural and artificial containers used by these mosquitoes. Additionally their life-cycle is 2-3 times that of their prey making it impossible for them to keep up with the other more rapidly developing mosquitoes.

Another group of biocontrol agents with promise for mosquito control is the predacious copepods (very small crustaceans). Copepods can be readily mass reared, are easily to delivered to the target sites, and perform well when used with insecticides.

Birds and bats are often promoted as potential biocontrol agents of adult mosquitoes. However, while both predators eat adult mosquitoes, they do not do so in sufficient amounts to impact the mosquito populations. Mosquitoes provide such a small amount of nutrition that birds or bats expel more energy pursuing and eating mosquitoes than they derive from them. They are not a primary food source for these predators. Additionally, with mosquito flight behavior being crepuscular they are not active during the feeding periods of most birds. While bats are active during the correct time period, they simply cannot impact the massive numbers of adult mosquitoes available.

Bio-rational products exploit insecticidal toxins found in certain naturally occurring bacteria. These bacteria are cultured in mass and packaged in various formulations. The bacteria must be ingested by mosquito larvae so the toxin is released. Therefore bio-rational products are only effective against larvae since pupae do not feed. The bacteria used to control mosquito larvae have no significant effects on non-target organisms. The possibility of creating a new invasive species by the introduction of biocontrols should be considered, evaluated, and avoided.

Pesticides. There are chemical and biological pesticide products registered for use against mosquitoes. Two biological pesticide products that are used against mosquito larvae singly or in combination are *Bacillus thuringiensis israelensis* (Bti) and *Bacillus sphaericus* (Bs). Manufactured Bti contains dead bacteria and remains effective in the water for 24 to 48 hours; some slow release formulations provide longer control. In contrast, Bs products contain live bacteria that in favorable conditions remain effective for more than 30 days. Both products are safe enough to be used in water that is consumed by humans. In addition to the biological pesticides, there are chemical pesticides for use against mosquitoes. As described below, once the determination is made to use pesticides to control mosquitoes, additional requirements under this general permit must be met.

Pesticide Use

Conduct larval and/or adult surveillance prior to each pesticide application to assess the pest management area and to determine when action threshold(s) are met that necessitate the need for pest management. Pest surveillance is important for timing pest control properly and to evaluate the potential need for pesticide use for mosquito control. Understanding surveillance data may enable mosquito control operators to more effectively target their control efforts. Operators are required to conduct a surveillance program to minimize discharges from control activities. Surveillance is necessary not only to establish species’ presence and abundance but also as an evaluation tool of the effectiveness of source reduction and chemical control activities. Furthermore, surveillance should be used as an indicator of the need for additional chemical control activities based on pre-established criteria related to population densities in local areas.

Larval surveillance involves routine sampling of aquatic habitats for developing mosquitoes. The primary tools used to determine larval densities and species composition are a calibrated dip cup and/or a bulb syringe for inaccessible areas such as treeholes. The counts may be expressed as the number of immature (larvae and pupae) mosquitoes per dip, per unit volume, or per unit surface area of the site. However, due to natural mortality from environmental factors, disease and predators, larval dip counts do not provide an accurate indication of the potential adult population. Nevertheless, larval counts do indicate when chemical larval control measures are warranted.

Adult surveillance is a key component of any mosquito control program. Adult surveillance can be conducted using CDC traps, New Jersey light traps, resting site traps, egg oviposition traps, vehicle traps, and landing count rates. Mosquito control operators should use a variety of the available traps as adults are attracted to different traps depending on their species, sex, and physiological condition. Trapped adults provide information about local species composition, distribution, and density. In addition, the need for adulticide application may also be established through the number and distribution of service requests received from the public. Collection data also provide feedback to the mapping and planning component of the IPM program as well as to its effectiveness and also serve to identify new sources of mosquitoes or identify recurring problem sites.

Disease surveillance, where practical, is also a key component of a pest management strategy. Detecting antibodies in “sentinel” chicken flocks, equine cases, and testing dead birds and adult mosquitoes for infections are all used to determine whether disease is being transmitted in an area. Mosquito and vector control agencies also may test mosquitoes for viruses in their laboratories. Although generally less sensitive than sentinel chickens, mosquito infections may be detected earlier in the season than chicken seroconversions and therefore provide an early warning of virus activity. However, disease surveillance is not applicable to all mosquito control programs. In the absence of a dedicated disease surveillance program, mosquito control operators should stay informed of arboviral occurrence or potential for occurrence in their control areas as determined by local, state, and/or national public health agencies.

Assess environmental conditions (e.g. temperature, precipitation, and wind speed) in the treatment area prior to each pesticide application to identify whether existing environmental conditions support development of pest populations and are suitable for control activities. Environmental conditions also may affect the results of adulticide application. Wind determines how the ULV droplets will be moved from the output into the treatment area. Conditions of no wind will result in the material not moving from the application point. High wind, a condition that inhibits mosquito activity, will quickly disperse the insecticide over too wide an area but at a diluted rate too low to effectively control pests. Light wind conditions (< 10 mph) are the most desirable because they move the material through the treatment area and are less inhibiting to mosquito activity. Thermal fogs perform best under very light wind conditions.

ULV application should be avoided during hot daylight hours. Thermal conditions, particularly temperature inversion, will cause the small droplets to quickly rise, moving them away from mosquito habitats. Generally, applications are made after sunset and before sunrise, depending upon mosquito species activity. Some mosquitoes (*Culex* and *Anopheles*) are most active several hours after sunset, while others (*Ae. aegypti* and *Ae. albopictus*) are more active during the daytime, and if these species are the targets, application should be made during the period of highest activity for the target species, provided that meteorological conditions are suitable for application (seldom during daylight hours).

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

Reduce the impact on the environment and on non-target organisms by applying the pesticide only when the action threshold has been met. Operators must apply pesticide only as indicated by action thresholds for the pest management area. As noted above, action threshold, established by the operator, help determine both the need for control actions and the proper timing of such actions. Timing pesticide application can reduce the impact on the environment and on non-target organisms.

In situations or locations where practicable and feasible for efficacious control, use larvicides as a preferred pesticide for mosquito or flying insect pest control when larval action thresholds have been met. Operators may use larvicides, adulticides or a combination of both. However, when practicable and feasible, larviciding should be the primary method for mosquito control. Larviciding is a general term for the process of killing mosquitoes by applying natural agents or manmade pesticide products designed to control larvae and pupae (collectively called larvicides) to aquatic habitats. Larviciding uses a variety of equipment, including aerial, from boats, and on the ground, as necessitated by the wide range of breeding habitats, target species, and budgetary constraints. Applications can be made using high pressure sprayers, ULV sprayers, handheld sprayers, and back sprayers. However, larviciding is only effective when a high percentage of the mosquito production sites are regularly treated, which may be difficult and expensive.

There are advantages and disadvantages to aerial and ground larvicide treatments. Ground larviciding allows application to the actual treatment area and consequently to only those micro-habitats where larvae are present. Therefore, ground larviciding reduces unnecessary pesticide load on the environment. However, ground applications often rely on in-the-field human estimates of the size of treatment areas and equipment output with a greater chance of overdosing or under-dosing. Ground larviciding is also impractical for large or densely wooded areas and exposes applicators to greater risk of insecticide exposure.

Aerial larviciding application methods are generally used for controlling mosquito larvae present in large areas and areas that are inaccessible for ground application. However, failure to treat an entire area with good larvicide coverage can result in the emergence of large adult populations. In order to prevent poor site coverage, a global positioning system (GPS), where economically feasible, or site flagging are necessary to increase accuracy of the treatment coverage while minimizing the amount of larvicides being applied. Aerial application does provide easier calibration of equipment due to the fact that the target area is generally mapped and the material is weighed or measured when loading. However, cost of aerial application is higher than ground application (i.e. additional personnel for flagging or expensive electronic guidance systems) and also requires special FAA licenses, training of staff, and additional liability insurance. In addition, aerial larviciding has greater potential for non-target impacts.

In situations or locations where larvicide use is not practicable or feasible for efficacious control, use adulticides for mosquito or flying insect pest control when adult action thresholds have been met. Chemical treatment for adult mosquitoes, adulticiding, is the most visible and commonly used form of mosquito control. Adulticide applications may be used for nuisance or disease vectoring mosquitoes. Adulticiding consists of dispersing an insecticide as a space spray into the air column, using ground or aerial equipment, which then remains suspended in the air column through the habitat where adult mosquitoes are flying. Any mosquito adulticiding activity that does not follow reasonable guidelines, including timing of applications, avoidance of sensitive areas, and strict adherence to the pesticide label, risks affecting non-target insect species.

Operators must ensure that the adulticide applications are made only when necessary by determining a need in accordance with specific criteria that demonstrate a potential for a mosquito-borne disease outbreak, or numbers of disease vector mosquitoes sufficient for disease transmission, or a quantifiable increase in numbers of pestiferous mosquitoes. To determine the need for adulticide application, at least one of the following criteria should be met and documented by records: 1) when a large population of adult mosquitoes is demonstrated by either a quantifiable increase in, or a sustained elevated mosquito population level as detected by standard surveillance methods, 2) where adult mosquito populations build to levels exceeding community standards (e.g., 25 mosquitoes per trap night or 5 mosquitoes per trap hour during crepuscular periods), and/or 3) when service requests for arthropod control from the public have been confirmed by one or more recognized surveillance methods.

The most common forms of adulticiding are ultra-low volume spray (ULV) and thermal fogging. Ground adulticiding is almost exclusively conducted with ULV equipment and is the most common method used to control mosquitoes. Ground adulticiding can be a very effective technique for controlling most mosquito species in residential areas with negligible non-target effects.

Aerial adulticiding is a very effective means of controlling adult mosquitoes, particularly in inaccessible areas, and may be the only means of covering a very large area quickly in case of severe mosquito outbreaks or vector borne disease epidemics. Aerial adulticide applications are made using either fixed wing aircraft or rotor craft. Application is generally as ULV spray but some thermal fogging still occurs.

Adulticide application has its own set of conditions that determine success or failure. The application must be at a dosage rate that is lethal to the target insect and applied with the correct droplet size. Whether the treatment is ground or aerially applied, it must distribute sufficient insecticide to cover the prescribed area with an effective dose. Typically with ground applications, vegetated habitats may require up to three times the dosage rates that open areas require. This is purely a function of wind movement and its ability to sufficiently carry droplets to penetrate foliage. In addition, aerial application is dependent upon favorable weather conditions.

Recommended Mosquito Control References

EPA recommends the following sources for additional information on IPM's and BMP's for mosquito control.

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b. Other Flying Insect Pest Control (Black Flies Example)

The Agency has chosen to use black flies as a demonstration of how IPM practices would be implemented for other flying insect pest control.

Black Flies – Background

There are 1800 species of black flies throughout the world with approximately 254 species in North America alone. Black flies can be 1) a source of annoyance to people, animals, and wildlife, 2) a limiting factor in economic development (e.g., residential development and property value), and 3) a causal factor in decreased agricultural productivity (e.g., animal weight loss/death and milk production). Black fly control in the U.S. provides economic, health and quality of life benefits. In contrast to the integrated approach used for mosquito control, due to its unique biology, black fly control in the U.S. is primarily through the use of larvicides.

Black Flies - IPM Practices

Identify the Problem

Part 2.2.1.1: Prior to the first pesticide application covered under this permit that will

result in a discharge to waters of the U.S., and at least once each calendar year thereafter prior to the first pesticide application for that calendar year, you must do the following for each pest management area, as defined in Appendix A. Operators must identify the pest problem in their pest management area prior to the first application covered under this permit. Knowledge of the pest problem is an important step to developing pest management strategies. Re-evaluation of the pest problem is also important to ensure pest management strategies are still applicable. Operators must identify the pest problem at least once each calendar year prior to the first application for that calendar year. Operators are required to fulfill problem identification requirements to minimize discharges to waters of the U.S. in black fly control operations. Identification includes: (1) black fly biology, (2) local developmental habitats, (3) avoidance methods, and (4) the benefits and risks of chemical use as a pest management strategy.

Black flies, commonly referred to as buffalo gnats, are the smallest of the blood feeding dipterans. Worldwide, blackflies are responsible for transmitting ochocerciasis (river blindness) to millions of people in tropical areas. Black flies can also vector bovine onchocerciasis, mansonellosis, and leucoytozoonosis in wild and domestic animals. While generally only considered nuisance pests in the U.S., epidemiological research has demonstrated that black flies are competent vectors of vesicular stomitis and suggests that these pests may be responsible for periodic outbreaks of this disease in livestock, wildlife, and humans in the western U.S. However, flies may also become so abundant as to be drawn into the air passages of livestock, occasionally resulting in death. Black fly feeding activity may also result in allergic reaction in both animals and man as a result of histaminic substances in black fly saliva.

Establish densities for larval and adult mosquito or flying insect pest populations to serve as action threshold(s) for implementing pest management strategies. Operators must develop action thresholds for black flies prior to first pesticide application covered under this permit. The action thresholds must be re-evaluated at least once each calendar year. As noted in the general discussion above, an action threshold is a point at which pest populations or environmental conditions indicate that pest control action must be taken. Action thresholds help determine both the need for control actions and the proper timing of such actions. It is a predetermined pest level that is deemed to be unacceptable.

Identify the target mosquito or flying insect pest species to develop species-specific pest management strategies based on developmental and behavioral considerations for each species. The life cycle for black fly includes four stages: egg, larva, pupa, and adult. All are aquatic except the adults, which leave the water to search for food and mates. Black fly immatures have three general life history strategies. One group of species produces 1 generation per year (univoltine) that matures in late winter or early spring. A second group is also univoltine, but these species develop during late spring or summer. The third and final group of species produces 2 or more generations per year (bivoltine or multivoltine) that typically develop from early summer through fall.

Adult females deposit from 150 to 500 eggs in flowing water. Flowing water habitats capable of black fly production range from a 4-inch trickle to large rivers. Egg-laying occurs near dusk for many species. The eggs are dropped singly from the air or deposited in masses on trailing vegetation, rocks, debris and other substrates. Eggs hatch in 2 days to 8 months, depending on black fly species and water temperature. Incubation time in some species is delayed by a prolonged diapause, or resting period. Eggs of many species can successfully withstand temperature extremes, fluctuating water levels, and desiccation associated with alternating flood and drought conditions during seasonal changes. Many species overwinter in the egg stage, but a few black flies spend the winter months as larvae and pupae, or rarely, as adults.

Larvae anchor themselves to clean vegetation, rocks, or debris by spinning a small silken pad with their mouthparts and inserting a row of hooks at the end of their enlarged abdomen into the silk pad. This technique allows the larvae to secure themselves in areas of very fast water velocity and orient their body with the abdomen pointed upstream, and head positioned downstream to feed. Larvae can easily relocate to other areas by drifting downstream on a silken thread, spinning a new silk pad, and reattaching themselves in areas with more acceptable substrates or food supplies. Feeding is accomplished by expanding a pair of fan-like structures on their hardened head capsule to efficiently filter microscopic food particles from the water column. The larvae filter or scrape very fine organic matter, filamentous algae, bacteria and tiny aquatic animals from the current or substrates. Larvae are often infected with various parasites and pathogens, including nematode worms, bacteria, fungi, protozoa and viruses.

Larval instars vary from 4 to 9, depending on species, with many species passing through an average of 7 instars. Larval development time varies from 1 week to 6 months depending on species, water temperature, stream turbidity and food availability. Larval growth is very temperature dependent, with relatively slow growth during the cold winter months and very rapid growth during warm summer water temperatures. Some summer-developing, multivoltine species are capable of completing their entire life cycle in just a few weeks. Mature larvae, with fully developed respiratory filaments visible as a dark area on each side of the thorax, stop feeding, and construct a silken pupal cocoon where metamorphosis takes place.

Pupae secure themselves inside their cocoons with rows of spine-like hooks on their abdomen. The tightly woven or loose cocoons, characteristically shaped for each species, are attached to substrates with the closed end facing upstream to protect pupae from current and sediments. Some species have a lateral aperture, or window, on each side of the cocoon to increase water circulation around the pupa. The branched respiratory organs that project from the pupal thorax are designed to function in or out of water. This adaptation allows pupae to obtain oxygen at all times, and survive normal fluctuations in water levels. The pupal stage may last from 2 days to several weeks depending on the species and water temperature.

Adults emerge from the pupal skin through an elongate slit at the top of the thorax and ride a bubble of air that propels them to the water surface. Freshly emerged adults fly to streamside vegetation where their wings and bodies quickly dry and harden. Mature adults immediately seek food sources and mates. Both sexes feed on nectar, sap, or honeydew to obtain the sugar used for flight and energy. Only females feed on blood. In most species, mating takes place in flight, with females flying into male swarms that form over landmarks such as waterfalls, vegetation or host species. Males utilize their large eyes to detect and seize females entering the swarm. Male and female pairs exit the swarm, and mating takes place in flight in just a few seconds. Females then seek a host to obtain the blood meal required to nourish their eggs. Adults are strong fliers, capable of dispersing many miles from their larval habitats.

Black fly females are attracted to their specific hosts by size, shape, color, carbon dioxide, body odor, body movement, skin texture, temperature and humidity. Females use their mouthparts to cut, or lacerate the host skin, and then drink from the resulting pool of blood. Anticoagulants in the saliva are injected into the bite to facilitate bleeding. Many domestic and wild animals have been killed by outbreaks of adult black flies. Deaths have been attributed to acute toxemia from large numbers of bites, anaphylactic shock, and weakness due to blood loss. In humans, lesions can develop at the bite, accompanied by reddening, itching, and swelling. In severe cases, allergic reactions may occur, resulting in nausea, dizziness, and fever.

Host specificity in black flies varies from highly specific species that will feed on blood from only 1 host, too much more generalized species that will draw blood from a number of different hosts. Although host preferences for many North American black flies are poorly understood, it is estimated that 67% feed on mammals and 33% feed on birds. Approximately 10% of North American species will feed on the blood of humans.

Prior to first pesticide application covered under this permit, operators must ensure proper identification of black fly species to develop a detailed pest management strategy. Due to preferred hosts and developmental habitats, proper identification of the pest species is instrumental in determining the biology (univoltine or multivoltine), and developmental habitat preference (e.g., flow rate, stream size, stream substrate composition), and flight range of the target species. By knowing these factors, a control program can 1) determine if the black fly species warrants control activities (i.e. host preference and historical problems), 2) identify habitats and delineate the potential area for ongoing monitoring and control activities, 3) determine frequency of site monitoring, 4) estimate timing for pesticide application (i.e. historical seasonal occurrence, age distribution of susceptible immature population, environmental conditions suitable for control activity, etc.), 5) reduce discharge of pesticides into waters of the U.S.

Identify known breeding sites for source reduction, larval control program, and habitat management. In conjunction with species identification, mapping should be considered part of control programs aimed at black fly management. Maps may simply be township/city/county maps but may also include aerial photo assessments, topographic maps, and satellite imagery where available and/or practicable. Mapping is essential to identify areas of flowing water which are suitable for production of the target species. As black flies are strong fliers and will travel great distance to obtain a blood meal, mapping should be for an extended area from the site to be protected by control activities. Species identification and mapping should also be a priority in a surveillance program (both current and historical) to determine the need for initiating control activity. Identification and mapping are both essential to planning a control program which reduces pesticide discharge into waters of the U.S.

Analyze existing surveillance data to identify new or unidentified sources of mosquito or flying insect pest problems as well as sites that have recurring pest problems. As discussed above, mapping is a valuable tool in assessing pest habitats and designing control programs. Operators must analyze existing surveillance data to identity new sources of black fly problems.

In the event there are no data for your pest management area in the past calendar year, see Part 5 for documentation requirements regarding why current data are not available and the data you used to meet the permit conditions in Part 2.2.1.1. Operators may use historical data or neighboring district data to identify the species and establish action thresholds.

Pest Management

Part 2.2.1.2: Prior to the first pesticide application covered under this permit that will result in a discharge to waters of the U.S., and at least once each calendar year thereafter prior to the first pesticide application for that calendar year, you must select and implement, for each pest management area, efficient and effective means of pest management that minimize discharges resulting from application of pesticides to control mosquitoes or other flying insect pests. In developing these pest management strategies, you must evaluate the following management options, considering impact to water quality, impact to non-target organisms, pest resistance, feasibility, and cost effectiveness: No action; Prevention; Mechanical/physical methods; Cultural methods; Biological control agents; and Pesticides. Operators are required to evaluate and implement a pest management strategy to minimize pesticide discharge into waters of the U.S. prior to the first pesticide application covered under this permit. Pest management strategies will vary by locality (i.e. stream size, stream substrate, and stream vegetation), black fly species (i.e. multi/univoltine development and host specificity), and financial concerns (i.e. accessibility to streams and size/rate of flow for the streams). As noted above, combinations of various management methods are frequently the most effective pest management strategies over the long term. The goal should be to emphasize long-term control rather than a temporary fix. Operators must reevaluate every year prior to the first pesticide application for that calendar year.

Based on problem identification, two preventive strategies other than pesticides should be evaluated. The first is reducing the number of black fly breeding areas. This may include removal (physical and/or chemical) of vegetation and other objects in streams to reduce number of larval habitats. The second is temporary damming of flowing stream larval development sites to create pool habitats. As larvae require flowing water for development, pooling can kill developing black fly larvae. However, the impact of these habitat management options must be considered in relation to other environmental impacts on other aquatic species. Furthermore, due to the wide variability in stream size/flow rate and the accessibility of streams for habitat modification, these options are seldom acceptable control solutions for most black fly developmental habitats.

Pesticide Use

Conduct larval and/or adult surveillance prior to each pesticide application to assess the pest management area and to determine when action threshold(s) are met that necessitate the need for pest management. Larval surveillance involves routine sampling of aquatic habitats for developing black flies. Larval surveillance is primarily accomplished by collecting stream substrates (rocks, vegetation, etc.) and examining for larval and pupal occurrence. Due to the varied developmental sites for black larvae and their ability to move in streams relative to changes in flow patterns, quantitative sampling will vary from site to site and in many instances, particularly with continuously changing water levels, is not practical. Qualitative sampling is often used in lieu of quantitative sampling, as an indicator of egg hatch and to indicate the age distribution of developing larvae. Qualitative sampling alone when used in conjunction with historical occurrence data can provide a reliable indicator of the need to initiate control activities.

Adult surveillance for black flies may include sweep sampling, vacuum aspiration of adults, and the use of silhouette traps. Traps may be simple visual attractants or may be baited with artificial attractants (e.g., ocentol and CO_2). However, as different black fly species will respond differently in relation to different attractants, based on host preference, care must be used in selecting attractants that will provide a representative sample of the complete black fly spectrum present in any given location. Choice of adult sampling will in many cases be dictated by historical occurrence of black flies in a given area. Regardless, surveillance data is a useful tool in providing feedback to the mapping and planning component of any pest management strategy.

Assess environmental conditions (e.g. temperature, precipitation, and wind speed) in the treatment area prior to each pesticide application to identify whether existing environmental conditions support development of pest populations and are suitable for control activities. Environmental conditions may affect the results of pesticide application. Operators must assess the treatment area to determine whether site conditions support pest populations and are suitable for pesticide application.

Reduce the impact on the environment and on non-target organisms by applying the pesticide only when the action threshold has been met. Operators must apply pesticide only as indicated by action thresholds for the pest management area. As noted above, action threshold help determine both the need for control actions and the proper timing of such actions. Timing pesticide application can reduce the impact on the environment and on non-target organisms.

In situations or locations where practicable and feasible for efficacious control, use larvicides as a preferred pesticide for mosquito or flying insect pest control when larval action thresholds have been met. Bacillus thuringiensis var israelensis (Bti) is the primary larvicide used for black fly control in the U.S. Bti is a gram positive, aerobic, spore-forming bacterium that produces protoxins in the form of parasporal protein crystals. In the alkaline digestive tract of black flies and mosquitoes, the protoxins become activated into highly toxic delta-endotoxins. The endotoxins cause a rapid breakdown in the lining of the mid-gut and necrosis of skeletal muscles, resulting in paralysis and mortality of target insect pests. Bti is nontoxic to most non-target organisms due to their acidic digestive systems and lack of suitable tissue receptor sites.

To minimize pesticide discharge into waters of the U.S., operators must apply larvicides as needed for source reduction as indicated by the action threshold in situations or locations where it is practicable and feasible to do so. The action threshold may be based on occurrence of adults (current or historical) and/or larval sampling of stream substrates for immature black flies. Surveillance is also a valuable tool for assessing the effectiveness of larval control activities.

Larvicides may be applied to streams using either ground or aerial equipment. Choice of equipment is largely dictated by stream size and accessibility. Application equipment may include backpack sprayers, boats equipped with sprayers or metered release systems, helicopters or fixed wing aircraft. The amount of insecticide required to treat a stream should be based on the desired dosage and the stream discharge. Stream discharge is calculated by determining the average width and depth of the stream and the stream velocity (discharge = width (m) x depth (m) x velocity (m/s)). Proper calibration of insecticide delivery based on discharge is necessary to ensure complete coverage throughout the water column in order to expose all larval habitats to an effective insecticide dose.

Larvicide is applied across the stream width for the time specified by the application rate. The point of application should be far enough upstream from the larval habitat to ensure proper insecticide dispersal in the water passing over the treatment area. Operators should determine the effective downstream carry (maximum distance at which at least 80% larval control is achieved) of the insecticide suspension. By determining downstream carry, black fly control operators can limit the number of applications necessary to treat any given stream and thereby reduce pesticide discharge into waters of the U.S.

In situations or locations where larvicide use is not practicable or feasible for efficacious control, use adulticides for mosquito or flying insect pest control when adult action thresholds have been met. Pesticide control of black flies in the U.S. historically relied upon both larvicides and adulticides. However, adulticide use against black fly populations is no longer a common practice. As adult black flies are seeking blood meals during the daytime, adulticide application coincides with human activity, so daytime application is no longer a standard control procedure. One reason for this change is due to environmental factors associated with daytime adulticide application, particularly thermal inversions, which cause adulticide application for black fly control to be ineffective. Furthermore, as only adults directly contacted by the adulticide application are killed, with no residual activity against other adults immigrating to the treatment area, adulticide applications are both ineffective and expensive. For these reasons, larvicides which target the immature stages before development of the pestiferous adult are now the primary means of black fly control in the U.S.

Recommended Black Fly Control References

EPA recommends the following sources for additional information on IPMs and BMPs for black fly control:

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University of Florida. 2007. Featured Creatures – Black Flies. EENY-30. Available at http://entomology.ifas.ufl.edu/creatures/livestock/bfly.htm

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2.2.2. Aquatic Weed and Algae Control

Background

Aquatic weeds and algae that negatively affect aquatic biodiversity, human health, and economic stability are considered to be pests. Aquatic weeds and algae can decrease populations of native aquatic species including threatened and endangered species. Aquatic weeds and algae can reduce aquatic biodiversity by preventing desirable species growth and unbalancing desirable aquatic species populations and development. Social, economic, and human health are all affected by a lower aesthetic appeal of a water bodies, an increased cost of agricultural irrigation water, and an increase in the risk of human diseases by providing ideal vector breeding grounds. In addition, the reduction in the utility of water can have social and economic impacts due to reduced hydroelectric operations, impeded opportunity for recreational activities (e.g., fishing, boating, and swimming), and disruption of water transport (e.g., agricultural irrigation) to name a few. As a result, if aquatic weeds and algae become established and impede the environmental stability and use goals for a body of water, control measures will be necessary. Pest control may be necessary before the pests become established.

The requirements in Part 2.2.2, apply to pesticide discharges associated with management of aquatic weed and algae in, but not limited to, lakes, ponds, rivers, streams, irrigation canals, and drainage systems. Irrigation and drainage systems differ in the type and disposition of the water that they convey; these systems may consist of earthen or concrete lined canals or combinations of the two.

Most aquatic plants and algae are largely beneficial to water quality, especially when present in the appropriate densities. However, overabundant native algae and aquatic vegetation, as well as introduced, exotic species can decrease water quality and utility. Dense plant or algae growth can interfere with recreational activities (e.g., fishing, boating, and swimming), disrupt water transport, reduce aquatic biodiversity by preventing desirable plant growth and unbalancing fish populations, lower the aesthetic appeal of a water body, and increase the risk of human diseases by providing ideal vector breeding grounds.

Algae

Algae are non-vascular plant that do not have true roots, stems, leaves, or vascular tissue and have simple reproductive systems. Some macroscopic algae may resemble a plant in appearance. Algae may occur in the sea or freshwater. Algae are an important aquatic food source for many animals. However, excess algae growth such as algae blooms, frequently caused by unbalanced or elevated nutrients, can be damaging to aquatic ecosystems. Control options include mechanical, biological, and chemical methods.

Weeds

Aquatic weeds include floating, emergent, or submerged plants that negatively impact the quality and utility of waters of the U.S. Aquatic systems need plant materials as an important part of the systems ecology; however, when vegetation becomes established to the point of impeding the use goals for a body of water, control measures will become necessary. As a part of such aquatic weed control programs a pest management strategy should consider mechanical, biological, and/or chemical controls. Details for developing an integrated aquatic weed pest management strategy can be found in the document *Aquatic Plant Management, Best Management Practices in Support of Fish and Wildlife Habitat* (January 2005. Aquatic Ecosystem Restoration Foundation. Project Leader Kurt Getsinger, Ph.D. http://cenapa.ucdavis.edu/files/54815.pdf).

The appropriate type of control for aquatic weeds and algae is dictated by the biology of the target species and by environmental conditions and concerns for a specific area. "Control" means, as appropriate, eradicating, suppressing, reducing, or managing invasive species populations, preventing spread of aquatic nuisance plants from areas where they are present, and taking steps such as restoration of native species and habitats to reduce the effects of aquatic nuisance plants and to prevent further invasions. [Source: www.invasivespeciesinfo.gov/laws/execorder.shtml#sec1] Numerous strategies are used to reduce the impact of aquatic weeds and algae, but a pest management strategy should be the basis for any pest control program. This is a comprehensive approach for managing pest populations using a variety of control methods.

Aquatic Weed and Algae Control IPM Practices

Identify the Problem

Part 2.2.2.1: **Prior to the first pesticide application covered under this permit that will result in a discharge to waters of the U.S., and at least once each calendar year thereafter prior to the first pesticide application for that calendar year you must do the following for each pest management area, as defined in Appendix A.** Operators must identify the pest problem in their pest management area prior to the first application covered under this permit. Knowledge of the pest problem is an important step to developing pest management strategies. Re-evaluation of the pest problem is also important to ensure pest management strategies are still applicable. Operators must identify the pest problem at least once each calendar year prior to the first application for that calendar year.

Identify areas with aquatic weed or algae problems and characterize the extent of the problems, including, for example, water use goals not attained (e.g. wildlife habitat, fisheries, vegetation, and recreation). Operators must be well-acquainted with the unique regional conditions of their sites and available methods for controlling the pest species present. Intended use goals for the water bodies that are being impeded because of nuisance pest infestation must also be considered based on the control site. The use of the best available mapping information to aid in identifying the problem areas is suggested. Mapping may include aerial photo assessments, topographic maps, and satellite imagery where available and/or practicable. Mapping can be essential to identify problem areas which can and cannot be controlled using non-pesticide preventative measures (e.g., mechanical control). Mapping can also be used in plotting the regional desired aquatic species, as well as water use goals and complaints or reports of aquatic weeds and algae from the public.

Identify target weed species. Positive identification of the aquatic weed or algae is required because many species within the same genera may require different levels and types of control measures species. Aquatic weed and algae identification is important when determining the best pest management strategy for each particular species and for determining application areas. Operators should develop a detailed pest management strategy based on identification of the targeted pest species which occur in their area.

Identify possible factors causing or contributing to the weed or algae problem (e.g., nutrients, invasive species, etc). While there may not be reasonable means to control and/or stop the introduction and occurrence of some nuisance species infestations, the identification of possible sources (e.g., outflows from other water systems/bodies) may help in reducing the need for control measures. Potential aquatic weed and algae sources such as changes in nutrient levels or accidental or intentional introduction of exotic species must be identified before control measures are implemented

Establish past or present aquatic weed or algae densities to serve as action threshold(s) for implementing pest management strategies. Any data and/or information regarding pest densities can be used to establish an action threshold. Determining increases in pest densities may indicate a need for action. An action threshold must be established before implementing a pest management strategy. However, action thresholds will be species specific.

In the event there are no data for your pest management area in the past calendar year, see Part 5 for documentation requirements regarding why current data are not available and the data you used to meet the permit conditions in Part 2.2.2.1. Operators may use historical data or neighboring district data to identify the species and establish action thresholds.

<u>**Pest Management**</u>

Part 2.2.2.2: Prior to the first pesticide application covered under this permit that will result in a discharge to waters of the U.S., and at least once each calendar year thereafter prior to the first pesticide application for that calendar year, you must select and implement, for each pest management area, efficient and effective means of pest management that minimize discharges resulting from application of pesticides to control aquatic weeds or algae. In developing these pest management strategies, you must evaluate

the following management options, considering impact to water quality, impact to non-target organisms, pest resistance, feasibility, and cost effectiveness: No action; Prevention; Mechanical/physical methods; Cultural methods; Biological control agents; and Pesticides. Operators must evaluate and implement a pest management strategy to minimize pesticide discharge into waters of the U.S. prior to the first pesticide application covered under this permit. As noted above, combinations of various management methods are frequently the most effective pest management strategies over the long term. The goal should be to emphasize long-term control rather than a temporary fix. Operators must reevaluate every year prior to the first pesticide application for that calendar year. All control measures must be implemented in a manner that reduces impacts to non-target species. The following describes the management options that must be evaluated.

No Action

No action is to be taken, although an aquatic weed or algae problem has been identified. This may be appropriate in cases where, for example, available control methods may cause secondary or non-target impacts that are not justified, no available controls exist, or the pest population is stable at a level that does not impair water body uses.

Prevention

Preventing introductions of possible aquatic weeds and algae is the most efficient way to reduce the threat of nuisance species (ANS Task Force, 2009). Identifying primary pathways of introduction and actions to cut off those pathways is essential to prevention. Through a better understanding of the transportation and introduction of aquatic weeds and algae, private entities (aquaculture) and the public have the necessary knowledge to assist in local aquatic weed and algae control by reducing conditions that encourage the spread of aquatic weeds and algae in their immediate surroundings. For example, recreational water users provide a pathway of unintentional introductions. Increasing public awareness of aquatic weeds and algae, their impacts, and what individuals can do to prevent their introduction and spread is critical for prevention. Other examples of prevention include: better design of water holding sites, better management and maintenance of potential problem sites, and volunteer removal of pest species (e.g., hand weeding). Monitoring and detection also play important roles in the prevention of the spread and introduction of aquatic weeds and algae.

Cultural Method

Cultural techniques include the use of pond dyes and water-level drawdown. Use pond dyes to manage filamentous algae and submersed (underwater) vegetation. Several pond colorants and one or two dyes are EPA-registered for aquatic-weed control. Pond dyes and colorants can be effective if there is little water outflow from the pond. Dyes and colorants intercept sunlight needed by algae and other underwater plants for photosynthesis. Therefore, they are generally ineffective on floating plants like duckweed and water lilies and emergent (growing above the surface) plants like cattails and bulrushes. Dyes and colorants are nontoxic and do not kill the plants, and they are safe for use in ponds for irrigation, fishing and livestock. However, they are not intended for use in large lakes with a lot of water flow or lakes used for public water supplies.[8]

Mechanical and Biological Control

Mechanical and biological controls will be the appropriate method in some cases, or a part of a combination of methods. In some instances, the need for chemical pesticide use in and adjacent to the affected habitat can be reduced or virtually eliminated with proper execution of alternative strategies and proper best management practices.

Mechanical control techniques will vary depending on the pest. Examples include dewatering, pressure washing, abrasive scrubbing, and weed removal by hand or machine.

Biological control of aquatic weeds and algae may be achieved through the introduction of diseases, predators, or parasites. While biological controls generally have limited application for control of aquatic weeds and algae, the operator should fully consider this option in evaluating pest management options.

Pesticide

Aquatic herbicides are chemicals specifically formulated for use in water to kill or control aquatic plants. Aquatic herbicides are spray directly onto floating or emergent aquatic plants or are applied to the water in either a liquid or pellet form. Systemic herbicides are capable of killing the entire plant. Contact herbicides cause the parts of the plant in contact with the herbicide to die back, leaving the roots alive and able to regrow. Non-selective, broad spectrum herbicides will generally affect all plants that they come in contact with. Selective herbicides will affect only some plants.[9]

Pesticide Use

Conduct surveillance prior to each pesticide application to assess the pest management area and to determine when the action threshold is met that necessitates the need for pest management. Often, each aquatic weed and algae species and pest management area warrants a different pest management strategy tailored to the regional conditions. The pest management strategy should consist of combinations of mechanical, biological, and/or pesticidal control methods. All control measures must be conducted in a manner that minimizes impacts to non-target species.

Operators should apply chemical pesticides only after considering the alternatives and determining those alternatives not to be appropriate control measures. If pesticides are used they must be used only as needed as determined by the action threshold, and proper best management practices including use of the minimum effective application rate. Also, the operator should conduct surveillance (e.g., pest counts or area survey) prior to application of pesticides to determine when the action threshold is met and necessitates the need for pest control measures.

[8] http://www.grounds-mag.com/mag/grounds_maintenance_weeds_overboard/
[9] http://www.ecy.wa.gov/programs/wq/plants/management/aqua028.html

Surveillance may include the relatively sophisticated transect method used in ecological studies to evaluate species distribution, or it may consist of simply conducting visual observations in the treated area to verify the eradication or reduction in populations of aquatic weeds and algae following pesticide application (Getsinger et al. 2005, pp 23-25).

Reduce the impact on the environment and non-target organisms by applying the pesticide only when the action threshold has been met. Operators must apply pesticide only as indicated by action thresholds for the pest management area. As noted above, action threshold help determine both the need for control actions and the proper timing of such actions. Timing pesticide application can reduce the impact on the environment and on non-target organisms. Environmental factors such as temperature and dissolved oxygen content, as well as biological factors such as stage of growth should be considered when deciding on application timing. Partial site treatments over time may be considered to reduce risk. Pesticide application must be limited to the appropriate amount required to control the target pests. Methods used in applying pesticides must reduce the impact to non-target species.

Recommended Aquatic Weed and Algae Control References

EPA recommends the following sources for additional information on IPM's and BMP's for aquatic nuisance plant control:

Aquatic Nuisance Species Taskforce. Online: http://www.anstaskforce.gov/default.php.

Aquatic Plant Management, Best Management Practices in Support of Fish and Wildlife Habitat. January 2005. Aquatic Ecosystem Restoration Foundation. Project Leader Kurt Getsinger, (http://cenapa.ucdavis.edu/files/54815.pdf)

2.2.3 Aquatic Nuisance Animal Control

Background

Aquatic nuisance animals, such as fish, lampreys, and mollusks, negatively affect aquatic biodiversity, human health, and economic stability. Aquatic nuisance animals decrease populations of native aquatic species including threatened and endangered species. Aquatic nuisance animals can reduce aquatic biodiversity by preventing desirable species growth and unbalancing desirable aquatic species populations and development. Social, economic, and human health are all affected by a lower aesthetic appeal of water bodies, an increased cost of agricultural irrigation water, and an increase in the risk of human diseases by providing ideal vector breeding grounds. In addition, the reduction in the utility of water can have social and economic impacts due to reduced hydroelectric operations, impeded opportunity for recreational activities (e.g., fishing, boating, and swimming), and disruption of water transport (e.g., agricultural irrigation), to name a few. As a result, if or when aquatic nuisance animals become established and impede the environmental stability and use goals for a body of water, control measures will become necessary.

The requirements in this Part apply to pesticide discharges associated with management of aquatic nuisance animals including, but not limited to, fish, lampreys, and mollusks. Aquatic nuisance animal control includes management of nuisance species in waters of the U.S. including but not limited to lakes, ponds, rivers, estuaries, and streams. As a part of an aquatic nuisance animal control program, a pest management strategy should consider mechanical, biological, and chemical controls. Details for identifying aquatic nuisance animals and developing a pest management strategy can be found online through the Aquatic Nuisance Species Taskforce (http://www.anstaskforce.gov/default.php).

Fish

Reasons for applications of piscicides in waters of the U.S. for controlling nuisance species of fish may include, but are not limited to, restoration of threatened and endangered species; fish population management; restoration of native species; and aquaculture. A pest management strategy for fish should consider mechanical, biological, and chemical controls.

Lampreys

There are approximately 40 species of lamprey, which are aquatic vertebrates. The sea lamprey is an example of a problematic non-native parasitic species that feeds on native fish species in U.S. waters. Lampreys may be managed using lampricides that are applied directly to the waters of the U.S. Several effective management techniques such as mechanical and biological methods are available for lamprey control in addition to lampricides and should be considered when developing a pest management strategy.

Mollusks

Nuisance mollusks including, but not limited to, zebra and quagga mussels, may cause damage to freshwater ecosystems, degrade drinking water, clog water-intake/discharge pipes for utilities and industries, and negatively impact commercial and recreational activities. Use of molluscicides is one of several methods of control for these aquatic nuisance animals; however, it is important to consider the impacts of mechanical, biological, and/or chemical pesticide use for control of mussels and other aquatic nuisance mollusk species.

Other Aquatic Nuisance Animals

There may be aquatic nuisance animals of concern in addition to fish, lampreys, and mollusks. Control of other aquatic animals including, but not limited to, crustaceans found to be a nuisance and requiring management with mechanical, biological, and/or chemical pesticides are included in the requirements in Part 2.2.3.

The appropriate type of control for aquatic nuisance animals is dictated by the biology of the target species and by environmental conditions and concerns for a specific area. "Control" means, as appropriate, eradicating, suppressing, reducing, or managing invasive species populations, preventing spread of aquatic nuisance animals from areas where they are present, and taking steps such as restoration of native species and habitats to reduce the effects of aquatic nuisance animals and to prevent further invasions. [Source: www.invasivespeciesinfo.gov/laws/execorder.shtml#sec1] Numerous strategies are used to reduce the impact of aquatic nuisance animals, but a pest management strategy should be the basis for any pest control program. This is a comprehensive approach for managing pest populations using a variety of control methods.

Aquatic Nuisance Animal IPM Practices

Identify the Problem

Part 2.2.3.1: Prior to the first pesticide application covered under this permit that will result in a discharge to waters of the U.S., and at least once each calendar year thereafter prior to the first pesticide application for that calendar year, you must do the following for each pest management area, as defined in Appendix A. Operators must identify the pest problem in their pest management area prior to the first application covered under this permit. Knowledge of the pest problem is an important step to developing pest management strategies. Re-evaluation of the pest problem is also important to ensure pest management strategies are still applicable. Operators must identify the pest problem at least once each calendar year prior to the first application for that calendar year

Identify areas with aquatic nuisance animal problems and characterize the extent of the problems, including, for example, water use goals not attained (e.g. wildlife habitat, fisheries, vegetation, and recreation). Operators must be well-acquainted with the unique regional conditions of their sites and available methods for controlling the pest species present. Intended use goals for the water bodies that are being impeded because of nuisance pest infestation must also be considered based on the control site.

The use of the best available mapping information to aid in identifying the problem areas is suggested. Mapping may include aerial photo assessments, topographic maps, and satellite imagery where available and/or practicable. Mapping can be essential to identify problem areas which can and cannot be controlled using non-pesticide preventative measures (e.g., mechanical control). Mapping can also be used in plotting the regional distribution of desired aquatic species, as well as water use goals and complaints or reports of aquatic nuisance animals from the public.

Identify target aquatic nuisance animal species. Positive identification of the aquatic nuisance animal is required because many species within the same genus may require different levels and types of control measures. Aquatic nuisance animal identification is important when determining the best pest management strategy for each particular species and for determining application areas. Operators must develop a detailed pest management strategy based on identification of the targeted pest species which occur in their area.

Identify possible factors causing or contributing to the problem (e.g., nutrients, invasive species). While there may not be reasonable means to control and/or stop the introduction and occurrence of some nuisance species infestations, the identification of possible sources (e.g., outflows from other water systems/bodies) may help in minimizing the need for control measures. Potential factors which could lead to establishment of aquatic nuisance animal populations such as accidental or intentional introduction of exotic species must be identified before control measures are implemented.

Establish past or present aquatic nuisance animal densities to serve as action threshold(s) for implementing pest management strategies. An action threshold should be established before implementing a pest management strategy. Any data and/or information regarding pest densities can serve as an action threshold.

In the event there are no data for your pest management area in the past calendar year, see Part 5 for documentation requirements regarding why current data are not available and the data you used to meet the permit conditions in Part 2.2.3.1. Operators may use historical data or neighboring district data to identify the species and establish action thresholds.

Pest Management

Part 2.2.3.2: Prior to the first pesticide application covered under this permit that will result in a discharge to waters of the U.S., and at least once each year thereafter prior to the first pesticide application during that calendar year, you must select and implement, for each pest management area, efficient and effective means of pest management that minimize discharges resulting from application of pesticides to control aquatic nuisance animals. In developing these pest management strategies, you must evaluate the following management options, considering impact to water quality, impact to non-target organisms, pest resistance, feasibility, and cost effectiveness: No action; Prevention; Mechanical/physical methods; Biological control agents; and Pesticides.
Operators are required to evaluate and implement a pest management strategy to minimize pesticide discharge into waters of the U.S. prior to the first pesticide application covered under this permit. As noted above, combinations of various management methods are frequently the most effective control strategies over the long term. The goal should be to emphasize long-term control rather than a temporary fix. Operators must reevaluate every year prior to the first pesticide application for that calendar year. All control measures must be conducted in a manner that minimizes impacts to non-target species. The following describes the management options that must be evaluated.

No Action

No action is to be taken, although an aquatic nuisance animal problem has been identified. This may be appropriate in cases where, for example, available control methods may cause secondary or non-target impacts that are not justified or no available controls exist.

Prevention

Preventing introductions of possible nuisance species is the most efficient way to reduce the threat of aquatic nuisance animals (ANS Task Force, 2009). Identifying primary pathways of introduction and actions to cut off those pathways is essential to prevention. Through a better understanding of the transportation and introduction of aquatic nuisance animals, private entities (aquaculturists) and the public have the necessary knowledge to assist in local aquatic nuisance animal control by reducing conditions that encourage the spread of aquatic nuisance animals in their immediate surroundings. For example, recreational water users provide a pathway of unintentional introductions. Increasing public awareness of aquatic nuisance species, their impacts, and what individuals can do to prevent their introduction and spread is critical for prevention. Other examples of prevention include: better design of water holding sites, better management and maintenance of potential problem sites, and volunteer removal of pest species (e.g., fishing). Monitoring and detection also play important roles in the prevention of the spread and introduction of aquatic nuisance animals.

Mechanical and Biological Control

Mechanical and biological controls will be the appropriate methods in some cases, or a part of a combination of methods. Mechanical control techniques will vary depending on the pest. Examples include fishing, dewatering, netting, electrofishing, pressure washing, use of electric fences and abrasive scrubbing.

Biological control of aquatic nuisance animals may be achieved through the introduction of diseases, predators, or parasites. While biological control generally has limited application for control of aquatic nuisance animals, operators should fully consider this option in evaluating pest management options.

Cultural Method

Cultural controls require altering the habitat such that it is unsuitable for the aquatic nuisance animals. This is an unlikely method of control for aquatic nuisance animal control.

Pesticide

Chemical and biological pesticides such as lampricides, molluscides, and piscicides, are registered for use to control aquatic nuisance animals. These pesticides are specifically formulated for use in water where aquatic nuisance animals occur. In some cases, pesticide use may impact non-target species. As described below, once the determination is made to use pesticides, additional requirements must be met.

Pesticide Use

Conduct surveillance prior to each application to assess the pest management area and to determine when the action threshold is met that necessitates the need for pest management. Often, each aquatic nuisance animal and pest management area warrants a different IPM plan, tailored to the regional conditions. The IPM practices should consist of combinations of mechanical, biological, and/or pesticidal control methods. All control measures must be conducted in a manner that minimizes impacts to non-target species.

Operators must apply chemical pesticides only after considering the alternatives and determining those alternatives not to be appropriate control measures. In some instances, the need for chemical pesticide use in and adjacent to the affected habitat can be reduced or virtually eliminated with proper execution of alternative strategies and proper best management practices. If pesticides are used, they must only be used as needed as determined by an action threshold, and proper best management practices must be adopted, including use of the minimum effective application rate. Also, the operator must conduct surveillance (e.g., pest counts or area survey) prior to application of pesticides to determine when the action threshold is met that necessitates the need for pest control measures.

Surveillance may include the relatively sophisticated transect method used in ecological studies to evaluate species distribution, or it may consist of simply conducting visual observations in the treated area to verify the eradication or reduction in populations of aquatic nuisance animals following pesticide application (Getsinger et al. 2005, pp 23-25).

Reduce the impact on the environment and non-target organisms by evaluating site restrictions, application timing, and application method in addition to applying the pesticide only when the action threshold has been met. Aquatic nuisance animal species and site restrictions (water use, water movement, etc.) must be identified when choosing an appropriate pesticide. Environmental factors such as temperature as well as biological factors such as migration timing should be considered when deciding on application timing. Partial site treatments over time may be considered to minimize risk to non-target organisms.
Pesticide application must be limited to the appropriate amount required to control the target pests. Methods used in applying pesticides must minimize the impact to non-target species.

Recommended Aquatic Nuisance Animal Control References

EPA recommends the following sources for additional information on IPMs and BMPs for ANS control:

Aquatic Nuisance Species Taskforce. Online: http://www.anstaskforce.gov/default.php.

Aquatic Plant Management, Best Management Practices in Support of Fish and Wildlife Habitat. January 2005. Aquatic Ecosystem Restoration Foundation. Project Leader Kurt Getsinger, (http://cenapa.ucdavis.edu/files/54815.pdf)

2.2.4 Forest Canopy Pest Control

Background

The forest canopy is the uppermost level of the forest. It is composed of mature treetops, or the crowns of the mature trees. It provides habitat for animals and plants, some of whom live their entire lives in the canopy. Pests that threaten the health of the forest canopy must be controlled to maintain forest health. Forest canopy pest control programs are designed to integrate environment-friendly control measures (e.g., sterile insect release, pheromone trapping, mating disruption, etc.) to reduce losses and pesticide use. But pesticide applications may aerially blanket large tracts of terrain to control an entire population of pests within a delimited geographic area

Forest canopy pest control programs included in this permit are treetop pesticide applications that may inadvertently expose waters of the U.S. to direct, but limited, pesticide application. Forest canopy pest control can be directed at a variety of pests, but primarily insects. Forest canopy pest control programs are utilized to prevent habitat elimination/ modification, economic losses (e.g., habitat aesthetics, tree losses), quarantine pest outbreaks, and eradicate or prevent the spread of introduced invasive species. Therefore, forest canopy pest management programs provide environmental, economic, and quality of life benefits in the U.S.

The type of forest canopy pest control is dictated by the biology of the target pest and by environmental conditions and concerns for a specific area. Forest canopy pest control programs are primarily conducted at the state and federal level but may also be conducted at the local/community level.

This permit requires IPM programs to incorporate, but not be limited to, the following components: problem identification, mapping/planning, pest survey, cultural control, biological control, chemical control, and education.

Forest Canopy Pest Control IPM Practices

Identify the Problem

Part 2.2.4.1*:* Prior to the first pesticide application covered under this permit that will result in a discharge to waters of the U.S., and at least once each calendar year thereafter prior to the first pesticide application in that calendar year, you must do the following for each pest management area, as defined in Appendix A. In order to reduce pesticide discharge into waters of the U.S. associated with forest canopy pest control, it is important for operators to ensure proper problem identification. Problem identification is determined through pest identification, delineation of the extent and range of the pest problem, determination of the potential for pest problem expansion, and assessing the economic impact of failure to provide pest control.

Establish target pest densities to serve as action threshold(s) for implementing pest management strategies. Operators must develop action thresholds for the target pests prior to first pesticide application covered under this permit. The action thresholds must be re-evaluated at least once each calendar year. As noted in the general discussion above, an action threshold is a point at which pest populations or environmental conditions indicate that pest control action must be taken. Action thresholds help determine both the need for control actions and the proper timing of such actions. It is a predetermined pest level that is deemed to be unacceptable.

Identify target species to develop a species-specific pest management strategy based on developmental and behavioral considerations for each species. Pest identification is a key activity for implementation of a forest canopy pest control system. Pest identification should only be conducted by personnel with adequate training and experience with the pests. While numerous similar pests (insects and/or pathogens) may be present in any given location, only a few of the representative species may constitute a threat which requires control activities. Through proper pest identification informed control decisions can be made based on the development biology of the pest (susceptible development stage), pest mobility (potential rate of spread), timing of selected control measures, applicable control techniques, and most effective chemical pesticides for the target species (insecticide class, resistance, etc.). Failure to identify pests can lead to unwarranted control activities and/or the need for chemical application with potential for discharge into waters of the U.S. Control for each specific pest is also predicated on the status of the pest as native recurring, quarantine restricted, or designated as an invasive species.

Identify current distribution of the target pest and assess potential distribution in the absence of control measures. Control activities are warranted only after exact pest identification and delineation of the extent of the pest infestation. As forest canopy pest control can involve treating large expanses of forests, mapping is also an important component in identification of the problem. The distribution of the pest, usually insects, within the area of infestation can impact the selection of treatment activities. In addition, mapping of the pest infestation will allow evaluation of the actual/potential spread of the infestation (e.g., pest biology, pest mobility, and host availability) and also serve as a tool to evaluate the effectiveness of the control activities. Mapping can also provide essential information for assessment of economic damages that can result from the current and potential pest infestation and failure to control the pest. Management decisions can thereby be based on cost/benefit evaluations based on the current and potential distribution of any pest.

The third component of problem identification is to determine the potential economic impact of not controlling the pest. By establishing economic thresholds, it is possible to determine pest density action thresholds which warrant control activities. However, control decisions must take into account not only the projected economic impact of the current pest infestation but also the potential of the pest infestation to spread. Therefore, control decisions based on economic impact must in turn rely on proper pest identification, pest biology, and current and potential pest distribution.

In the event there are no data for your pest management area in the past calendar year, see Part 5 for documentation requirements regarding why current data are not available and the data you used to meet the permit conditions in Part 2.2.4.1. Operators may use historical data or neighboring district data to identify the species and establish action thresholds.

Pest Management

Part 2.2.4.2: Prior to the first pesticide application covered under this permit that will result in a discharge to waters of the U.S., and at least once each calendar year thereafter prior to the first pesticide application for that calendar year, you must select and implement for each pest management area efficient and effective means of pest management that minimize discharges resulting from application of pesticides to control forestry pests. In developing these pest management strategies, you must evaluate the following management options considering impact to water quality, impact to non-target organisms, pest resistance, feasibility, and cost effectiveness: No action; Prevention; Mechanical/physical methods; Cultural methods; Biological control agents; and Pesticides. Pest control activities in forest canopy management programs may be warranted following problem identification and based solely on pest occurrence (e.g., quarantine pest, invasive species). However, in many instances control activities may only be necessary based on pest population distribution and/or pest densities. To minimize the need for pest control while also producing the best control results, a pest management strategy appropriate for the specific problem site(s) must be developed. A site-specific management plan will consider biotic (e.g., plant and animal species community structure) and abiotic (e.g., environmental) factors. Combinations of various management methods are frequently the most effective pest management strategies over the long term. The goal of a pest management strategy in forest canopy pest control should be to emphasize long-term control rather than a temporary fix.

All control measures must be conducted in a manner that minimizes impacts to non-target species. The following is a discussion of the relevant management options as they might be implemented for forest canopy pest control.

No Action

No action is to be taken, although a forest canopy pest control problem has been identified. This may be appropriate in cases where available control methods may cause secondary or non-target impacts or where aesthetic/ economic losses are not anticipated.

Mechanical and Biological Control

Mechanical and biological controls will be the appropriate method in some cases, or a part of a combination of methods. In some instances, the need for chemical pesticide use in and adjacent to the affected habitat can be reduced or virtually eliminated with proper execution of alternative strategies and proper best management practices.

Mechanical control techniques will vary depending on the pest. An example of mechanical control in a forest canopy would be egg mass removal (gypsy moth).

Biological control of forest canopy pests may be achieved through the introduction/enhancement of diseases, predators, or parasites. In addition, forest canopy pest control programs aimed specifically at insects may also utilize sterile insect release, mating disruption, and biological pesticides. While biological controls generally have limited applications for forest canopy pest control programs, they should be fully considered as an option in the development of an IPM plan. The latter two control approaches are often utilized when controlling for gypsy moth.

Cultural Method

Cultural control methods are strategies that make the habitat unsuitable for a pest. An example of a cultural method to manage pests of the forest canopy would be to select a different species of tree to plant, or to plant resistant varieties of trees. Maintaining the trees in good health to discourage pests is another method of cultural control.

Pesticide

Several chemical and biological pesticides are available that may be used to reduce defoliation of the trees. These pesticides are typically used when pest populations are high and the action threshold has been reached. These products are aerially applied. As described below, once the determination is made to use pesticides, additional requirements must be met.

Pesticide Use

Conduct surveillance prior to each application to assess the pest management area and to determine when a pest action threshold is met that necessitates the need for pest management. Operators must apply pesticides only as needed as determined by pre-established criteria and pest action thresholds. Operators must establish a pest action threshold that warrants pesticide application based on problem identification and pest surveillance. In order to establish pest densities and determine when pest action thresholds have been met, forest canopy pest control programs must include pest surveillance activities as an integral component of pest management strategies. Pest surveillance is necessary to detect the presence (or confirm the absence) and magnitude of pest populations in a given location and precisely pinpoint zones of infestation. Surveillance activities will vary according to the pest (insect, weed, or pathogen) but in general should include observations of pest numbers, developmental stage of the current infestation, and biotic factors which would enhance development/expansion of pest populations (e.g., weather, crowding, predators, pathogens, etc.).

Pest surveillance will vary according to pest type and species. For insect pests, surveillance activities may include, but not be limited to, pheromone traps, sticky traps, light traps, defoliation monitoring. In some cases, traps used in surveillance activities have been developed to the extent that they alone provide adequate control of the targeted pest, thus eliminating the need for pesticide completely. Conversely, in the instance of quarantine pests or invasive species, pest identification alone may suffice to fulfill surveillance requirements and indicate need for control measures. Regardless, surveillance should take in to account local environmental conditions and projected environmental conditions which would support development and/or spread of the pest population and which would limit the choice or effectiveness of control activities.

It is also important to continue surveillance following control activities to assess treatment efficacy and to monitor for new pests. Surveillance can determine if the current techniques are effective and whether additional control measures are required, particularly pesticide application. Based on follow-up surveillance activity, operators can make informed decisions which serve to increase the effectiveness of their control programs and minimize the potential for pesticide discharge to waters of the U.S. Surveillance is necessary not only to establish the species presence and their abundance but also as an evaluation tool of the effectiveness of chemical control activities. Furthermore, surveillance should be used as an indicator of the need for additional chemical control activities based on pre-established criteria related to population densities in local areas.

Assess environmental conditions (e.g. temperature, precipitation, and wind speed) in the treatment area to identify conditions that support target pest development and are conducive for treatment activities. Operator may use insecticides as dictated by the pest. Although pesticide formulations and applications vary according to pest and habitat, the focus here is on aerial applications of chemical/biological sprays. Aerial application is considered the preferred application method for large areas and areas that are inaccessible for ground application. In order to prevent poor site coverage, a guidance system (GPS), where economically feasible, or site flagging are necessary to increase accuracy of the treatment coverage while minimizing the amount of pesticides being applied.

Before using a pesticide, the forest canopy pest control operator should consider the following points; 1) do not apply a pesticide in unfavorable environmental conditions (e.g., windy, rainy, etc.) with increased potential for drift and wash off/runoff, 2) choose an application method and a pesticide formulation that will minimize the potential for movement of the material to off-site locations, 3) restrict or minimize the use of volatile pesticides on areas in or around sensitive on-target plants or animals, especially during hot weather, 4) generally, liquid pesticides applied by broadcast methods are more subject to drift than are granular formulations and their application methods, 5) during liquid application, spray droplet size should be maintained within the recommended range for the proposed target and the application method to be used, and 6) use additives to minimize drift and enhance efficacy as appropriate.

Reduce the impact on the environment and non-target organisms by evaluating the restrictions, application timing, and application methods in addition to applying the pesticide only when the action thresholds have been met. Forest canopy pest species and site restrictions (water use, water movement, etc.) must be identified when choosing an appropriate pesticide. For instance with gypsy moth control a biological insecticide, Bacillus thuringiensis kurstaki, is usually selected. However, if endangered or threatened butterfly or moth species are in the area, a viral insecticide that specifically targets gypsy moth larvae will be selected. Environmental factors such as temperature, as well as biological factors such as migration timing should be considered when deciding on application timing. Partial site treatments over time may be considered to minimize risk to non-target organisms. Pesticide application must be limited to the appropriate amount required to control the target pests. Methods used in applying pesticides must minimize the impact to non-target species.

Evaluate using pesticides against the most susceptible developmental stage. For forest canopy pests, pesticides should be selected that target the most susceptible life stage. For instance, with gypsy moths, the larvae are present in the canopy, are soft-bodied, and therefore are the target of chemical controls.

Recommended Forest Canopy Pest Control Reference

EPA recommends the following source for additional information on IPM's and BMP's for forest canopy pest control:

Emily Grafton and Ralph Webb. Homeowner's guide to gypsy moth management. West Virginia University Extension Service.
http://www.nj.gov/agriculture/divisions/pi/pdf/GMguide.pdf

3. WATER-QUALITY-BASED EFFLUENT LIMITATIONS

The CWA requires NPDES permits to include technology-based effluent limitations for all discharges and then if necessary for a specific discharge, water quality based effluent limitations (WQBELs). Permit writers are to assess whether the technology-based effluent limitations are protective of water quality standards and if not, permit writers must also include WQBELs as necessary to ensure that the discharge will not cause, have the reasonable potential to cause, or contribute to an excursion above any state water quality standard, including state narrative criteria for water quality (see 40 CFR 122.44(d)). In developing WQBELs; permit writers must consider the potential impact of every proposed surface water discharge on the quality of the receiving water. Unlike individual permits that include requirements tailored to site-specific considerations, general permits, while tailored to specific industrial processes or types of discharges (e.g., from the application of pesticides), often do not contain site-specific WQBELs. Instead, in general, EPA includes a narrative statement that addresses WQBELs. In this permit the WQBEL is as follows:

Your discharge must be controlled as necessary to meet applicable numeric and

narrative state, territory, or tribal water quality standards.
If at any time you become aware, or EPA determines, that your discharge causes or contributes to an excursion of applicable water quality standards, you must take corrective action as required in Part 6.

The first sentence includes the general requirement to control discharges as necessary to meet water quality standards, while the second sentence implements this requirement in more specific terms by imposing on operators a responsibility to take corrective action in response to an excursion of applicable water quality standards, whether discovered by EPA or by the permittee. Failure to take such corrective action is a violation of the permit. Additionally, the permit includes a provision, in Part 1.2.3, that specifies that EPA may determine that additional technology-based and/or water quality-based effluent limitations are necessary, or may deny coverage under this permit and require submission of an application for an individual NPDES permit, as detailed in Part 1.3.

Each permittee is required to control its discharge as necessary to meet applicable water quality standards. In general, EPA expects that compliance with the other conditions in this permit (e.g., the technology-based limitations, corrective actions, etc.) will result in discharges that are controlled as necessary to meet applicable water quality standards based on the cumulative effect of the following factors, which are described in more detail below:

(1) Under FIFRA, EPA evaluates risk associated with pesticides and mitigates unreasonable ecological risk. Compliance with FIFRA is assumed. (See Part III.1.5 of this fact sheet.)

(2) EPA evaluated national–scale ambient monitoring data, as well as the frequency of the identification of specific pesticides as the cause of water impairments, to assess whether pesticide residues are currently present in waters at levels that would exceed water quality standards. The monitoring data show that, in most samples, most pesticides were below ambient water quality criteria or benchmarks developed by EPA's Office of Pesticide Programs (OPP) as indicators of narrative water quality criteria. For the small number of pesticides found in monitoring data to be present above such benchmarks, the evaluation, as summarized in Appendices B and C of this fact sheet, also documents risk mitigation actions taken by EPA (such as cancellation of pesticide uses) that EPA expects have reduced the levels of those pesticides in water.

(3) Technology-based effluent limitations in the PGP provide further protections beyond compliance with existing FIFRA requirements.

(4) Biological pesticides discharged to waters, by regulatory definition, do not work through a toxic mode of action. For chemical pesticides, the discharges covered under this permit are the residues after the pesticide has performed its intended purpose. Thus, the residue will be no higher than, and in many instances, lower than, the concentration of the pesticide as applied.

(5) The PGP excludes pesticide applications that result in discharges of any pesticide to (1) waters impaired for that pesticide or (2) any Tier 3 waters (i.e., outstanding national resource waters).

In addition to the five factors identified above, before issuance, EPA permits require CWA §401 certification by states and tribes. The states and tribes review the permit and certify that it will meet their water quality standards. States and tribes can, in this process, add further conditions to ensure that water quality standards will be met. Part 10 of the permit is reserved for any additional conditions so required by any state or tribe in areas where this permit is available.

This permit requires permittees to control discharges as necessary to meet applicable water quality standards. When the permittee or EPA determines a discharge will cause or contribute to an excursion above any WQS, including failure to protect and maintain existing designated uses of receiving waters, the permittee must take corrective action to ensure that the situation is eliminated and will not be repeated in the future. (See Part 6.0). If additional control measures are required, EPA expects the operator to vigilantly and in good-faith follow and document, as applicable, the process for BMP selection, installation, implementation and maintenance, and cooperate to eliminate the identified problem within the timeframe stipulated in Part 6.0 of the PGP.

(1) <u>Under FIFRA, EPA evaluates risk associated with pesticides and mitigates unreasonable ecological risk</u>

Background

EPA regulates the use of pesticides under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). In general, FIFRA authorizes EPA to register each pesticide product intended for distribution or sale in the U.S. To register a pesticide, the Agency must determine that its use in accordance with the label will not cause "unreasonable adverse effects on the environment." (see, e.g., FIFRA sec. 3(c)(5)). FIFRA defines that term to mean, in part, "any unreasonable risk to man or the environment, taking into account the economic, social, and environmental costs and benefits of the use of any pesticide" (FIFRA sec. 2(bb)). The "unreasonable adverse effects" standard requires EPA, in effect, to balance the human health and ecological risks of using a pesticide against its economic, social, human health, and ecological benefits. Pesticides are registered for sale and distribution only if EPA determines that the benefits outweigh the risks. In making decisions on whether to register a pesticide, EPA considers the use directions on proposed product labeling and evaluates data on product chemistry, human health, ecological effects, and environmental fate to assess the potential risks associated with the use(s) proposed by the applicants for registration and expressed on the labeling. Among other things, the Agency evaluates the risks to human health and the environment (including water quality) posed by the use of the pesticide.

As stated above, EPA reviews and approves pesticide product labeling. EPA implements risk mitigation measures identified through the risk assessment process by placing use restrictions and warnings on labeling to ensure the use of the pesticide (under actual use circumstances and commonly accepted practice) will not cause any "unreasonable adverse effects on the environment." It is a violation under FIFRA sec. 12(a)(2)(G) (FIFRA's "misuse" provision) to use a registered pesticide inconsistent with its labeling.

After a pesticide has been registered, changes in science, public policy, and pesticide use practices will occur over time. FIFRA, as amended by the Food Quality Protection Act of 1996, mandates a registration review program, under which the Agency periodically reevaluates pesticides to make sure that as the ability to assess risk evolves and as policies and practices change, all registered pesticides continue to meet the statutory standard of no unreasonable adverse effects to human health or the environment. The Agency is implementing the registration review program pursuant to Section 3(g) of FIFRA and will review each registered pesticide every 15 years to determine whether it continues to meet the FIFRA standard for registration. Information on this program is provided at: http://www.epa.gov/oppsrrd1/registration_review/.

Ecological Risk Assessment

The following is a discussion about the FIFRA risk assessment process with a focus on Ecological (specifically aquatic) Assessments. Persons seeking pesticide registrations bear the burden of demonstrating their products meet the statutory standard under FIFRA. As set forth in 40 CFR Part 158, applicants for pesticide registrations must provide EPA with a suite of product chemistry, residue chemistry, toxicity, environmental fate, and ecotoxicity studies to support an application for registration. To support outdoor uses, studies are required that provide information related to the environmental fate and transport of the chemical and that measure the acute and chronic toxicity to terrestrial and aquatic organisms. These studies, along with open literature that meet data quality guidelines, are the basis for the ecological risk assessments. The ecological risk assessment combines the results of an environmental exposure assessment and an ecological effect assessment for a pesticide active ingredient to produce a quantitative measure of potential risk.[10] A risk characterization is also presented to put the quantitative assessment of risk in the context of other lines of evidence, such as available monitoring data and incident reports, and to discuss uncertainties in the risk assessment. The quantitative and qualitative determination of potential ecological risk is independent of economic or other benefit considerations.

Aquatic Exposure

EPA estimates pesticide concentrations in aquatic environments to determine if exposure to a pesticide active ingredient is at a level that could cause unreasonable adverse effects to aquatic organisms. EPA estimates pesticide concentrations in water using peer-reviewed simulation modeling because there are not sufficient monitoring data to estimate exposure to aquatic organisms under all potential use conditions. When available, monitoring data are used to help characterize aquatic exposure.

EPA also estimates potential exposure from uses involving direct application to water. The model used for pesticides applied directly to water uses environmental fate data to simulate partitioning of the pesticide between the water column and bottom sediment in a standard rice paddy. This modeling is conservative because it does not simulate degradation of the applied pesticide, as would be necessary to estimate the amount of residue remaining after the pesticide product had performed its intended function. Depending on the rate of degradation, the initial concentration as estimated by the model could be much higher than the residual concentration remaining after treatment has been completed. Additionally, this modeling scenario is conservative because the resulting exposure estimate is the concentration in the paddy water itself, not taking into account dilution which would occur when paddy water is diluted by precipitation or when it is released into a receiving water body.

[10] As part of the risk assessment, EPA also examines available information to determine the need to expand beyond the focus on the active ingredient to consider pesticide formulation, inert ingredients, or degradates.

As discussed above, when available, EPA uses ambient water monitoring data as a line of evidence to characterize aquatic exposure in ecological and human health risk assessments. The U.S. Geological Survey (USGS) maintains several sources of pesticide monitoring data. These sources include the National Water Quality Assessment program (NAWQA), the Toxic Substances Hydrology Program, and the National Stream Quality Accounting Network (NASQAN). EPA sources of water monitoring data include STORET, a storage and retrieval database of national water quality information, the Safe Drinking Water Information System (SDWIS), Office of Water compliance monitoring data, and the USGS/EPA Reservoir Monitoring Program. In addition to the federal data sources, monitoring data are sometimes available from States, pesticide registrants, and the open literature.

These monitoring data are evaluated on a case-by-case basis to help characterize the likelihood, extent, and nature of pesticide concentration in water under current use practices and actual field conditions. EPA considers the locations and frequency of sampling, the analytical methods, and detection limits when determining how such data will be incorporated into the risk assessment. The usefulness of monitoring for an aquatic exposure assessment is tied to the purpose of the monitoring studies from which the data are derived. For example, a monitoring study targeted to measure concentrations of a pesticide in a watershed with high agricultural use of that pesticide will not provide much insight on the potential exposure from its use as a mosquito adulticide. Similarly, a general survey of ambient water quality might not necessarily target specific pesticide use areas or the time of year when pesticide concentrations may be at their peak, and for this reason may not provide a reliable estimate of acute exposure. However, if monitoring data from such a study shows higher confirmed detections than estimated by modeling, the higher monitoring values typically would be used in the risk assessment.

In sum, EPA's screening level exposure estimates from simulation models are conservative, consistent with their intended use as a screen to identify pesticide use scenarios that do not pose a risk of concern, both because of the selected inputs used to generate them and the values from the model outputs that are selected for risk assessment. When ambient aquatic monitoring data are available for a given pesticide, monitored concentrations are usually lower than modeled concentrations and in many cases substantially lower. The next section describes the second portion of the risk assessment: effects.

Aquatic Effects

To determine if a pesticide is sufficiently toxic at its estimated exposure concentrations to cause unreasonable adverse effects in the environment, EPA reviews available ecotoxicity data. These data may come from a number of sources, including direct guideline study submissions required in support of registration, and open literature data retrieved through ECOTOX[11]. The typical assessment endpoints for pesticide ecological risk assessments are reduced survival from direct acute exposures and survival, growth, and reproductive impairment from direct chronic exposures. As noted in the OPP Overview[12] document, which describes the process OPP uses to

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[11] U.S. EPA. 2007. Ecotoxicity Database (ECOTOX) Mid-Continent Ecology Division, National Health and Environmental Effects Research Laboratory. U.S. Environmental Protection Agency, Office of Research and Development. http://cfpub.epa.gov/ecotox/.

[12] U.S. EPA. 2004. Overview of the Ecological Risk Assessment Process in the Office of Pesticide Programs. Office of Prevention, Pesticides, and Toxic Substances. Office of Pesticide Programs. Washington,

conduct ecological risk assessment, OPP evaluates other data on sublethal effects in addition to direct effects on survival, growth and reproduction.

In general, the current data regulations require studies that include but are not limited to a suite of aquatic toxicity studies for effects characterization. These test requirements are defined for each chemical class by use category (40 CFR Part 158 Subpart D; Wildlife and Aquatic Organism data requirements; http://edocket.access.gpo.gov/cfr_2007/julqtr/40cfr158.490.htm) and are performed on a limited number of laboratory test organisms in the following broad taxonomic groupings.

- Freshwater fish,
- Freshwater invertebrates,
- Estuarine/marine fish,
- Estuarine/marine invertebrates, and
- Algae and aquatic plants.

Within each of these very broad taxonomic groups, the most sensitive acute and chronic toxicity value is selected from the all available test data, including open literature and registrant submissions. If additional toxicity data for more species of organisms in a particular group are available, the most sensitive toxicity values from all sources for other species/studies that meet data quality standards are used in the risk assessment[13]. Aquatic toxicity data are required for each active ingredient, but aquatic toxicity data are also required on the typical end use product for any pesticide that will be introduced directly to aquatic environments (40 CFR Part 158.630).

Risk Characterization

Risk characterization is the integration of effects and exposure characterization to determine the ecological risk from the use of the pesticide and the likelihood of effects on non-target species based on the pesticide-use scenarios. In screening-level assessments, OPP relies on the deterministic risk quotient (RQ) method to compare estimated exposure to toxicity endpoints. Estimated environmental concentrations (EECs) derived in the exposure characterization are divided by acute and chronic toxicity endpoints identified in the effects characterization. Risk quotients are then compared to the Agency's Levels of Concern (LOCs). These LOCs are the Agency's interpretative policy and are used to analyze the potential risk to non-target organisms and the need to consider regulatory action. These criteria are used to indicate when a pesticide use as directed on the label has the potential to cause adverse effects on non-target organisms. If a risk of concern is identified, risk mitigation measures are considered.

Risk Mitigation

EPA acknowledges that there are uncertainties in its pesticide risk assessments (see full discussion below), nonetheless the Agency reduces the risks of concern by imposing additional restrictions on the use of a pesticide to reduce pesticide concentrations in the aquatic environment. Mitigation measures may include limits on the amount and frequency that a pesticide may be applied, or the application methods may be restricted to limit off-site transport.

D.C. January 23, 2004. Support Document 1: Study Classification used by EFED in Data Evaluation Records (DERs) http://www.epa.gov/oppfead1/endanger/consultation/ecorisk-overview.pdf

[13] *Ibid* U.S. EPA 2004

Mitigation may also limit the geographical areas to which a pesticide can be applied or may include mandatory buffer distances from sensitive habitats. Mitigation measures are implemented through product labeling instructions, with which pesticide users are required to comply.

In some cases, EPA restricts the use of a pesticide so that levels of pesticide predicted by the model to reach water are below the relevant aquatic benchmarks (see Aquatic Bencharmks discussion below). In other cases, using the FIFRA risk-benefit balancing standard, EPA may permit the use of a pesticide even though estimated water concentration might exceed a relevant benchmark. In such cases, the decision incorporates consideration of the benefits of the pesticide use and other lines of evidence, such as any available National Recommended Water Quality Criterion for ambient water quality, concerning the conservativeness of the modeling assessment and available monitoring data.

Uncertainties with Risk Assessment and Mitigation

For the majority of pesticides, the Agency relies on simulation modeling to predict potential aquatic exposure following pesticide applications. There are uncertainties embedded in the exposure assessment, for example, the extent to which the simulated scenario represents actual use conditions in terms of hydrologic vulnerability and the amount and frequency with which pesticides are applied. In order to account for the inherent uncertainty the Agency uses a combination of parameters and assumptions in the models that results in estimated potential exposure concentrations that are high-end and are not likely to underestimate actual aquatic exposure. This allows the Agency to screen out pesticides that are not likely to pose a risk to aquatic life.

In the effects characterization under FIFRA, the lowest acute and chronic toxicity values from the most sensitive species tested in acceptable studies are used as the relevant endpoint for evaluating risk to various taxa. Implicit in the use of the lowest toxicity values for the most sensitive species is the presumption that these toxicity values afford protection not only for the individual surrogate species but for other untested taxa as well. The extent to which the most sensitive laboratory test species are representative of the sensitivities of naturally occurring aquatic species to pesticides is uncertain.

In the FIFRA risk characterization, data gaps are also considered as a source of uncertainty in the risk assessment conclusions, and each risk assessment discusses the potential for additional data to affect the risk assessment conclusions.

An additional source of uncertainty in assessing risk to aquatic life is the impacts of multiple stressors on aquatic organisms. A United States Geological Survey (USGS) 10-year study (*Gilliom et al., 2006*) shows that the most common form of pesticide exposure for aquatic organisms is simultaneous exposure to multiple pesticides. More than 50 percent of all stream samples contained five or more pesticides, although the majority of mixtures are comprised mainly of agricultural herbicides and their degradates, or urban/residential use insecticides in urban streams. Pesticides that will be applied under the PGP may also co-occur with other manmade contaminants and/or other pesticides from other uses. For instance, the USGS has also performed monitoring studies which revealed the widespread presence of some pharmaceuticals and personal care products in drinking water. However, although pesticides may be detected with other chemicals or in discharges covered by other NPDES permits, the majority of research and data on the effects of pesticides has focused on individual pesticides.

Possible interactions among pesticides or between pesticides and other contaminants may occur including: independent, additive, antagonistic or synergistic. The variety of chemical interactions presented in the available literature suggests that the interaction can be a function of many factors including but not necessarily limited to: (1) the exposed species, (2) the co-contaminants in the mixture, (3) the ratio of concentrations in the mixture, (4) differences in the pattern and duration of exposure among contaminants, and (5) the differential effects of other physical/chemical characteristics of the receiving waters (e.g., organic matter present in sediment and suspended water). Quantitatively predicting the combined effects of all these variables on mixture toxicity to any given taxon with confidence is beyond the capabilities of the available data. In order to assess the impacts of environmental mixtures on aquatic life, states have included ambient toxicity testing (also called Whole Effluent Toxicity or WET testing) in their monitoring programs. WET testing allows states to identify potential impacts to aquatic life and identify the toxicant(s) and through the toxicity reduction evaluation, reduce the source(s) of the toxicant(s). The level of toxic effect to the most sensitive tested species is therefore assumed to be protective of other species that may be present in any given water body and is assumed to represent the most toxic component of a mixture. Note that a discussion of EPA's consideration of WET testing as a condition of the permit is discussed in Part III.4 of the fact sheet.

Aquatic Benchmarks

EPA's Office of Pesticide Programs (OPP) derives aquatic benchmarks by multiplying the most sensitive toxicity values (*i.e.*, the lowest acceptable toxicity value for the most sensitive species within a taxonomic group) by their respective (level of concern) LOC. These taxon-specific benchmarks, based on toxicity data used by OPP in assessments for pesticide registration decision-making, are considered estimates of the concentrations below which pesticides are not expected to have the potential for adverse effects for the particular taxon for which those data serve as surrogates. It is reasonable to assume that above these levels, there is potential for the pesticide to cause adverse effects to the given taxon.

EPA's Office of Water (OW) and OPP agreed that these values can be used by States and others to evaluate potential risks of pesticides in the aquatic environment, if a National Recommended Water Quality Criterion for ambient water quality is not available.[14] A number of States have used these benchmark values as indicators of whether pesticide residues detected in surface water warrant additional action such as refined monitoring efforts. While benchmarks can be useful as a screening tool, they do not provide the information necessary to link detected concentrations with their sources.

In response to recommendations and input from stakeholders, EPA developed a webpage of non-regulatory "OPP Aquatic Benchmarks."[15]

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[14] Correspondence to SFIREG, November 3, 2006 from Office of Water director.

[15] OPP Aquatic Benchmark Table http://www.epa.gov/oppefed1/ecorisk_ders/aquatic_life_benchmark.htm

As described above, EPA's FIFRA risk assessment process includes a number of conservative assumptions that taken as a whole mitigate unreasonable ecological risk and protect water quality.

(2) Examination of national–scale ambient monitoring data to assess whether pesticide residues are currently present in waters at levels that would exceed water quality standards.

U.S. Geological Survey: The Quality of Our Nation's Waters – Pesticides in the Nation's Streams and Ground Water, 1992-2001.

In addition to the protective nature of the pesticide risk assessment, EPA reviewed readily available surface-water monitoring data. In 2006, the USGS National Water-Quality Assessment Program (NAWQA)[16] released a 10-year (1992-2001) study of 51 major river basins and aquifer systems that account for more than 70 percent of total U.S. water use and more than 50 percent of the U.S. drinking water supply. Most NAWQA samples were analyzed for 75 pesticides and eight degradation products, including 20 of the 25 most commonly used herbicides and 16 of the 25 most commonly used insecticides. Water samples were collected at 186 stream sites for analysis of pesticides and degradates dissolved in water. The samples were collected from streams throughout the year, including high-flow and low-flow conditions. Sampling was most intensive during the time of highest pesticide use and runoff – generally weekly or twice monthly for a 4- to 9-month period. As a general matter, the USGS uses sampling and analytic methods that provide highly reliable data. The NAWQA database stands out among available data sources in terms of the number of pesticides and sites examined, as well as the overall number of samples collected and analyzed.

Overall results. Overall, the 10-year assessment indicates that for the pesticides sampled, surface and ground water are generally not being adversely affected by pesticide applications for irrigation, drinking water, and home/recreational uses. The USGS analytical methods are very sensitive and are designed to detect and measure minute amounts – in some cases parts per trillion – that are often 10 to 100 times lower than benchmarks or water quality criteria for most pesticides. There were detections of pesticides in these samples, but the concentrations detected were generally low (parts per billion and parts per trillion). The NAWQA data generally reflect pesticides that were used in watersheds from which water samples were taken. There were also some detections of legacy pesticides that were no longer registered at the time of sampling.

For environmental effects, the USGS compared the concentrations found in the NAWQA sampling with two general types of aquatic life benchmarks (1) ambient water quality criteria (AWQC) for the pesticide and (2) benchmarks derived from the lowest acute and chronic ecological effects endpoint for the pesticide (OPP benchmarks). Acute AWQC and all acute OPP benchmarks were compared with each measured concentration for the most complete year of data for each NAWQA stream. Chronic AWQC were compared with 4-day moving average concentrations, chronic OPP benchmarks for invertebrates were compared to 21-day moving average concentrations, and chronic fish OPP benchmarks were compared to 60-day moving average concentrations. AWQC were available for 7 of the 83 pesticides and degradates

[16] Gilliom and others 2006. The Quality of Our Nation's Waters-Pesticides in the Nation's Streams and Ground Water, 1992-2001: U.S. Geological Survey Circular 1291, 172p.

analyzed by NAWQA. One or more OPP benchmarks were available for 60 of the 83 NAWQA analytes, including 5 of the 7 that had AWQC. A total of 62 of the pesticide compounds analyzed in water by NAWQA had one or more aquatic-life benchmarks.

A total of 20 pesticides or degradates exceeded an EPA benchmark in one or more agricultural streams and/or urban streams (see Appendix A of fact sheet for a complete list of pesticides/degradates that had exceedances). In agricultural streams, most concentrations greater than a benchmark involved chlorpyrifos, azinphos-methyl, atrazine, *p,p*'-DDE and alachlor. In urban streams most concentrations greater than a benchmark involved diazinon, chlorpyrifos, and malathion. It should be noted that pesticide concentrations in agricultural streams most often originate from terrestrial agricultural activities exempted under the CWA from NPDES permit requirements or activities not covered under this permit.

Since 2001, the last year of sampling covered by the NAWQA report, EPA has taken regulatory action against all 20 pesticides found to be in excess of a benchmark and many of their uses have been canceled (several detections were of pesticides no longer in use prior to the start of the study). For atrazine, the registrant has been required to undertake an aggressive and innovative ecological monitoring program to protect vulnerable watersheds in areas of atrazine use, and to develop mitigation measures for watersheds that might have atrazine detections above levels of concern. Residential uses of the two pesticides most commonly detected above a benchmark (diazinon and chlorpyrifos) have been canceled. Additional detail on the nature of EPA's regulatory actions under FIFRA appears in Appendices B and C of the fact sheet.

State Water Quality Monitoring under CWA

Every two years States must identify waterbodies that are not attaining water quality standards (WQS; both narrative and numeric) under CWA Section 303(d). States must place waterbodies not meeting water quality standards on a list (303(d) list) which identifies the pollutant or pollutants causing or expected to cause the impairment. The Office of Water's Impaired Waters and Total Maximum Daily Loads website[17] (accessed November 2009) indicates 303(d) impairments in several states for 14 currently registered specific pesticides and 3 general classes of pesticides (e.g., pyrethoids; Table 1). With the adoption of a 303 list, States are required to develop a Total Maximum Daily Load (TMDL). States also must include a priority ranking for developing those TMDLs. A critical component in the TMDL process is to identify the sources of each parameter for which the waterbody is listed. Then, the State must develop waste load allocation(s) for point source(s) and load allocation(s) for nonpoint source(s).

Table 1. Currently registered pesticides listed as causes of 303(d) impairment (data accessed November 2009).

Cause of Impairment	States
2-Methylnaphthalene	CA, NH, WA
Acrolein	OR
Atrazine	AL, IA, IL, KS, LA, MO, NE, OH, OR
Azinphos-methyl	CA, OR
Carbaryl	OR
Carbofuran	CA, LA, OR

[17] http://iaspub.epa.gov/waters10/attains_nation_cy.control?p_report_type=T

Cause of Impairment	States
Chlorpyrifos	AL, CA, OK, OR, WA
Dacthal	CA
Diazinon	CA, OK, OR, WA
Dibutyl phthalate	OR, WA
Dimethyl phthalate	OR, WA
Diuron	OR
Endosulfan	AL, CA, MT, OR, WA
Fipronil	LA
Malathion	CA, OR
Methyl parathion	AL, CA, LA
Naphthalene	NH, OR, WA
Prometon	OR
Pronamide	OR
Simazine	OR
Terbacil	OR
Tributyltin	VA
Trifluralin	OR
Xylenes	CA
Organophosphates	CA
"Pesticides" – listed generically as such	CA, IN, MA, NY, OH, OR, PA, PR
Pyrethroids	CA

According to the Office of Water's Impaired Waters and Total Maximum Daily Loads website there are a total of 75,677 causes of impairments for 303(d) listed waters[18]. Of these, approximately 2% (a total of 1,798) are listed as pesticides. The majority (77% or 1,386 of the 1,798) of impairments attributed to pesticides are for those no longer registered for use by the EPA. While 23% (412 of the 1,798) of impairments attributed to pesticides are for currently registered pesticides, including impairments listed generically for "pesticides" (83 of the 1,798). This accounts for 0.5% (412 of 75,677) of the total causes of impairments for 303(d) listed waters nationally. However, it is important to note that many States do not routinely monitor for many currently registered pesticides which is a source of uncertainty for this assessment. Additionally, 3,266 impairments are listed for "impaired biota" and 1,259 impairments are for an "unknown" cause, which together account for about 6% of all impairments.

EPA has received ambient monitoring data for pesticides present in waters that are attributable to the pesticide use patterns covered under this permit from states and other stakeholders. A list of these data sources is included in the administrative record for this permit (see docket number EPA-HQ-OW-2010-0257). EPA is still in the process of evaluating these data in more detail, but in general, these data do not show the presence of pesticides in concentrations above levels of concern (i.e., recommended water quality criteria – available at http://epa.gov/waterscience/criteria/wqctable/ or FIFRA benchmark levels – available at http://www.epa.gov/oppefed1/ecorisk_ders/aquatic_life_benchmark.htm).

2004 National Water Quality Inventory Report

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[18] http://iaspub.epa.gov/waters10/attains_nation_cy.control?p_report_type=T

States, tribes and territories are required to report biennially on the water quality of navigable waters in their boundaries, and the extent to which these waters support designated uses, under Section 305(b) of the Clean Water Act. In its report to Congress on the 2004 reporting cycle[19], which was submitted in January 2009, the Agency reported the results on the portion of Waters of the U.S. evaluated during that cycle. The report indicated that 44% of river miles assessed, 64% of lake acres assessed, and 30% of the square miles of estuaries assessed were impaired for failing to support at least one designated use.

While pesticides are not always monitored when assessing water quality, the Report to Congress indicated that pesticides were not among the most common causes of impairments in the 2004 cycle for rivers and streams, nor for lakes, ponds and reservoirs. Pesticides were the sixth leading cause of impairments for bays and estuaries, but the Report did not indicate whether these were caused by actively registered pesticides, or by sediment contamination by persistent legacy pesticides, which account for the majority of water impairments caused by pesticides nationwide. The Report does not indicate whether any impairments identified by the States were caused by uses that will be subject to NPDES permits under the CWA.

Interpretation of Monitoring Data Relevant to the PGP

When re-evaluating the registrations of existing pesticides, the Agency considers available surface-water monitoring data as a line of evidence regarding potential aquatic risk in addition to considering exposure estimates derived from simulation models. Such monitoring data can provide a measure of trends in aquatic exposure associated with mitigation measures imposed by the Agency. For instance, the USGS's 2009 report of *Trends of Pesticide Concentrations in Corn-belt Streams* states, "(t)he declines in pesticide concentrations closely followed declines in their annual applications, indicating that reducing pesticide use is an effective and reliable strategy for reducing pesticide contamination in streams."

Monitoring studies are valuable because they may specifically target areas in which pesticides considered in the study are likely to be used. This is an effective way of evaluating impact from mitigation measures, or the increase in use of other pesticides that might replace pesticides to which mitigation measures are applied.

The best way to interpret the likely causes of pesticide detections in surface water is to consider any detection in light of the design of the monitoring study itself. For instance, the USGS's study *The Quality of Our Nation's Water – Pesticides in the Nation's Streams and Ground Water, 1992-2001*, described above, used a targeted approach, focusing on areas of relatively homogenous land-use and environmental settings to relate pesticide occurrence to individual non-point sources. The sampling was also most intensive during periods of high pesticide use and runoff. Such a design can best capture transport of pesticide to surface water from runoff from treated agricultural fields (or treated buildings/lawns) in a watershed. But, the timing and location of sample collection may not be as effective in capturing residues of pesticides applied for purposes covered under the General Permit. Concentrations detected could at times reflect such uses, but the design of the study was meant to capture more diffuse non-point transport of pesticides in watersheds, and not point source discharge.

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[19] http://www.epa.gov/owow/305b/2004report/

Uncertainties with Monitoring Data

The Agency recognizes that monitoring of pesticide levels in water has limitations in its ability to identify whether use of specific pesticides may adversely affect water quality. The product monitoring data give only a "snap shot" of the concentration in a particular waterbody at a particular time. While the USGS (*Gilliom et al., 2006*) intensified the frequency of its monitoring during times of the year when most agricultural pesticide usage commonly occurred, their sampling did not necessarily account for timing of specific pesticide applications, frequency of applications, and meteorological events that can cause pesticides to reach surface water as covered by this permit. Thus, monitoring may not collect a sample when pesticide concentrations are at peak levels or when present in the water. Moreover, if monitoring detects the presence of a pesticide, the data usually do not identify the source or if the pesticide residue is actually still a product serving its intended purpose. Ambient monitoring cannot determine whether the contamination was due to lawful use (and if so, which one) or unlawful pesticide use, an accidental spill or discharge, or whether the residues detected were from runoff, or from aquatic uses such as those to be included in the NPDES general permit. Monitoring data are often difficult to interpret because the ancillary data on pesticide usage in a basin, and factors that could make the location more or less vulnerable are often not available.

<u>(3) Technology-based effluent limitations in the PGP provide further protections beyond compliance with existing FIFRA requirements.</u>

EPA expects the proposed general permit contains requirements necessary to ensure that water quality is protected. For example, the operators that apply pesticides over the annual treatment area threshold must implement IPM control measures under Part 2.2. As stated above, EPA expects that the technology-based effluent limitations are as stringent as necessary to meet WQS. These effluent limitations require permittees to minimize the discharge of pesticides through the use of the most efficient and effective means of pest management options, including pesticide and non-pesticide methods. The technology-based effluent limitations require applicators to: use the lowest effective amount of pesticide product per application and optimum number of applications to control the target pest, perform regular maintenance activities on pesticide containers and application equipment, and calibrate equipment. There are other requirements to consider human health and ecological impact, pest resistance, feasibility, and cost effectiveness and include prevention, mechanical/physical methods, cultural methods, biological control agents, and as a final resort, the application of pesticides. To ensure that pesticide discharges are minimized, permittees identified under Part 2.2 must identify target pest species and areas where those pests occur, identify the possible sources of the problem, and establish action thresholds for implementing pest management strategies. The technology-based effluent limitations also require permittees identified under Part 2.2 to conduct surveillance prior to each pesticide application to assess the treatment area and to determine when pest action thresholds are met.

The general permit includes several other provisions that the Agency expects to provide further protections beyond compliance with FIFRA requirements. For one, Part 4 of the permit requires these operators to monitor pesticide applications activities to minimize discharges and during any post-application monitoring to determine effectiveness of the pesticide treatment. In addition, Part 6.0 of the general permit contains requirements for all permittees to document and report adverse incidents involving non-target organisms or the environment, and to take corrective action if it is determined that revising control measures can help to prevent future incidents. An adverse incident report calls due attention to a situation in which water quality may be impacted by pesticide use and may indicate that corrective action is required to ensure that water quality standards are further protected during future applications. The permit also requires permittees to take corrective actions to eliminate other situations such as unauthorized releases (i.e., spills or leaks) or the failure to meet applicable water quality standards. These requirements are discussed further in Part 6.0 of this fact sheet. EPA expects this approach will further reduce discharges of pesticides to waters of the U.S. from the use patterns covered under this permit.

(4) Biological pesticides do not work through a toxic mode of action. For chemical pesticides, the discharges covered under this permit are the residues after the pesticide has performed its intended purpose.

This permit provides coverage for point source discharges from certain applications of pesticides, as identified in Part 1.1.1 of the PGP. Discharges from the application of both chemical and biological pesticides are covered under this PGP consistent with the Sixth Circuit Court's reading of the CWA term "pollutant" in *National Cotton Council v. EPA.*

For chemical or conventional pesticides applied directly to waters (e.g., for aquatic weed control and aquatic nuisance pest control), it is the pesticide residue, including excess pesticide that is present outside of the treatment area or within the treatment area once the target pests have been controlled that is considered a pollutant under this permit. For any pesticide applied over water (e.g., mosquito control), any pesticide or pesticide residue that is incidentally deposited in waters of the U.S. is considered a pollutant since the intended purpose of the application is to target pests above the water. Therefore, the concentrations of "pollutants" will be no higher, and in many instances significantly lower, than the product concentrations considered in EPA's assessment when registering these products.

Discharges of biological pesticides require permit coverage regardless of whether or not a residue exists. Biological pesticides or biopesticides are certain types of pesticides derived from such natural materials as animals, plants, bacteria, and certain minerals. Two classes of biopesticides are relevant to this permit, microbial pesticides and biochemical pesticides. Microbial pesticides consist of a microorganism (e.g., a bacterium, fungus, virus or protozoan) as the active ingredient. The most widely used microbial pesticides are subspecies and strains of *Bacillus thuringiensis*, or Bt. Biochemical pesticides, as defined at 40 CFR 158.2000(a), are naturally occurring substances that control pests by non-toxic mechanisms. Biochemical pesticides include substances, such as insect sex pheromones that interfere with mating, as well as naturally-occurring repellants and attractants.

Biopesticides are usually inherently less toxic than conventional pesticides and generally only affect the target pests and closely related organisms. Often, they are effective in very small quantities and decompose quickly thereby resulting in lower exposures and largely avoiding the pollution problems caused by chemical pesticides. When used as a component of Integrated Pest Management (IPM) programs, biopesticides can greatly decrease the use of chemical pesticides;

however, use of biopesticides effectively requires users to have a very good understanding of pest management. Since biochemical pesticides, by regulatory definition, do not work through a toxic mode of action they may be less likely to result in an excursion of a water quality standard.

(5) The PGP excludes pesticide applications that result in discharges of any pesticide to (1) waters impaired for that pesticide or (2) any Tier 3 waters (i.e., outstanding national resource waters).

EPA identified two scenarios where it believes the PGP may not be adequately protective of water quality standards and has excluded those discharges from coverage under this permit. Namely, the PGP excludes from coverage: (1) discharges to impaired waters from the application of pesticides when that waterbody is impaired for that specific pesticide or its degradates and (2) discharges to Tier 3 Waters (i.e., Outstanding National Resource Waters). Any operator desiring to discharge in either of these two scenarios is required to submit an application for an individual permit. Note that the PGP does cover situations where a waterbody may be impaired generically for "pesticides," though EPA is requesting comment on this issue. EPA will post on its website a list of Tier 3 waterbodies in the areas of the country where this permit applies.

4. Site Monitoring

Monitoring is required in any NPDES permit specifically for the purpose of demonstrating compliance with the permit conditions. There are a variety of monitoring methods that a "traditional" NPDES permit may require, including end-of-pipe monitoring to show compliance with relevant effluent limitations prior to discharging to a receiving waterbody. Monitoring may also pertain to actions taken to ensure that record keeping or other permit control activities are being properly implemented. Water quality monitoring of receiving streams is not typically required in NPDES permits unless it is required to determine among other things, compliance with mixing zone dilution standards or some other special permit condition.

Pursuant to CWA section 308 and 402(a)(2), 40 CFR 122.43(a), and other applicable implementing regulations, the following requirements have been included in the permit, as discussed below. The monitoring requirements of this permit are narrative and demonstrate compliance with permit conditions by using currently established pesticide use routines for monitoring pest control. For instance, the permit requires routine visual inspections (described below) to be conducted as part of the pest treatment activity or as part of post-application pest surveillance, and calls for records of the pesticide discharge volume to be kept. The monitoring requirements of the permit are reasonable measures of good pest management practice that the conscientious operator should be currently employing to ensure environmental health and safety and optimal control of pest organisms.

Monitoring of pesticide discharges poses several challenges not generally encountered in "traditional" NPDES permitting situations. For example, there is no "wastewater discharge" per se from pesticide applications that is analogous to end-of-pipe discharges. A manufacturing plant would, for example, typically direct its wastewater through a treatment system to remove pollutants, and then would direct the effluent through a pipe into a receiving waterbody. However, for chemical pesticide applications, at the time of application the pesticide contains both the portion serving its intended purpose as well as the potential residual for which monitoring data would be appropriate. Thus, monitoring the "outfall" in this case would merely provide data on the amount of the product as applied (information already known through the FIFRA registration process) and would not be useful for comparing with any type of effluent limitation or water quality standard.

EPA considered requiring ambient water quality monitoring. However EPA determined that it was infeasible for the following reasons:

1) Uncertainty: Ambient water quality monitoring would generally not be able to distinguish whether the results were from the pesticide application for which monitoring is being performed, or some other upstream source.

2) Lack of applicable measurable standards: Pesticide-specific water quality standards do not exist at this time for the vast majority of constituents in the products authorized for use under this PGP.

3) Safety and Accessibility: Pesticides, particularly those used for mosquito control and forestry pest control, are often applied over waterbodies in remote areas, hazardous terrain, and swamps that are either inaccessible or pose safety risks for the collection of samples.

4) Difficulty of residue sampling for chemical pesticides: For chemical pesticides, the "pollutant" regulated by the PGP is the residue that remains after the pesticide has completed its activity, and it is this residue that would be the subject of any water quality monitoring requirement. However, the point at which only "residue" remains is not practically discernable at this time for all pesticides.

5) Usefulness of data: Some states have questioned the value of ambient water quality monitoring data obtained from state permitting programs. The data generally showed that water quality impacts were not occurring, and one state even discontinued the requirement in revisions of its state permit.

Given the questionable ability of ambient water quality data to demonstrate permit compliance, EPA has determined that there are suitable alternative monitoring activities to determine permit compliance, other than ambient water quality monitoring, for this permit.

Additionally, in assessing the appropriateness of requiring ambient water quality monitoring, EPA also considered Whole Effluent Toxicity (WET) testing as a possible option for assessing operator compliance with permit conditions; however, WET testing in an NPDES permit program is best used to monitor whether an operator's discharge is toxic and not whether a receiving stream (i.e., the ambient environment), that may be influenced by a number of different discharges from different operators and different sources is toxic. In addition, WET testing would not indicate the actual source of the toxicity. If a waterbody is found to be toxic or to contain pollutants above water quality standards, it can be quite complex to identify the source of the toxicity, which may or may not actually be the NPDES permittee performing the monitoring.

Thus, the monitoring program that EPA has developed for this PGP has been tailored to accommodate the unique situations related to pesticide applications. Visual monitoring is required in the PGP to determine if any pesticide use practices may need to be revised to ensure that avoidable adverse impacts to the environment do not occur (See Section 4.2 of fact sheet). Monitoring records required by those operators who submit NOIs will establish a history that may indicate if or when practices need to be reconsidered.

4.1 Monitoring Requirements for all Permittees

All permittees must monitor the amount of pesticide used to ensure that the lowest amount needed to effectively control the pest is balanced with the potential for development of pesticide resistance. EPA understands that appropriate application rates are variable depending on conditions, and expects permittees to use their best professional judgment in combination with the label requirements in determining the appropriate amount of product needed to optimize efficacy of the treatment. EPA expects that should a pest be eradicated or marginalized, no further discharge to control that pest should occur unless it is absolutely necessary for the continued control of that pest. All permittees must also monitor their operation to ensure the integrity of application equipment by calibrating, cleaning, and repairing equipment on a regular basis to reduce the potential for leaks, spills, and unintended/accidental release of pesticides to waters of the U.S.

4.2 Visual Monitoring Requirements

Visual monitoring assessments are required as a means of identifying, for example, instances of detrimental impact to non-target organisms, disruption or degradation of wildlife habitat, or the prevention of designated recreational or municipal uses of a waterbody that may possibly be related to the operator’s use of pesticides in a given area. Visual monitoring will consist of spot checks in the area to and around which pesticides are applied for possible and observable adverse incidents, such as fish kills and/or distressed fish or macro-invertebrates.

Visual monitoring assessments are also required during the pesticide application when feasibility and safety allow. Visual monitoring is not required during the course of treatment when that treatment is performed in darkness as it would be infeasible for the inspector to note adverse effects under these circumstances. Additionally, the following scenarios often preclude visual monitoring during pesticide application:

1. Applications made from an aircraft
2. Applications made from a moving road vehicle when the applicator is the driver
3. Applications made from moving watercraft when the applicator is the driver
4. Applications made from a moving off-road wheeled or tracked vehicle when the applicator is the driver.

A visual monitoring assessment must also be conducted during any post-application surveillance to determine the efficacy of the pesticide treatment. Visual monitoring of this type is only required if the operator performs post application surveillance in the normal course of business. EPA expects that visual assessments may reasonably be conducted during applications and efficacy inspections may be conducted on foot or from a stationary vehicle.

5. Pesticide Discharge Management Plan (PDMP)

Part 5 of this permit requires any operator who is subject to Part 2.2 of this permit (i.e., one who is required to submit an NOI) to develop a Pesticide Discharge Management Plan (PDMP). Operators who know or should have reasonably known prior to commencement of discharge, that they will exceed an annual treatment area threshold identified in Part 1.2.2 for that year, must develop a PDMP prior to first pesticide application covered under this permit.. Operators who do not know or would reasonably not know until after commencement of discharge, that they will exceed an annual treatment area threshold identified in Part 1.2.2 for that year , must develop a PDMP prior to exceeding the annual treatment area threshold.. Operators commencing discharge in response to a declared pest emergency situation as defined in Appendix A, that will cause the operator to exceed an annual treatment area threshold, must develop a PDMP no later than 90 days after responding to the declared pest emergency. Once the operator meets the requirement to prepare a PDMP, he/she must maintain the plan thereafter for the duration of coverage under this general permit. This means even if the operator's annual treatment area subsequently falls below the annual treatment area threshold, the operator is required to keep the plan up-to-date.

Developing a PDMP helps operators ensure they have (1) taken steps to identify the pest problem, (2) evaluated pest management options, and (3) appropriate control measures to control pesticide discharges. Operators, who exceed an annual treatment area due to a declared pest emergency and thus must submit an NOI, do not need to include activities in their PDMP that were conducted in response to that declared pest emergency. Their PDMP, however, must address any future pesticide application covered under this permit. Part 5.1 of the permit contains the required elements to be documented in the PDMP.

The PDMP itself does not contain effluent limitations; rather it constitutes a tool both to assist the operator in documenting what control measures it is implementing to meet the effluent limitations, and to assist the permitting/compliance authority in determining whether the effluent limitations are being met. A PDMP is a "living" document that requires periodic reviews and must be kept up-to-date. Where control measures are modified or replaced to meet effluent limitations, such as in response to a Part 6.1 triggering condition, such changes must be documented in the PDMP. If operators fail to develop and maintain an up-to-date PDMP, they will have violated the permit. This recordkeeping violation is separate and distinct from a violation of any of the other substantive requirements in the permit (e.g., effluent limitations, corrective action, monitoring, reporting, and state-specific requirements).

Operators may choose to reference other documents, such as a pre-existing integrated pest management (IPM) plan or spill prevention and response plan, in the PDMP rather than recreating the same text in the PDMP. It is not required that an operator must have authored the pre-existing plan in order to use it. When referencing other documents, the operator is responsible for ensuring his/her PDMP and the other documents together contain all the necessary elements for a complete PDMP, as specified in Part 5.1. In addition, the operator must ensure that a copy of relevant portions of those referenced documents is attached to the PDMP and is located on-site and it is available for review consistent with Part 5.3 of the permit.

5.1. Contents of Your PDMP

The PDMP prepared under this permit must meet specific requirements under Part 5.1 of the permit. Generally, operators must document the following: (1) a pesticide discharge management team; (2) a description of the pest management area and the pest problem; (3) a description of control measures; (4) schedules and procedures for application rate and frequency, pest surveillance, assessment of environmental conditions, spill prevention and response, equipment maintenance, adverse incident response, and pesticide monitoring; and (5) any eligibility considerations under other federal laws.

Pesticide Discharge Management Team

The permit requires that a qualified individual or team of individuals be identified to manage pesticide discharge, including the pesticide applicator. If the pesticide applicator has not been identified at the time of the plan development, the operator should indicate whether or not a for-hire applicator will be used. Identification of a pesticide discharge management team ensures that appropriate persons (or positions) are identified as necessary for developing and implementing the plan. Inclusion of the team in the plan provides notice to staff and management (i.e., those responsible for signing and certifying the plan) of the responsibilities of certain key staff for following through on compliance with the permit's conditions and limits.

The pesticide discharge management team is responsible for developing and revising the PDMP, implementing and maintaining the control measures to meet effluent limitations, and taking corrective action where necessary. Team members should be chosen for their expertise in the relevant areas to ensure that all aspects of pest management are considered in developing the plan. The PDMP must clearly describe the responsibilities of each team member to ensure that each aspect of the PDMP is addressed. EPA expects most operators will have more than one individual on the team, except for small entities with relatively simple plans and/or staff limitations. The permit requires that team members have ready access to any applicable portions of the PDMP and the permit.

Pest Management Area Description

The pest management area description includes the pest problem description, action threshold(s), a general location map, and water quality standards.

1. Pest Problem Description.

The permit requires that the PDMP include a description of the pest problem at the pest management area. A detailed pest management area description assists operators in subsequent efforts to identify and set priorities for the evaluation and selection of control measures taken to meet effluent limitations set forth in Parts 2 and 3 and in identifying necessary changes in pest management. The description must include identification of the target pest(s), source of the pest problem, and source of data used to identify the problem. The permit allows use of historic data or other available data (eg, from another similar site) to identify the problem at your site. If you use other site data, you must document in this section why data from your site is not available or not taken within the past year and explain why the data is relevant to your site. Additionally, the pest management area descriptions should include any sensitive resources in the area, such as unique habitat areas, rare or listed species, or other species of concern that may limit pest management options.

2. Action Threshold(s)

The permit requires that the PDMP include a description of the action threshold(s) established for the target pest, including a description of how they were determined. An action threshold is a level of pest prevalence at which an operator takes action to reduce the pest population.

3. General Location Map

The PDMP must also contain a general location map of the site that identifies the geographic boundaries of the area to which the plan applies and location of the waters of the U.S. To improve readability of the map, some detailed information may be kept as an attachment to the site map and pictures may be included as deemed appropriate.

4. Water Quality Standards

Operators must identify the water quality standards applicable to their discharge. This must include a list of pesticide(s) or any degradates for which the water is impaired. Internet links to all state, territory and tribal water quality standards are available at: http://epa.gov/waterscience/standards/wqslibrary/.

Description of Control Measure

The permit requires that the PDMP include a description of the control measures to demonstrate how the operators specifically plan to meet the applicable technology-based or water quality-based effluent limitations. The description of the control measures selected to meet the effluent limitations must include a brief explanation of the control measures used at the site to reduce pesticide discharge, including evaluation and implementation of the six pest management tools (no action, prevention, mechanical/physical methods, cultural methods, biological control agents, and pesticides). Operators must consider impact to non-target organisms, impact to water quality, pest resistance, feasibility, and cost effectiveness when evaluating and selecting the most efficient and effective means of pest management to minimize pesticide discharge to waters of the U.S.

All six pest management tools may not be available for a specific use category and/or treatment area. However, the PDMP must include documentation of how the six pest management tools were evaluated prior to selecting a site specific pest management strategy. For the no action option, operators should document the impact of this option without any current pest management strategy at the site. For the prevention management option, the operator should document the methods implemented to prevent new introductions or the spread of the pests to new sites such as identifying routes of invasion and how these can be intercepted to reduce the chance of invasion. Prevention may include source reduction, using pathogen-free or weed-free seeds or fill; exclusion methods (e.g., barriers) and/or sanitation methods, like wash stations, to prevent reintroduction by vehicles, personnel, etc. Some prevention management methods may fall under mechanical/physical or cultural methods as well.

For the pesticide management option, operators must include a list of active ingredient(s) evaluated. Discussion should also identify specific equipment or methods that will prevent or reduce the risks to non-target organisms and pesticide discharges to waters of the U.S.

Schedules and Procedures

a. The following schedules and procedures, used to comply with the effluent limitations in Part 2 of the permit, must be documented in the PDMP:

1. Application Rate and Frequency Procedures

In the PDMP, operators must describe the procedures for determining the lowest effective amount of pesticide product per application and the optimum frequency of pesticide applications to minimize discharges from the application of pesticide.

2. Spill Prevention

a. Operators must describe the spill prevention program for their pest management area. The program should address areas and activities at the site that typically pose a high risk for spills including loading and unloading areas, storage areas, process areas, and waste disposal activities. It should also address appropriate material handling procedures, storage requirements, and containment or diversion equipment that will minimize the potential for spills, or in the event of a spill, enable proper and timely response.

b. As required in Part 6.1 of this permit, any spills or leaks that occur while covered under this permit must be documented.

c. Documenting spills does not relieve operators of any reporting requirements established in 40 CFR 110, 40 CFR 117, and 40 CFR 302, or any other statutory requirements relating to spills or other releases of oils or hazardous substances.

3. Pesticide Application Equipment Procedures

Operators must describe the preventive equipment maintenance program to keep the pesticide application equipment in proper operating condition, including how and when the following will be addressed: calibration, regular inspections, and cleaning/repairing of the application equipment to avoid situations that may result in leaks, spills, and other releases.

4. Pest Surveillance Procedures

Operators must discuss how their pest surveillance programs assess the pest treatment area, to determine when the action threshold(s) is met. The discussion should also include surveillance method(s) selected.

5. Environmental Conditions Assessment Procedures

Operators must discuss the procedures and methods to assess environmental conditions in the treatment area.

b. The following additional schedules and procedures necessary to minimize discharges must also be documented in the PDMP

1. Spill Response Procedures

The PDMP must document procedures for expeditiously stopping, containing, and cleaning up leaks, spills, and other release. In addition, the PDMP must include documentation of the procedures for notification of appropriate facility personnel, emergency response agencies, and regulatory agencies.

2. Adverse Incident Response Procedures

In the PDMP, operators must document appropriate procedures for responding to an adverse incident resulting from pesticide applications. Operator must identify and document the following:

- Course of action or responses to any incident resulting from pesticide applications;
- Chain of command notification for the incident, both internal to your agency/organization and external;
- State/Federal contacts with phone numbers;
- Name, location, and telephone of nearest emergency medical facility;
- Name, location, and telephone of nearest hazardous chemical responder; and (including police and fire department).

3. Pesticide Monitoring Schedules and Procedures
In the PDMP, operators must describe procedures for monitoring consistent with the requirements in Part 4.0 including:

- The process for determining the location and timing of monitoring;
- A schedule and procedures for monitoring;
- The person (or position) responsible for conducting monitoring; and
- Procedures for documenting any observed impacts to non-target organisms resulting from your pesticide discharge.

Signature Requirements

The PDMP must be signed and certified in accordance with the signatory requirements in the Standard Permit Conditions part of the permit (Appendix B, subsection B.11). This requirement is consistent with standard NPDES permit conditions described in 40 CFR 122.22 and is intended to ensure that the operator understands his/her responsibility to create and maintain a complete and accurate PDMP. The signature requirement includes an acknowledgment that there are significant penalties for submitting false information.

5.2 Pesticide Discharge Management Plan Modifications.

This permit requires that the PDMP be updated whenever any of the triggering conditions for corrective action in Part 6.1 of the permit occur, or when a review following the triggering conditions in Part 6.1 requires the operator to revise his/her control measures as necessary to meet the effluent limitations in this permit (Part 2). Keeping the PDMP up-to-date will help the operator ensure that the condition that triggered the corrective action does not reoccur. Operators are also required to review the PDMP at least once a year or whenever necessary to update the pest problem description and pest management strategies at the pest management area.

It is important to note that failure to update the PDMP in accordance with Part 5.2 is a recordkeeping violation, not a violation of an effluent limit. For example, if the operator changes its maintenance procedures, but fails to update its PDMP to reflect these changes, a recordkeeping violation will result. The operator must revise its PDMP to reflect the new maintenance procedures and include documentation of the corrective action (in accordance with Part 6) to return to full compliance.

5.3 Pesticide Discharge Management Plan Availability.

This permit requires that a copy of the current PDMP, along with all supporting maps and documents, be kept at the address provided on the NOI. The PDMP and all supporting documents must be immediately available to representatives of EPA, a State, Tribal, or local agency governing pesticide applications, as well as representatives of the U.S. Fish and Wildlife Service (USFWS) or the National Marine Fisheries Service (NMFS) at the time of an on-site inspection or upon request. This requirement is consistent with standard NPDES permit conditions described in 40 CFR 122.41. Part 5.3 of this permit indicates that EPA may provide access to portions of your PDMP to a member of the public upon request. Confidential Business Information (CBI) may be withheld from the public, but consistent with 40 CFR Part 2, may not be withheld from EPA or the Services.

6.0 Corrective Action

The purpose of including corrective action requirements in this permit is to assist this new universe of NPDES permittees with effectively meeting technology-based and water-quality-based effluent limitations and implementing integrated pest management practices in this permit. Corrective actions in this permit are follow-up actions a permittee must take to assess and correct problems. They require review and revision of control measures and pesticide application activities, as necessary, to ensure that these problems are eliminated and will not be repeated in the future. The permit makes clear that the permittee is expected to assess why a specific problem has occurred and document what steps were taken to eliminate the problem. EPA believes this approach will help permittees in complying with the requirements of the permit quickly. Compliance with many of the permit’s requirements -- for instance, those related to reporting and recordkeeping and some of those related to operation and maintenance -- can be accomplished immediately, and therefore, are not considered problems that trigger corrective actions.

It should be noted that a situation triggering corrective action is not necessarily a permit violation and, as such, may not necessarily trigger a modification of control measures to meet effluent limitations. However, failure to conduct (and document) corrective action reviews in such cases does constitute a permit violation.

6.1 Situations Requiring Revision of Control Measures.

Permittees are required to review and, as necessary, revise the selection and implementation of their control measures to eliminate any of the following situations:

- an unauthorized release or discharge occurs;
- the permittee becomes aware, or EPA determines, that control measures are not stringent enough for the discharge to meet applicable water quality standards;
- an inspection or evaluation of your facility by an EPA official, or local, state, or Tribal entity, determines that modifications are necessary to meet the non-numeric effluent limits detailed in Part 2 of the PGP; or
- the permittee observes or is otherwise made aware (e.g., a third party notification) of an adverse incident for which symptoms are unusual or unexpected during the normal course of treatment.

EPA considers the above situations to be of significant concern. Thus, EPA is requiring permittees to assess the cause of these situations which may be affiliated with the permittees discharge from the application of pesticides and to take any necessary steps to eliminate the situation and ensure that the situation will not be repeated in the future.

The purpose of Part 6.1 is to ensure compliance with corrective action requirements through increased accountability and oversight. EPA views ongoing assessment of control measure effectiveness and corrective actions as integral to an effective pesticide management program. This corrective action assessment must be kept with the other recordkeeping documentation required by this permit.

6.2. Corrective Action Deadlines.

The permit requires that corrective action be completed “before the next pesticide application that results in a discharge, if practicable, or if not, as soon as practicable thereafter.” EPA emphasizes that this timeframe is not a grace period within which an operator is relieved of any liability for a permit violation. EPA is adopting this flexible deadline to account for the variation in types of responses (e.g., evaluate situation and select, design, install, and implement new or modified control measures) that may be necessary to address any identified situations of concern. EPA recognizes that in rare cases a corrective action review may identify the need for substantial improvements to the permittee’s control measures, and does not want to limit the selection and implementation of such controls with an inflexible deadline. Another possibility is that EPA or the permittee may determine that further monitoring is needed under Part 6.3 of the permit to pinpoint the source of the problem, and this monitoring may need to be conducted during future pesticide application activities. However, EPA believes that in the vast majority of cases, corrective action reviews will identify responses that can be taken quickly, either before the next pesticide application that results in a discharge or shortly thereafter. EPA expects operators to document and justify any schedules for selecting, designing, installing, and implementing new or modified control measures.

When any of the listed situations are identified under 6.1, such as discovery that water quality standards are being exceeded, the permittee must take steps to ensure the problems causing any violation are eliminated. If the original inadequacy constitutes a permit violation, then that violation is not excused by response within the timeframe EPA has allotted for corrective action, though EPA may consider this when determining the appropriate enforcement response to a violation. EPA assumes that permittees will need less time to make minor repairs or change practices than to make substantial operational changes or equipment repair. A timeframe, albeit flexible, is included specifically so that problems are not allowed to persist indefinitely. Failure to take the necessary corrective action within the stipulated timeframe constitutes an additional and independent permit violation.

6.3 Effect of Corrective Action

The occurrence of a situation described in Part 6.1 may, but does not implicitly, constitute a violation of the permit. The occurrence of a situation identified in Part 6.1 does require the permittee to immediately review and as necessary, revise the selection and implementation of their control measures to eliminate the situation. Part 6.3 explains that taking corrective action does not absolve the permittee of any liability for a permit violation requiring that action, however, failure to take required corrective action will constitute an original or an additional permit violation. EPA will consider the appropriateness and promptness of corrective action in determining enforcement responses to permit violations. EPA or a court may impose additional requirements and schedules of compliance, including requirements to submit additional information concerning the condition(s) triggering corrective action, additional site-specific water-quality based limitations, additional monitoring requirements, or other schedules and requirements more stringent than specified in this permit. Those requirements and schedules will supersede those of Part 6.1 if such requirements conflict.

6.4 Adverse Incident Documentation and Reporting

Part 6.4 of the PGP requires permittees to take specific actions in response to identified adverse incidents which may have resulted from a discharge from the permittee's pesticide application. Namely, permittees are required to provide oral notice to EPA within 24 hours and then follow-up with a written report within 5 days of becoming aware of the adverse incident. EPA defines an "adverse incident" in Appendix A of the PGP, but generally it is defined as any effect of a pesticide's use that is unexpected or unintended.

Part 6.4.1 requires Permittees to call the appropriate EPA Incident Reporting Contact within 24 hours of any identified adverse incident and provide basic information about it. The purpose of this requirement is twofold: (1) to provide an opportunity for the Agency to respond to these incidents as soon as reasonably can be expected, and (2) to provide a basis for potential corrective actions. EPA does not expect this initial notification to be detailed but merely a reporting of the date of the finding, a general discussion of the incident and a review of the necessity to conduct corrective action. The permit requires permittees to document the information identified in 6.4.1, including the date and time you notified EPA and a description of any deviations from 6.4.1 notification requirements based on nuances of the adverse incident. For example, a permittee may decide to notify multiple EPA contacts because of the severity of the adverse incident. This type of information should be included in the written documentation of the 24-hour notification as described below.

Part 6.4.2 requires permittees to provide a written report of the adverse incident to the appropriate EPA Regional office and to the State Lead Agency for pesticide regulation within 5 days of discovering the adverse incident. The adverse incident report must include the following information:

- Information required to be provided in Part 6.4.1
- Date and time you contacted EPA notifying the Agency of the adverse incident;

- Location of incident, including the names of any waters affected and appearance of those waters (sheen, color, clarity, etc.)
- A description of the circumstances of the incident including species affected, number of individual and approximate size of dead or distressed organisms
- Magnitude of the effect (e.g., aquatic square area or total stream distance affected)
- Pesticide application rate, intended use site (e.g., banks, above, or direct to water), and method of application;
- Description of the habitat and the circumstances under which the incident occurred (including any available ambient water data for pesticides applied);
- Actions to be taken to prevent recurrence of the incident.

EPA believes adverse incident information associated with discharges from the application of pesticides is useful to the Agency because the information:

- Provides the Agency with an indication of the effectiveness of the permit in controlling discharges to protect water quality, including data upon which the Agency may base future permit decisions (e.g., modifications to or reissuance of this permit).
- May be considered when reviewing applications for registration of new pesticides that are chemically similar to existing pesticides;
- May be considered in ecological risk assessment and during deliberations on risk management decisions;
- May be reviewed to determine trends that may indicate potential ecological impacts with an existing pesticide and/or to track improvements when mitigation measures are applied;
- Provides information on the nature, extent, and severity of incidents to decision-makers, stakeholders, and the public; and
- Provides the Agency with information on which to assess compliance with regulatory requirements, including documentation and reporting.

Currently, there is no database that includes adverse reporting from anyone other than the registrant under 6(a)(2) of FIFRA. EPA does not consider inclusion of adverse incident reporting in the NPDES permit to be a duplicative requirement to the FIFRA section 6(a)(2) requirements for registrant reporting of adverse incidents. This is because pesticide registrants are not likely to be directly covered under the PGP. Requiring the reporting of adverse incidents and follow-up corrective actions may address the lack of a universal, mandatory legal duty for pesticide users to report adverse incidents, at least for the pesticide use patterns covered by this permit.

EPA acknowledges that assessing and correcting adverse incidents may be complicated in certain instances. For example, symptoms associated with adverse incidents are often vague or mimic other causes which may lead to incorrect diagnoses. Thus, it may be difficult to identify and track chronic effects resulting from pesticides discharges. It may also be difficult to observe adverse effects because of limited visibility or access such as dead fish poisoned in a wetland under dense vegetation or in sparsely populated areas or because scavengers scatter or devour carcasses before discovery. However, EPA believes that it is important to identify to the extent feasible situations where adverse effects occur where discharges from the application of pesticides also occur.

Immediately observable signs of distress or damage to non-target plants, animals and other macro-organisms within the treatment area may warrant concern for a possible adverse incident related to a discharge of pesticides during application. EPA acknowledges that some degree of detrimental impact to non-target species is to be expected and is acceptable during the course of normal pesticide treatment. EPA expects operators to use their best professional judgment in determining the extent to which non-target effects appear to be abnormal or indicative of an unforeseen problem associated with an application of pesticides.

During a visual inspection, operators should watch for distressed or dead juvenile and small fishes, washed up or floating fish, fish swimming abnormally or erratically, fish lying lethargically at the water surface or in shallow water, fish that are listless or nonresponsive to disturbance, the stunting, wilting, or desiccation of non-target submerged or emergent aquatic plants, and other dead or visibly distressed non-target organisms including amphibians, turtles, and macro-invertebrates. These observations must be noted unless they are deemed not to be aberrant (for example, distressed non-target fish are to be expected when conducting a treatment with rotenone and non-target vegetation will be stressed near the target of contact herbicides). It should be noted that observation of these impacts does not necessarily imply that a pesticide has been misused or that there has been a permit violation or an instance of noncompliance, but may provide cause for further investigation of local water quality or reconsideration of Best Management Practices. Not reporting such incidents, however, is a permit violation.

Complete information concerning adverse impacts will aid EPA in any review of current or future pesticide use, adherence to Best Management Practices, or effectiveness of Best Management Practices. Reporting of adverse incidents is not required under this permit in the following situations: (1) you are aware of facts that clearly establish that the adverse incident was not related to toxic effects or exposure from the pesticide application; (2) you have been notified in writing by EPA that the reporting requirement has been waived for this incident or category of incidents; (3) you receive information notifying you of an adverse incident but that information is clearly erroneous; (4) an adverse incident occurs to pests that are similar in kind to pests identified as potential targets on the FIFRA label. However, records of all visual inspections, even for these situations, must be kept on site with the permittee.

6.5 Reportable Spills and Leaks

Part 6.5.1 requires permittees to call the appropriate EPA Incident Reporting Contact to report any spill or leak of a hazardous substance or oil into waters of the U.S with 24 hours of becoming aware of the spill or leak.[20] Part 6.5.2 requires permittees to document this notification within 5 days of becoming aware of such spill or leak. This documentation provides a written record of what you reported to EPA orally. It should also include a description of the reporting system that will be used to alert responsible managers and legal authorities in the event of a future spill or leak and a description of preventive measures to prevent, contain, or treat spills and leaks of these materials. Part 6.4.3 requires permittees to notify either the National Marine Fisheries Service or the U.S. Fish and Wildlife Service if the permittee becomes aware of an incident that may have resulted from a discharge from your pesticide application that adversely affects a federally-listed threatened or endangered species or its federally-designated

[20] Reportable Spills and Leaks are defined as those that trigger the requirement to notify the National Response Center (40 CFR Parts 110, 117, 302) based on the type of pollutant and quantity released.

critical habitat. This information will be used by EPA to ascertain compliance with permit conditions.

6.6 Other Corrective Action Documentation

For any event described in Part 6.1 of the permit, other than for adverse incidents or reportable spills or leaks, immediate reporting to EPA is not required, but permittees must document basic information describing the event and the permittees' response to that event within 5 days. For triggering events in Part 6.1, where the permittee determines that any revision to control measures is not necessary, the permittee must still document the review and the basis for this determination. EPA is not requiring permittees to submit this documentation to the Agency. Rather, EPA expects permittees to retain this information on-site and upon request, to make any such records available to EPA or any other Federal, state, or local regulatory agency governing pesticide applications. A summary of this information must also be included in the annual report for permittees subject to the annual reporting requirement.

7. Recordkeeping and Annual Reporting

This permit requires operators to maintain certain records to help them assess performance of control measures and to document compliance with permit conditions. These requirements are consistent with Federal regulations at 40 CFR 122.41(j), but have been tailored to more closely reflect requirements of the PGP. Part 7 of this permit describes recordkeeping requirements for all operators and the requirements for certain operators (i.e., those large applicators that are required to submit an NOI). Operators can rely on records and documents developed for other programs, such as requirements under FIFRA, provided all requirements of the permit are satisfied.

This permit requires those who will exceed the annual treatment area threshold in Part 1.2.2. to keep additional records and to submit an annual report. EPA recommends that all operators keep records of acres of linear miles treated each calendar year for all applicable use patterns covered under this general permit. This record will help operators estimate when they will exceed the annual treatment area threshold. As explained in the NOI discussion, the total acres or linear miles should not include those acres/miles accounted for in another operator's NOI.

The records that must be kept by all operators, specifically the entity who has operational control over the decision to perform pesticide applications, include the following:

- A copy of the permit;
- Adverse incident reports; and
- Rationale for any determination that reporting of an identified adverse incident is not required consistent with allowances identified in Part 6.4.1.
- A copy of any corrective action documentation (See Part 6.6)

As noted above, operators who are required to submit an NOI must keep additional records. These records are listed below and identified in Section 7.2 of the permit. Section 7.2 of the permit applies to the entity submitting the NOI and to any pesticide applicator hired by such entity to perform activities covered under the permit. Records of equipment maintenance and calibration are to be maintained only by the entity performing the pest management activity on behalf of self or client.

a. A copy of the NOI submitted to EPA, any correspondence exchanged between you and EPA specific to coverage under this permit, and a copy of the EPA acknowledgment letter assigning your permit tracking number;
b. The date on which you knew or should have known that you would exceed an annual treatment area threshold during any calendar year, as identified in Part 1.2.2;
c. Surveillance method(s) used, date(s) of surveillance activities, and findings of surveillance;
d. Target pest(s);
e. Pest density prior to pesticide application;
f. Company name and contact information for pesticide applicator;
g. Pesticide application date(s);
h. Description of treatment area, including location and size (acres or linear feet) of treatment area and identification of any waters, either by name or by location, to which you discharged any pesticide(s);
i. Name of each pesticide product used including the EPA registration number;
j. Quantity of pesticide applied (and specify if quantities are for the pesticide product as packaged or as formulated and applied)
k. Concentration (%) of active ingredient in formulation;
l. For pesticide applications directly to waters, the effective concentration of active ingredient required for control;
m. Any unusual or unexpected effects identified to non-target organisms;
n. Documentation of any equipment cleaning, calibration, and repair (to be kept by pesticide application equipment operator);
o. A copy of your PDMP, including any modifications made to the PDMP during the term of this permit.

All required records must be prepared as soon as possible but no later than 14 days following completion of the associated activity. Operators must retain copies of these documents for a period of at least 3 years from the date their coverage under this permit expires or is terminated. The recordkeeping requirements in Appendix B, Subsection B.12 include a more general statement of the NPDES standard condition for records retention, but does not impose additional requirements on the operator above what is required in Part 7.

In addition to recordkeeping, EPA is requiring certain operators (i.e., those larger applicators that are also required to submit an NOI) to submit annual reports that contain basic information on their pesticide discharges to waters of the U.S. EPA expects to have an online system available in time for submission of the first annual reports (in early 2012) with the intent of streamlining the process for completing this permit obligation.

The annual report must include information for the calendar year, with the first annual report required to include activities for the portion of the calendar year after the effective date of the NOI. If the effective date of the NOI is after December 1, he/she is not required to submit an annual report for that first partial year but must submit annual reports thereafter, with the first annual report submitted also including information from the first partial year. When an operator terminates permit coverage, as specified in Part 1.2.5, the operator must submit an annual report for the portion of the year up through the date of the termination. The annual report is due no later than 45 days after the termination date, or February 15 of the following year, whichever is earlier.

This information in the annual report will be used by EPA to assess permit compliance and to determine whether additional controls on pesticide discharges are necessary to protect water quality. For example, these data will help the Agency identify where pesticide discharges are occurring and the types of pesticides being discharged.

The annual report is a summary of the pest control activities for each applicable use pattern. The annual report must contain the following information specific to each pest treatment area covered under the permit:

a. Identification of any waters or other treatment area, including size, either by name or by location, to which you discharged any pesticide(s);
b. Pesticide use pattern(s) (i.e., mosquito and other flying insects, aquatic weeds and algae, aquatic nuisance animals, or forest canopy) and target pest(s);
c. Company name(s) and contact information for pesticide applicator(s), if different from the NOI submitter;
d. Total amount of each pesticide product applied for the reporting year by the EPA registration number(s) and by application method (e.g., aerially by fixed-wing or rotary aircraft, broadcast spray, etc.);
e. Whether this pest control activity was addressed in your PDMP prior to pesticide application;
f. If applicable, an annual report of any adverse incidents as a result of these treatment(s), for incidents, as described in Part 6.4.1; and
g. A description of any corrective action(s), including spill responses, resulting from pesticide application activities and the rationale for such action(s).

8. EPA Contact and Mailing Addresses

This part of the permit identifies contact information and mailing addresses for any applicable reporting requirements of this permit. Note that depending on the requirement, some reports/notifications are to go to the EPA Regional office while others are to be sent to an EPA Headquarters location. Generally, Regions are notified for information that may require rapid review and response by the Region to address potential adverse effects or other concerns requiring more immediate attention.

9. Permit Conditions Applicable to Specific States, Indian Country Lands, or Territories

Part X of the final PGP will contain conditions provided by States and Tribes as part of the Clean Water Act (CWA) Section 401 certification and consistent with the Coastal Zone Management Act (CZMA).

Section 401 of the CWA provides that all Federally-issued permits be certified by the state in which the discharge occurs. The state certifies that the proposed permit will comply with state water quality standards and other state requirements. Additionally, Section 401 provides that any certification under the Act shall set forth any effluent limitations and other limitations, and monitoring requirements necessary to assure that any applicant for a Federal license or permit will comply with any applicable effluent limitations and other limitations, standard of performance, or prohibition, effluent standard, or pretreatment standard, and with any other appropriate requirement of State and Tribal law set forth in such certification and shall become a condition on any Federal permit subject to the provisions of this section.

The Coastal Zone Management Act (CZMA) and its implementing regulations (15 CFR Part 930) require that any Federal licensed activity directly affecting the coastal zone of a state with an approved Coastal Zone Management Program (CZMP) be consistent with the enforceable policies of that approved program to the maximum extent practicable. Agency general permits that do not involve case-by-case or individualized determinations by the Agency are federal activities for the purposes of CZMA section 307(c)(1). For the final PGP, EPA will make a consistency determination regarding the enforceable policies in each approved state CZM program for the coastal zones including state waters where the PGP would authorize discharges. 15 CFR 930.31(d).

Those provisions are not included in the draft PGP but will be included in the final PGP.

10. Appendices

A. Definitions and Acronyms

Appendix A of the Permit provides permit-specific definitions of statutory, regulatory, and other terms important for understanding this draft permit and its requirements. Any terms that are not listed in this definitions part have the meaning given to the terms by 40 CFR Part 122.2 (the definitions section of the NPDES regulations). To develop these definitions, EPA has, where possible, relied on existing definitions in other laws and regulations applicable to this universe of permittees in order to provide consistency with those laws and provide permittees with a familiar framework.

B. Standard Permit Conditions

Federal regulations require that all NPDES permits contain the standard permit conditions specified in 40 CFR 122.41. Appendix B incorporates those standard conditions with some minor revisions to more clearly address pesticide application operations covered under the PGP. Of note, Subsection B.1 in Appendix B explains the permittee's duty to comply with the conditions of the permit with failure to do so constituting a violation of the Clean Water Act.

C. Areas Covered

As noted above, this permit is available in those areas where EPA remains the NPDES permitting authority for discharges from the application of pesticides to or over, including near, waters of the U.S. NPDES-authorized states issue permits elsewhere in the U.S. for these types of discharges. Appendix C includes a list of those areas where this EPA permit is available for such discharges and includes portions of all ten EPA Regions where EPA remains the NPDES permitting authority. One important note to acknowledge is that the State of Alaska has received authorization to administer the NPDES program; however, EPA and the State established a three-year phase-in schedule that does not have the State issuing permits for discharges from pesticide applicators until November 1, 2011. As the court decision only granted a stay until April 9, 2011, EPA is including discharges from pesticide applications in Alaska in this permit such that permit coverage is available at least between April 9, 2011 and November 1, 2011.

D. Notice of Intent Form

Part 1.2.2 identifies certain operators required to prepare and submit a complete and accurate Notice of Intent (NOI) form to be authorized to discharge under this permit. Operators must submit NOIs in accordance with the deadlines provided in Part 1.2.3 of the PGP. The NOI form provides EPA with the information necessary to determine an operator's eligibility to discharge under this permit, and enables EPA to better match up permittees with other reporting requirements and to prioritize oversight activities. Appendix D of the PGP contains information that is required to be provided on the NOI form. Operators are required to submit that information electronically using EPA's eNOI system (website URL to be provided in the final permit but will be similar to EPA's Vessel General Permit eNOI site at: http://cfpub.epa.gov/npdes/vessels/enoi.cfm and EPA's stormwater general permit eNOI site at http://cfpub.epa.gov/npdes/stormwater/enoi.cfm). EPA is using the eNOI system because it is easier (including availability of online instructions and help menus to guide you through the process), faster (NOIs can be processed 2 weeks or more faster than paper forms), and more accurate (eNOI will ensure form is completed and will auto check certain key elements to improve accuracy of information submitted).

E. Notice of Termination Form

Part 1.2.5 of the PGP requires certain permittees (i.e., those required to submit an NOI to be authorized under this permit) to submit a Notice of Termination (NOT) form within 30 days of the occurrence of one of several different triggering events: (1) when a new operator has taken over responsibility for the pest treatment, (2) the operator has ceased aquatic pesticide application covered under the general permit, (3) there is not and no longer will be pesticide discharge, or (4) the operator has obtained coverage under an individual permit or an alternative general permit. Appendix E of the PGP contains a copy of the information required to be submitted on the NOT form. Like the NOI, EPA is requiring that operators complete and submit the NOT form electronically using EPA's eNOI system, (website URL to be provided in final permit).

F. Endangered Species Procedures

Background

Section 7(a)(2) of the Endangered Species Act (ESA) requires each Federal agency, in consultation with and with the assistance of the Fish and Wildlife Service (FWS) and the National Marine Fisheries Service (NMFS), collectively "the Services," to ensure that the actions they authorize, fund, or carry out are not likely to jeopardize the continued existence of any endangered or threatened species (referred to as "listed species") or result in the destruction or adverse modification of their designated critical habitats.

The Services have published regulations implementing ESA section 7 at 50 CFR Part 402. The regulations provide that a Federal agency (such as EPA) must consult with FWS, NMFS, or both if the agency determines that an activity authorized, funded, or carried out by the agency may affect listed species or critical habitat. The kinds of effects that trigger the consultation obligation could include, among other things, beneficial, detrimental, direct and indirect effects. EPA believes the issuance of the PGP may affect listed species and is thus subject to the ESA section 7(a)(2) consultation requirements.

Current Action

EPA is consulting with the National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (FWS) on this general permit, which may result in the addition of permit conditions to further protect:

- Species that are listed under the Endangered Species Act (ESA) as endangered or threatened (known as "listed species");
- Listed species' habitat that is designated under the ESA as critical ("critical habitat"); and
- Species proposed, but not yet listed as endangered or threatened, or habitat proposed, but not yet listed as designated critical habitat.

EPA initiated informal consultation with the Services in October 2009 and continues to work closely with them to meet the Agency's obligation to insure that issuance of the PGP will not be likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of their designated critical habitats.

As a result of EPA's discussions with the Services, EPA has proposed three provisions in the draft permit to address ESA-related concerns. First, if an operator is required to file an NOI to be eligible for coverage, the operator must provide information in the NOI relating to the possibility that the pesticide activities covered by the permit will overlap with the distribution of listed species or critical habitat. If such overlap is expected and the pesticide activities have not been the subject of consideration by the appropriate Service under ESA sections 7 or 10, the operator must identify the species and habitat within the areas for which the operator is seeking permit coverage. (See the Notice of Intent requirements in Appendix D of the draft permit.) The Agency proposes to transmit to the appropriate Service a copy of NOIs received pursuant to the general permit. Second, Part 6.4.3 of the draft permit would require any permittee who becomes aware of an adverse effect on any listed species to report that information not only to EPA (as is already required under Parts 6.4.1 and 6.4.2), but also to the appropriate Service. Information submitted pursuant to either of these provisions could lead EPA to impose on a permittee additional restrictions to protect listed species or critical habitat. Finally, Part 1.6.2 of the draft permit contains a provision that makes clear that an operator must comply with requirements resulting from any pre-existing consultations under ESA section 7 or "take permits" under ESA section 10 that address any discharges from activities that would be covered under this general permit.

The general permit also includes a placeholder in Part 1.6.1 noting that the Agency is working with the Services to identify possible additional permit conditions (i.e., effluent limitations, site monitoring, planning, corrective action, recordkeeping, and/or reporting) to reduce the risks to listed species and critical habitat from actions under this permit in addition to documenting the actions necessary and that were taken to protect species and critical habitat. In developing these additional requirements, EPA is considering how best to draft these requirements so that they apply to operators whose activities may affect listed species or their critical habitat, while not imposing requirements on operators when their activities would not affect listed species or critical habitat. EPA is also considering how best to draft these permit provisions so that compliance with permit terms that may require operators to further minimize or eliminate pesticide use in certain circumstances does not result in operators taking actions that would cause greater harm to listed species and their habitats than would otherwise result from the application of pesticide discharges consistent with the conditions in the draft PGP.

Based on the results of consultation with the Services, it may be necessary to add additional effluent limitations to the permit. Effluent limitations such as those identified below are examples of what EPA is considering, should they be necessary, to protect listed species and their habitat. The limitations described below reflect two general approaches that may be appropriate for inclusion in the PGP: a) where practicable, avoid the discharge of any pesticide in areas where it could adversely affect listed species adversely; or b) when avoiding pesticide discharge is impracticable, select the types of pesticide and the method of application that will minimize adverse effects. In the FR notice announcing this draft permit, EPA is requesting comment on appropriate measures to protect listed species, including the potential provisions described below.

1. For aquatic weeds and algae control upstream of threatened and endangered species habitat, explore the use of mechanical or physical control methods before applying pesticides. In many cases, manual removal of weeds would be less harmful than applying pesticides.

2. Consider treating vegetation early in the season and the vegetation growth stage to minimize the build-up of nuisance vegetation, and to minimize the depletion of dissolved oxygen from decaying vegetation at these times unless listed species are present only at this time.

3. In cases where listed species use a waterbody for specific periods, if practicable, control pests when these organisms are not present.

4. Treat only a portion of a waterbody at a time, allowing the possibility that more mobile organisms will move away from the treatment area, if such a step-wise treatment would provide for adequate pest control. Depending on the type of organism, using some type of exclosure or deterrence measures in or near the treated area prior to treatment may reduce likelihood of species being exposed. For instance, in areas upstream of areas containing listed salmonids, consider the use of block nets to deter movement of fish into the treatment area.

5. In cases where pesticides are applied upstream, or in a pond-like environment draining into waters occupied by listed species, consider the retention time of the treated areas, degradation rate of the pesticide and/or the dilution capacity of the receiving waters to minimize exposure of listed species to pesticides.

APPENDIX A. List of pesticides and degradates which exceeded aquatic-life benchmarks in the USGS study and the draft CA Central Valley Regional 303(d) impairment list of pesticides.

Table A1. List of all pesticides and degradates which exceeded aquatic-life benchmarks in the USGS study

Pesticide/Degradate	Percentage of sites that exceed one or more aquatic-life benchmarks	
	Agricultural sites	Urban Sites
Chlorpyrifos	20.5	36.7
Azinphos-methyl	19.3	13.3
Atrazine	18.1	--
p,p-DDE	15.7	13.3
Alachlor	14.5	--
Diazinon	8.4	73.3
Malathion	7.2	30.0
Parathion-methyl	7.2	3.3
Carbofuran	6.0	--
Disulfoton	2.4	--
Diuron	2.4	6.7
Methomyl	2.4	--
Thiobencarb	2.4	--
Carbaryl	1.2	13.3
Dieldrin	1.2	3.3
Molinate	1.2	--
Parathion	1.2	6.7
Phorate	1.2	--
Propargite	1.2	--
Terbufos	1.2	--

Table A2. Pesticides/Degradates that are listed as 303(d) impairments from the CA Central Valley (Draft 2008 list)		
Pesticide/Degradate	**# of impairments**	**WQS being exceeded**
Aldicarb	1	Narrative toxicity and pesticide objectives – one-tenth the 48-hr LC50 Chironomus tentans.
Azinphos-methyl	3	Narrative toxicity and pesticide objectives – USEPA ambient water quality criteria (USEPA, 1976).
Bifenthrin	1	Narrative toxicity and pesticide objectives - one tenth the 96 hour LC50 for Haylella azteca.
Carbofuran	1	Narrative toxicity and pesticide objectives – USEPA recommended water quality criterion for the protection of freshwater aquatic life.
Chlorpyrifos	63	Numeric site-specific water quality objective for chlorpyrifos or narrative toxicity and pesticides objective – exceedance of 1-hour and/or 4-day average maximum concentration criterion above the allowable frequency.
Copper (not all from pesticide sources)	18	Exceedance of 4-day average maximum concentration criterion above the allowable frequency; or exceedance of California Toxics Rule criteria.
Diazinon	46	Numeric site-specific water quality objective for diazinon or narrative toxicity and pesticides objectives – exceedances of 1-hour and/or 4-day average maximum concentration criterion above the allowable frequency.
Dichlorvos	1	Narrative toxicity and pesticides objectives – one-tenth the 96-hour LC50 for Daphnia magna.
Dimethoate	8	Narrative toxicity and pesticides objectives – one-tenth LC50 for the most sensitive species in freshwater (Cyclops strenuus, a copepod crustacean).
Disulfoton	1	Narrative toxicity and pesticides objectives – USEPA National Ambient Water Quality Disulfoton Criterion for freshwater aquatic life protection, maximum concentration of 0.05 ug/L.
Diuron	8	Narrative toxicity and pesticides objectives – the 96-hour EC50 for Chlorella pyrenoidosa (1.3 ug/L).
Malathion	3	Narrative toxicity and pesticides objectives – The USEPA recommended 4-day average criterion continuous concentration (CCC) (0.1 ug/L) (USEPA, 1976). The California Department of Fish and Game Hazard Assessment Criterion 1-hr average concentration (CMC) (0.43 ug/L) (CDFG, 1998)..
Organophosphorus Pesticides	1	Narrative toxicity and pesticides objectives – Toxicity and chemistry results indicating organophosphorus pesticide toxicity..
Oxyflurofen	2	Narrative toxicity and pesticides objectives – the 96-hour EC50 for Selenastrum capricornutum, a green algae.
cis-Permethrin	1	Narrative toxicity and pesticides objectives – one-tenth the LC50 value for the most sensitive freshwater species, Tanytarsus sp.
Prometryn	1	Narrative toxicity objective; 96-hour EC50 value for Navicula pelliculosa, a freshwater diatom.
Pyrethroids	13	Narrative toxicity objective; sediment-bound toxicity; chemical analysis; and TIE manipulations indicate pyrethroid pesticides are the likely cause.
Simazine	4	Drinking water primary Maximum Contaminant Limit (MCL) (4 µg/L).

Table A2. Pesticides/Degradates that are listed as 303(d) impairments from the CA Central Valley (Draft 2008 list)

Pesticide/Degradate	# of impairments	WQS being exceeded
Trifluralin	1	Narrative toxicity and pesticides objectives; interpreted using LOEC for Pimephales promelas of 0.7 ug/L.

Appendix B. Chemicals with exceedances in USGS study and subsequent mitigation measures that reduce pesticide residues in water

Chemical	**Action**	**Date**
Alachlor	Reduced maximum application rates and frequency of application; Restricted Use Pesticide; 50 foot setback from waters for mixing and loading; state management plan; spray drift advisory; monitoring program.	1998 Reregistration Eligibility Decision (RED)
Atrazine	Intensive monitoring program	2003 Interim Reregistration Eligibility Decision (IRED)
Diuron Used monitoring data from USGS, Florida & California	Powder formulations cancelled; reduction in application rates and number of applications; no aerial applications for most crops; no treatment of home lawns	2003 RED
Thiobencarb	Application restrictions for LA, TX; label restrictions for catfish/crayfish farming; 14-day holding periods for rice farming; mixing and loading restrictions within 100 ft of water; no applications within 24 hr of rainfall	1997 RED
Azinphos-methyl	All uses to be phased out by 2012; until such time, the following measures imposed: buffer zones; limit maximum usage and frequency; spray drift requirements; prohibit aerial application on most crops; limit maximum usage and frequency	2001 IRED
Carbaryl	Lawn broadcast uses of liquid formulations cancelled; certain other uses and application methods cancelled; reduced application rates for some uses; prohibit most aerial applications	2003 IRED
Carbofuran	Most uses cancelled; for remaining six uses the Agency plans to issue a Notice of Intent to Cancel.	2006 IRED
Chlorpyrifos	Residential uses cancelled; agricultural use restrictions including reduced application rates and fewer applications per season, increase in retreatment intervals and addition of buffer zones around water bodies	2001 IRED
Diazinon	Residential uses and granular uses cancelled; aerial application cancelled; seed treatment uses cancelled	2002 IRED
Disulfoton	Cancelled some uses; reduced application rates and frequency of application for certain crops; buffers zones near water; aerial application prohibited; Notice of Receipt of Voluntary Cancellation of all Product Registrations published 7/22/09. Product Cancellation Order published September 23, 2009.	2002 IRED

Chemical	**Action**	**Date**
Malathion	Some uses cancelled; reduced application rates and frequency of application for many crops; 25 and 50 foot buffer zones for non-ULV and ULV aerial applications near water; droplet size and application altitude specifications for mosquito adulticide use; spray drift minimization label statements for agricultural and public health products; environmental hazard precautionary label statements required for agricultural, public health, and residential products	2006 RED; 2009 RED Revision
Methomyl	Reduced maximum applications rates; buffer zones; use rate restrictions; ground water and surface water advisories	1998 RED
Methyl Parathion	Cancelled several fruit and vegetable uses; mixing and loading away from water; reduced application rates and number of applications	2003 IRED
Phorate	Reduced application rates and number of applications; prohibit aerial applications; buffer zones; setbacks from wells	2001 IRED
Propargite	Reduced maximum rates and number of applications; 50 ft buffer; spray drift label requirement	2001 RED
Terbufos	Buffer zones and setbacks; reduction in sales; limited mixing and loading near water	2001 IRED
Lindane	All uses cancelled except seed treatment (2002 RED); all remaining uses cancelled effective 7/07	2002 RED; 2006 RED Addendum
Heptachlor/Heptachlor Epoxide	All uses cancelled	1978 Cancellation
Chlordane	All uses cancelled	1978 Cancellation
Molinate	All uses cancelled over 5 year period - 2008 effective date	2003 Voluntary Cancellation
Ethyl Parathion	All uses cancelled; all products phased out by 2003	2000 Cancellation
Dinoseb	All uses cancelled	1986 Cancellation
Cyanazine	All uses cancelled	1996 Cancellation

Chemical	Action	Date
DDT/DDE	All uses cancelled	1972 Cancellation
Dieldrin	All uses cancelled	1974 Cancellation
Toxaphene	All uses cancelled	1982 Cancellation
Methoxychlor	All uses cancelled	2004 Cancellation
Endrin	All uses cancelled	1995 Cancellation

APPENDIX C

Summary of Pesticide-Specific Exceedance Data and Risk Mitigation Actions

- Of the 75 pesticides and 8 degradates analyzed, 19 pesticides in use at the time of the study were measured at concentrations that exceeded EPA benchmarks: 5 herbicides (alachlor, atrazine, diuron, molinate, and thiobencarb) and 13 insecticides (azinphos-methyl, carbaryl, carbofuran, chlorpyrifos, diazinon, disulfoton, malathion, methomyl, parathion, methyl parathion, phorate, propargite, and terbufos).
- In addition, DDE, a degradate of DDT, was detected at levels in approximately 20 streams that exceeded EPA benchmarks.
- The uses for five pesticides (diuron, diazinon, chlorpyrifos, parathion, and DDT (degradate DDE)) detected by USGS have been cancelled or significantly limited.
- 5 pesticides accounted for the majority of the exceedances: alachlor, azinphos-methyl, chlorpyrifos, diazinon, and malathion. These pesticides are discussed in more detail below:

Alachlor

Summary of USGS Findings:

- For alachlor, there were 14 instances where alachlor measured concentrations exceeded a benchmark. Usage of alachlor declined along with number of exceedances throughout the study and following the issuance of EPA's RED in 1998, there were no exceedances observed in the last 3 years of the study (1999 – 2001).

Azinphos Methyl

Summary of USGS Findings:

- For azinphos-methyl, there were 15 instances where azinphos-methyl measured concentrations exceeded a benchmark. All uses of azinphos methyl will be phased out by 2012.

Atrazine

History:

- Registered in 1958 as a triazine herbicide
- Initiated special review based on carcinogenic potential in 1988
- Risk reduction measures voluntarily initiated by registrant in 1990s
- Special review for triazines initiated in 1994
- January 2003 IRED specified mitigation measures to reduce risk, including intensive drinking water monitoring of 125 vulnerable CWS
- October 2003 Addendum to IRED concluded not likely to be a human carcinogen; specified ecological monitoring and mitigation program for vulnerable watersheds; and, consistent with FIFRA-SAP review, concluded that available data does not establish atrazine caused developmental effects on amphibians
- Cumulative triazine assessment to be issued later this year and may identify further risk mitigation options

Review Process:

- Extensive public participation review process during reregistration
- Extensive consultation with federal, state, and local regulatory partners, registrants, pesticides users, public interest groups, and other stakeholders
- SAP review of Agency's cancer assessment and ecological risk assessment for amphibians

Mitigation Measures:

- Product use changes required in January, 2003 IRED to reduce exposure to workers and exposure from residential uses
- Intensive and targeted monitoring program of drinking water (raw water at 125 CWS in areas of atrazine use); if atrazine exceeds EPA's safety standards, use will be prohibited in affected watershed area; complemented by routine SDWA monitoring of finished drinking water and rural well monitoring study
- Ecological monitoring and risk mitigation within 40 representative vulnerable watersheds associated with corn and sorghum production. If watershed exceeds level of concern, remediation measures will be required, and need for further expansion of monitoring will be considered.
- Implementation of testing program to evaluate potential risk to amphibians
- Continue to review ongoing epidemiology and cancer studies and amphibian studies

Summary of USGS Findings:

- Only 4 exceedances in agricultural streams for the aquatic community benchmark were observed.

Atrazine Ecological Monitoring Program

- As a condition of reregistration, the registrant must conduct a monitoring program. The purpose of program is to determine the extent to which water bodies in the most vulnerable watersheds may exceed an effects-based benchmark. If a water body exceeds a benchmark, it will be subject to mitigation measures through registrant actions, regulatory options, and/or TMDL-like watershed management programs.
- Endpoint of concern or benchmark is change in aquatic community structure, based in part, on a large number of microcosm and mesocosm studies for atrazine. This is the most sensitive endpoint and considers direct effects on fish and invertebrates and indirect effects on habitat and food sources.
- The FIFRA risk assessment and draft atrazine aquatic life criteria are based on the same endpoint and were jointly prepared.
- 40 representative vulnerable watersheds in corn/sorghum areas (Midwest) are being monitored. Monitoring in the Midwest sites will occur over three years (2004-2006) and each watershed will have a minimum of two years worth of data. Each watershed is sampled every 4 days; some watersheds are sampled daily.
- 4 vulnerable watersheds in sugarcane growing areas (LA, FL) will be monitored; sugarcane monitoring sites will have two years of data from 2005-2006.
- EPA scientists are reviewing the first 5 years of Midwest data and 2 years of the sugarcane data for Louisiana. Preliminary analysis suggests that measured

concentrations of atrazine in Missouri and Nebraska exceeded the Agency's LOC. The Agency is evaluating the sugarcane data and has not yet made a determination on those results.

Atrazine Drinking Water Monitoring Program

- As a condition of reregistration, the registrant must monitor over 130 Community Water Systems (CWSs) in areas of atrazine use in 10 states (Illinois, Indiana, Iowa, Kansas, Kentucky, Missouri, North Carolina, Ohio, Texas, and Louisiana.) If atrazine is detected above Agency standards for raw water, the use will be prohibited in that specific watershed area.
- Weekly monitoring through the growing season (generally April through July) with biweekly monitoring for the rest of the year.
- Both raw and finished water are being monitored; some CWSs have more than one raw water source measured.
- There were no exceedances of the human health benchmark, which is 37.5 ppb atrazine and its degradates based on a 90-day average in raw water.

Chlorpyrifos

History and Mitigation Measures

- Registered in 1965 as an Organophosphate ("OP") insecticide
- MOA signed with registrant in January 1997 to reduce indoor exposures
- MOA signed with registrant in June 2000 to eliminate and phase out most uses that result in residential exposure (home lawns, indoor crack and crevice treatments, and whole house post-construction termiticide treatments). These actions also mitigated risks to workers who apply chlorpyrifos and reduced risks to the environment.
- IRED issued in February 2002 included additional provisions to further reduce worker and ecological risks through label changes that included worker protection measures, buffer zones around water bodies, and rate reductions for agricultural uses.

Summary of USGS Findings:

- Chlorpyrifos exceedances were observed in approximately 20 of the agricultural streams, 10 of the mixed land-use streams, and 14 of the urban streams predominantly in the period of 1993-1994.
- For chlorpyrifos, there were 46 instances where chlorpyrifos measured concentrations exceeded a benchmark which were predominantly observed in the period of 1993-1994. Urban uses for chlorpyrifos have been banned in 2000, and in 2002 agricultural uses were changed to mitigate potential aquatic effects.
- Chlorpyrifos levels have decreased significantly since the June 2000 MOA was signed and residential uses were eliminated

Diazinon

History and Mitigation Measures:

- MOA with registrant signed in December 2000; phased out and cancelled all indoor and outdoor residential uses.

- IRED issued in May 2004 included additional measures for the remaining agricultural use products to further reduce risks to workers, birds and the environment. These measures included cancellation of certain crop uses, terminating most uses of the granular formulation, deleting most aerial applications, reducing the amount and frequency of use, adopting engineering controls, and other protective measures.
- EPA's regulatory activities have eliminated about 75% of diazinon's former uses, particularly its residential uses.
- Final water quality criteria was issued by Office of Water in 2006

USGS Results:

- Diazinon exceedances were observed in approximately 10 agricultural streams, 10 mixed land-use streams, and 20 urban streams.
- The vast majority of exceedances were associated with potential aquatic invertebrate effects.
- For diazinon, there were 44 sites where diazinon measured concentrations exceeded a benchmark.
- Since urban uses of diazinon were cancelled in 2000, concentrations have decreased significantly in urban and mixed land-use streams. A recent regional USGS study of diazinon shows declining concentrations in several urban streams in the Northeast during 1998-2004.

Malathion

Summary of USGS Findings:

- For malathion, there were 27 instances where malathion measured concentrations exceeded a benchmark.
- The revision of the malathion RED was completed in 2009. Mitigation required by the RED will reduce maximum application rates and the number of applications allowed annually when labels are revised during product reregistration, which is currently underway.