

Pesticides and You

News from Beyond Pesticides / National Coalition Against the Misuse of Pesticides (NCAMP)



Managing Mosquitoes Without Poisoning People

**ChemicalWATCH Factsheet: DEET • Backyard Mosquito Management
• Public Health Mosquito Management Strategy**

Can Pesticides Have Public Health Benefits?

Control of West Nile Virus Sparks Debate on Widespread Pesticide Use

This issue of *Pesticides and You* focuses on mosquito management and West Nile virus (WNV) because these are issues that may soon confront you and your community, if they haven't already. WNV has now been found, either in infected mosquitoes or birds, in 27 states and the District of Columbia. It has been found up and down the east coast, in the South, Midwest, and is expected to reach the west coast within a year or two. WNV first appeared in the U.S. in September 1999 in New York City and was identified by public health officials as the cause of 7 deaths that summer. Symptoms of WNV include mild flu-like effects, but can be deadly to older people and those with compromised immune systems. The source of WNV in the U.S. is not known. Some believe it hitchhiked in through transcontinental travel, while others say it was released from a research lab at Plum Island Animal Disease Center off of New York City, where their motto is, "Not once in our more than 40 years of operation has an animal pathogen escaped from Plum Island."

Do Pesticide Benefits Outweigh Disease Risks?

The arrival of WNV has sparked a debate that has been brewing for some time on the widespread use of pesticides for public health protection. Certainly, pesticide promoters and many public health professionals see the widespread use of pesticides in the face of an insect-borne disease as a no-brainer. Concerned citizens put pressure on public officials to spray their communities against the threat of disease. With the presumption that pesticides present no- to low-risk, or that their "benefits outweigh the risks," spray programs go forward, mostly without any public notice or debate.

The reality is that pesticides are harmful to human health and the environment and present a set of real risks of their own, which are discussed in this issue. Many argue, in the case of WNV, that the risks of harm caused by pesticides are greater than those caused by the disease. Ironically, the very same people who are at risk from WNV, because of compromised immune systems, are also in the highest risk group for pesticide poisoning.

The problem with the debate on public health uses of pesticides is the flawed assumption that conventional pesticides are effective tools. With this assumption, less of our community, state and federal resources are put into prevention, or source reduction, through the management of breeding areas, which is discussed extensively in this issue. In fact, the Centers for Disease Control (CDC), despite a lack of attention to the public health threat associated with pesticide exposure, does say, "The underlying philosophy of mosquito control is based on the fact that the greatest control impact on mosquito populations will occur when they are concentrated, immobile and accessible. This emphasis focuses on habitat management

and controlling the immature stages before the mosquitoes emerge as adults. This policy reduces the need for widespread pesticide application in urban areas." One of the problems that New York City reportedly ran into when WNV made its surprise debut was the lack of a sound mosquito management program that focused on prevention.

Prevention is the Best Strategy

The lack of a prevention program leads to a heavy reliance on pesticide spray programs that target adult mosquitoes. Experts estimate that these spray programs hit less than 10 percent of the targeted spray area, actually increase the number of mosquitoes by destroying their natural predators, and result in mosquitoes that are pesticide-resistant, longer-lived, more aggressive and carry more of the virus in their bodies. If managers do not focus on the behavior of the specific mosquito species (how far does it fly from its breeding area) and the behavior of disease hosts (such as migratory birds), spraying may occur in areas that do not contain infected mosquitoes that are a threat. It is widely agreed that by the time a human illness is diagnosed, spray programs are essentially worthless. Therefore, with information on the biology of the insect, monitoring of infected mosquito pools is essential.

In addition, this issue highlights research by Mohammed Abou-Donia, Ph.D., of Duke University Medical Center, that identifies the harmful synergistic effects of mixing exposures to a widely used adult mosquito insecticide, permethrin (as one example), with insect repellents containing the widely used ingredient DEET. Finally, there are serious issues associated with worker exposure and lack of training and protective equipment provided to those who conduct spray programs.

Take Action

With an understanding of all the complexities involved, as discussed in the centerpiece of this issue, the *Public Health Mosquito Management Strategy*, communities can embrace meaningful practices that reduce reliance on pesticides, utilize effective education, prevention and monitoring, and only engage in narrow, targeted spray programs as a last resort. Some states, like Connecticut, and communities, like Nassau County, NY, have operated

effective programs that may serve as models. This issue is intended to serve as a tool to support local and state action. Use the information to contact your local public health official and help set in motion a strategy that avoids widespread pesticide use in your town.



—Jay Feldman executive director
of Beyond Pesticides/NCAM

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Invasion of the Moths

Dear Beyond Pesticides,
Do you know any non-toxic ways to get rid of moths in the pantry? I have heard that some herbs will repel them, and I have heard that moth traps work. I just don't know where to find such products. These moths have ruined lots of expensive organic food!

Deb Brinker
via email

Dear Ms. Brinker:
Moths are frequent pests in kitchen cabinets. The first thing you need to do when moths have invaded your pantry and home is to get rid of any infested food. If you are lucky, the moths have just recently entered your home and are concentrated at their source. All packages and food must be carefully inspected for signs of infestation. Look for small holes in the packaging and webbing in the tighter areas of the package. Seal up the infested packages and discard the food in an outdoor can. Alternatively, you can actually kill moths in your food by manipulating temperatures they are exposed to. If you choose this method, just remember the moths' bodies will remain in the food and must be sifted out afterwards. Storing food in your freezer for three weeks will guarantee killing the moths. You can really play it safe by storing susceptible foods in your refrigerator for several months after detecting moths in your cabinets. This includes grains, crackers, flour, spices and even pet food. Heating also works. 130 degrees Fahrenheit for two hours should do the trick.

Once the food in your pantry is moth-free, thoroughly clean the infested area. Use soap and hot water in your pantry, paying special attention to corners and crevices. Take all cans out and wash them as well to kill any microscopic larvae. Vacuum any infested areas in the kitchen. Caulk and seal areas in your pantry where crumbs may fall into and stay for a while. Make sure pantry shelves fit flush against the wall. Also, be sure areas that attract crumbs, such as in the toaster, stay clean.

Monitor the problem after your clean-up. Every day you should check door and cabinet frames for lurking moths or cocoons. Pheromone traps come in handy here. After

you have taken care of the majority of the infestation, they can be used to kill any leftover moths and to monitor their population. If you notice an increase in the number of moths in your traps, it is time to inspect your food again. Non-toxic pantry pest traps are available from companies such as Victor Safer Brand (see www.victorpest.com for more information). They are available at most retail stores. You can just leave only your kitchen light on at night and capture the stray moth when it comes out from its hiding spot to the light.

Once all of your winged friends are gone, take preventive measures to keep any more from visiting you. Store any food you buy in tight containers. Regularly clean your cabinets, counters, toaster oven and anywhere else moths might feast. Clean out containers that stored old food before re-filling with new food. Remember to keep them sealed tight!

People Rally for Safer Mosquito Management

Dear Beyond Pesticides,
My daughter and I began researching pesticide spraying in our area two years ago, as a home-school project. Our project was sparked by a truck that passed our house every Thursday night, from Memorial Day to Labor Day, spraying pesticides. My daughter asked me why, and I suggested that we find out. We discovered permethrin is being sprayed to target mosquitoes. We have witnessed spraying inconsistent with the manufacturer's label, such as during rain and when wind was blowing more than 10 miles per hour. Today we have an interview with the man in charge of the spraying.

Our neighbors have recently joined us in our efforts with great enthusiasm. The word has spread, and now everyone on our street has agreed to put up signs and to sign a petition to stop the spraying on

our street. The only exception on our block is a former Monsanto employee. We soon found out that our community is the only one within St. Louis to do its own spraying. St. Louis takes care of every other community. So our goal is to get the entire Glendale area stopped, and then St. Louis.

We are looking for help in finding Missouri laws regarding signs in the yard in order to stop pesticide spraying. We are also looking for laws pertaining to notification requirements before spraying, since we were sprayed several nights that we were not notified about.

Thank you so much for your wonderful website and the very important work that you do. This site was the inspiration behind our action.

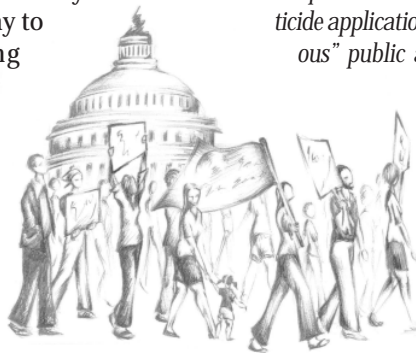
Shelly Knichel
Glendale, Missouri

Dear Ms. Knichel:
Thank you for your actions for pesticide reform. Keep up the great work! Unfortunately, Missouri has no state regulations regarding prior notification of community pesticide spraying. Many states do require prior notification, but it may take different forms. For example, Alaska requires that notice of certain pesticide applications be published in local newspapers. Iowa does not require notification for community pesticide applications as long as a "conspicuous" public announcement is made,

such as on a major TV or radio station, 24 hours prior. New Jersey requires seven to 30 day prior notification to people living in the vicinity of the targeted area.

In Maine, you can request notification for pesticide applications that will affect your property or any other sensitive area. Pennsylvania has a notification registry for residents that have medical documentation of sensitivities to such applications.

It is important that you report the misapplications you witnessed to your local and state pesticide regulatory agencies. The petition you mentioned is a great idea. Outreach to neigh-



bors is one of the first steps, and an extremely important one at that, to making a difference in your community. Approaching members in your community about pesticides can be very touchy. It is always good to broach the subject in an easy-going manner; using common sense points. Attacking neighbors and friends with scientific jargon can be both intimidating and confusing for them. By emphasizing the human health threats, especially those posed to children, people may be more willing to consider your point of view. Another subject that grabs attention is money. Preventive measures are almost always cheaper than using toxic chemicals. Yard signs are another great way to make a statement about the dangers pesticides pose. Contact Beyond Pesticides for further information on talking to your neighbors about pesticides, or signs for your lawn.

When you approach your city's pesticide regulatory agency about the mosquito spraying, try presenting less toxic alternatives to its current use of permethrin. You can read up on this and other things your community can do to combat mosquitoes safely in this issue of Pesticides and You. Another resource is Beyond Pesticides' West Nile Virus Organizing Manual (\$10 ppd), which contains helpful information about chemical toxicity of mosquito spraying, alternatives, and community organizing to achieve success.

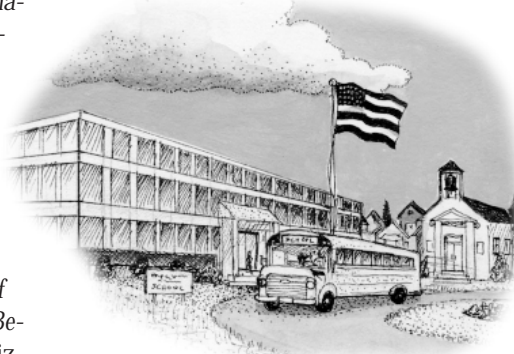
Reforming School Pest Management

Dear Beyond Pesticides,
I am attempting to educate the principal at our local school about the use of integrated pest management (IPM). The school has problems mainly with yellow jackets and ants. Mice are also causing some trouble. I am trying to contact an IPM provider for the school. The principal is planning a possible "power spray" soon and I am trying to persuade her to use alternate methods. However, I cannot find an appropriate business in our area. She contacted another company that seems to incorporate some IPM principles, but I am uncomfortable with his intent to spray the school grounds, including the playground

equipment. Would you be able to refer me to a true IPM specialist in our area? I have been unable to find a source for alternative products to control yellow jackets, mice and ants.

Additionally, we are about to double the size of our existing school building this spring. I believe this would be a great time to dust the open walls with boric acid and/or diatomaceous earth as a preventive measure. Is my thinking appropriate or flawed?

Maria Davis
Murrysville, PA



Dear Ms. Davis,
Companies claiming to practice IPM while at the same time using toxic chemicals are not uncommon. They are not implementing true IPM. Beyond Pesticides defines IPM as a program that includes three major components: (a) eliminates or mitigates economic and health damage caused by pests; (b) minimizes the use of pesticides and the risk to human health and the environment associated with pesticide applications; and, (c) uses integrated methods, site or pest inspections, pest population monitoring, an evaluation of the need for pest control, and one or more pest control methods. These methods include sanitation, structural repairs, mechanical and living biological controls, and other non-chemical methods. If non-toxic options are unreasonable and have been exhausted, the least-toxic pesticides may be used.

Because there is no standard definition, IPM can mean virtually anything the practitioner wants it to mean. Unfortunately, there are chemical dependent companies that masquerade as IPM practitioners. When you call a pest

control company, make it clear you would like only non-toxic or, if necessary, least-toxic means of pest management. Be persistent with your request. If you are unsure about a product or chemical a company is planning to use, check out its toxicity at www.beyondpesticides.org, or contact Beyond Pesticides for more information. In your search for a company, see the Safety Source for Pest Management on the Beyond Pesticides website. This is a directory of lawn care and pest control companies that use some or all non-toxic or least-toxic management strategies. The directory is ideal for you to see all the options a company makes available. You will be able to see what chemicals different companies use, how toxic they are, along with the least toxic and non-toxic methods. If you have found a good company that you don't see listed, please tell us about it!

Your suggestion to use boric acid and desiccating dusts as a preventive measure is certainly appropriate. Prevention and monitoring decrease the potential use of more toxic pesticides further down the road. This will help the ant problem you mentioned. Mice infestations are best taken care of with structural modifications and mechanical controls such as traps. Yellow jackets can be managed with cultural controls, such as tightly fitted garbage dumpster lids which should be monitored daily and emptied frequently. A great resource for IPM practices for these and other common pests is Beyond Pesticides' Building Blocks For School IPM: A Least-Toxic Structural Pest Management Manual (\$15 ppd). Contact Beyond Pesticides to order a copy.

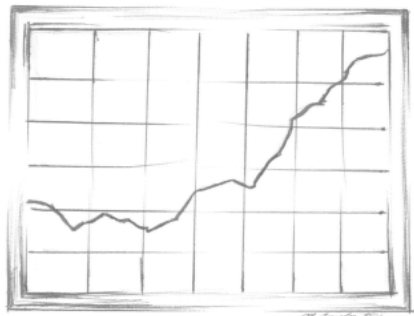
Write Us!

Whether you love us, disagree with us or just want to speak your mind, we want to hear from you. All mail must have a day time phone and verifiable address. Space is limited so some mail may not be printed. Mail that is printed will be edited for length and clarity. Please address your mail to:

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National Cancer Foundations Fail To Act on Known Cancer Risks

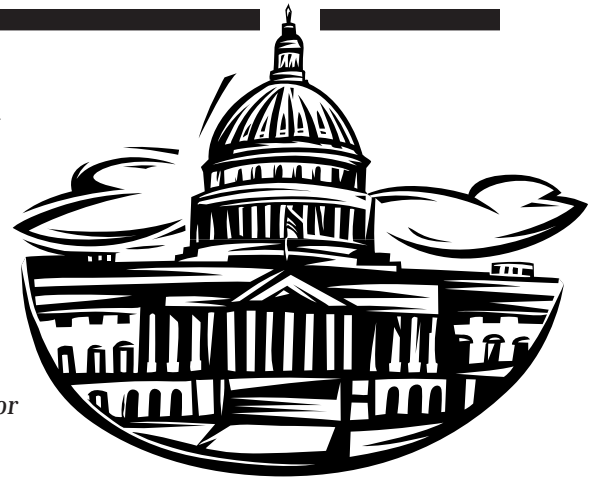
While national cancer foundations have the potential to help millions of people, their lack of focus on prevention and carcinogens in the environment, including pesticides, has drawn criticism from the environmental and public health communities. In a recent statement, Samuel S. Epstein, M.D., chairman of the Cancer Prevention Coalition and Professor Emeritus of Environmental and Occupational Medicine, University of Illinois School of Public Health, and Quentin D. Young, M.D., chairman of the Health and Medicine Policy Research Group, charge that major national cancer foundations, including the National Cancer Institute (NCI) and the American Cancer Society (ACS), have long ignored dramatic increases in childhood cancer rates. Since the U.S. declared the “war on cancer” in 1971, childhood cancers have increased by 26% overall. Rates of some specific cancers have increased even more dramatically — acute lymphocyte leukemia by 62%, brain cancer by 50%, and bone cancer by 40%. The doctors charge that the federal NCI and the ACS have, “failed to inform the public, let alone Congress and regulatory agencies, of this alarming information. As importantly, they have failed to publicize well-documented scientific information on avoidable causes responsible for the increased incidence of childhood cancer,” which include pesticides and other synthetic chemicals. The consumption of non-organic foods containing pesticide residues and the treatment of lice and scabies with the pesticide and human carcinogen lindane are also important. The statement charges that the ASC



has long supported the chlorine industry in its continued defense of the use of chlorinated pesticides. Despite dramatically increasing their budgets, both organizations continue to spend negligible amounts to warn the public of avoidable cancer risks, according to Drs. Epstein and Young.” Read the press statement at <http://www.prnewswire.com>, search for “Epstein.”

Federal Legislation Calls for Funding To Protect Children from Endocrine Disrupting Chemicals

U.S. Representative Louise Slaughter (D-NY) has introduced legislation to substantially increase federal research on hormone disrupting chemicals. The *Hormone Disruption Research Act of 2002* (H.R. 4709) would authorize up to \$500 million for the National Institute of Environmental Health Sciences (NIEHS) to conduct and coordinate a five-year research program on hormone disruption. NIEHS would also be required to provide public reports on the extent to which hormone-disrupting chemicals pose a threat to human health and the environment. “This legislation is long overdue. Not one chemical in use today has been adequately tested for its ability to undermine the construction of children’s bodies and brains,” said Theo Colborn, Ph.D., director of World Wildlife Fund’s Wildlife and Contaminants Program and co-author of *Our Stolen Future*. “There is an urgent need to support innovative research designed to identify hazards that traditional toxicology has missed.” Hormone disruptors are synthetic chemi-



cals that block, mimic, or otherwise interfere with naturally produced hormones, which control how an organism develops and functions. Since the 1970s, the incidence of childhood cancers, learning disabilities, autism, diabetes, early puberty, and abnormal penile development has increased substantially. At the same time, evidence linking these disorders with exposure to hormone disrupting chemicals has continued to mount. “What is especially troubling is that children are exposed to these chemicals in the womb and shortly after birth—periods of rapid development. It’s time for prevention,” said Dr. Colborn. “President Bush has urged the country to not ‘leave any child behind.’ This research ultimately will help all children reach their full potential.”

Congress Pulls \$250 Million Subsidy for Pesticide Industry from Farm Bill

If you were the pesticide industry, where would you hide \$250 million? Well, they tried to sneak it in as a subsidy in the massive \$180 billion *Farm Security and Rural Investment Act of 2002* (Farm Bill), but failed during the final moments of negotiations. The provision sought to waive fees to be paid by the industry established by Congress in the *Food Quality Protection Act* (FQPA) to cover the cost of pesticide registration and safety reviews.

The provision, originally contained in Subtitle D of the Senate Farm bill, fell below the radar of budget buster watchers when drafters included only a one-month authorizing period, thus enabling chemical industry backers to hide the bill's budgetary impact. When it was brought to light that backers planned to extend the authorizing period for five years, the provision was pulled. However, just days after their defeat in the Farm Bill, industry lobbyists were back on Capitol Hill looking for a new vehicle to place their financial burden on the American taxpayer. "It would be a travesty if Congress further subsidizes an industry that produces hazardous pesticides that can be replaced by less toxic alternatives," said Jay Feldman, executive director of Beyond Pesticides. "Taxpayers should not have to pay the pesticide industry's bills."

EPA To Consult on Pesticide Harm to Endangered Species

When Europeans first settled the American West, they sent letters home describing rivers so full of spawning salmon that you could cross the river by walking on their backs. Now the numbers of this once vibrant population are dwindling, with many salmon runs on the Endangered or Threatened Species Lists. Large hydroelectric dams and loss of habitat play a large role in the decline, but contamination from pesticide runoff is also significant. Until recently, EPA ignored endangered salmon when it registered pesticides for use in the region. However, on April 19, 2002, EPA settled with three California environmental groups that brought suit for not consulting with other government agencies on the effects of pesticides on endangered salmon and other imperiled species, as required by the *Endangered Species Act* (ESA). According to the settlement, EPA must consult with the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife

Service (FWS) on specific uses of eighteen pesticides in California. These pesticides, which include chlorpyrifos, diazinon, atrazine, glyphosate (Roundup), and 2,4-D, will be analyzed for effects in one or more of these usage sites in the habitat of each of the seven salmon species and 33 forest plants that collectively are named in the settlement. "These species are close to extinction and pesticides continue to pollute their habitat, but the EPA hasn't even begun to take action to protect them. How can an endangered species survive if the effect of widely used pesticides isn't taken into account?" said Patty Clary of Californians for Alternatives to Toxics (CATs), the lead plaintiff group. "We welcome the EPA's resolve to take these first important steps to protect some of the nation's most highly valued and imperiled wildlife species from the effects of pesticides."

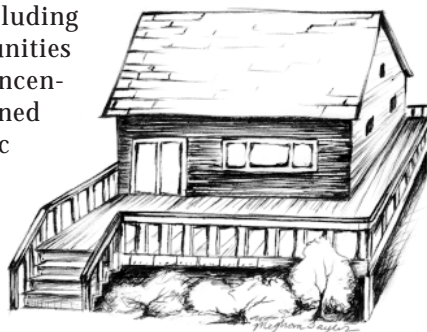
Bill Introduced To Improve Environmental Health Tracking

On March 21, 2002, Senators Hillary Clinton (D-NY) and Harry Reid (D-NV) introduced the *National Health Tracking Act of 2002*, legislation that would set up a national environmental health tracking system. The legislation is the product of several Congressional hearings, including two held in communities suffering from a concentrated and unexplained outbreak of chronic diseases. These two field hearings, held in Fallon, NV and Long Island, NY, looked for possible environmental links to cancer in the communities and resulted in a firm recommendation for establishing a nationwide tracking network for chronic diseases. "[The National Health Tracking Act] will help get to the bottom of the mystery behind high rates of chronic

disease that afflict communities like Fallon, Nevada and Long Island, NY. And once we are able to track these diseases, and detect links to environmental or other causes, we will be able to attack the problem and ultimately prevent public health problems before they occur," said Senator Clinton. "Thus far, states have been in charge of setting up their own tracking systems. Since the quality and extent of each state program varies, it is difficult to link together each state's data in order to understand causes of chronic diseases."

Bill Seeks To Classify CCA Treated Lumber as Hazardous Waste

Because of a loophole in federal law, pressure treated wood is not required to be disposed of as hazardous waste. Understanding that disposal is an important factor in the pressure-treated wood debate, U.S. Representative Jan Schakowsky (D-IL) introduced *The Arsenic Treated Lumber Prohibition and Disposal Act* on May 10, 2002. The act phases-out the use of arsenic treated lumber in residential settings; requires the disposal of arsenic-treated lumber in lined landfills with leachate and groundwater monitoring systems; requires EPA to conduct a risk assessment regarding arsenic; and, provides monetary assistance to schools and local communities. Railroad ties and piers are exempt in the legislation. Although EPA has worked out a deal with the pressure treated wood industry to phase-out many uses of treated lumber products by December 31, 2003, Representative Schakowsky believes that the agreement is inadequate and her legislation is needed to ensure that the industry would be required by law to phase out this dangerous product.





Top-Selling Weed Killer Disrupts Sexual Development in Frogs

While giving a talk on endocrine disruption at a Beyond Pesticides conference, University of Florida Zoologist Lou Guillette said, "When you want to get the attention of politicians in Washington, DC, talk about penis size." Environmentalists hope that a recent study out of the University of California (UC) at Berkeley, which finds that the nation's top-selling weed killer, atrazine, disrupts the sexual development of frogs at concentrations 30 times lower than allowed by the Environmental Protection Agency (EPA), will do just that. In an article published in the April 16 issue of *Proceedings of the National Academy of Sciences*, (vol. 99, no. 8), UC Berkeley developmental endocrinologist Tyrone B. Hayes reports that atrazine, at levels often found in the environment, demasculinizes tadpoles and turns them into hermaphrodites – creatures with both male and female sexual characteristics. The herbicide also lowers testosterone levels in sexually mature male frogs by a factor of ten. "Atrazine-exposed frogs do not have normal reproductive systems," Dr. Hayes said. "The males have ovaries in their testes and much smaller vocal organs," which are essential in calling potential mates. The

findings come at a time when EPA is re-evaluating allowable levels of atrazine in drinking water, which stand today at three parts per billion (ppb), and has drafted new criteria for the protection of aquatic life, limiting four-day average exposures to 12 ppb. Hayes found hermaphroditism in frogs at levels as low as 0.1 ppb. Even with today's limits, 40 ppb atrazine has been measured in rain and spring water in parts of the Midwest, as well as in agricultural runoff.

Now There's Proof: Organic Foods DO Have Less Pesticide Residues

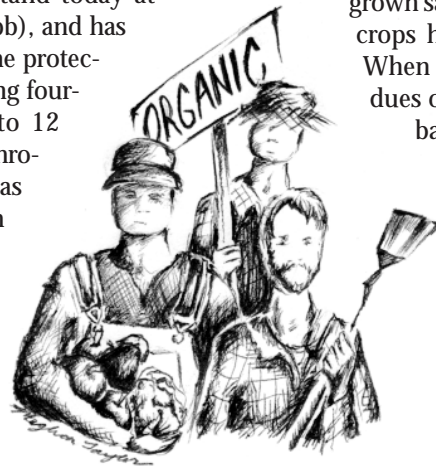
Health-conscious shoppers around the country have always known that buying organic is better for their families, the environment and farmworkers. Yet there have always been those in the media doubting the health and environmental benefits of organic food. Remember when ABC's 20/20 news reporter John Stossel claimed organic produce had the same amount of pesticide residue as conventional produce and suggested that organic produce may actually be more dangerous because of e-coli contamination

(but later made an on-air apology for fabricating the data)? Although common sense would suggest crops coated in toxic, carcinogenic chemicals would have more residue on the final product, until now there have been no "scientific" studies proving this is the case. According to a study by Consumers Union (CU), the publisher of *Consumer Reports* magazine, and the Organic Materials Research Institute (OMRI), published in the May 8, 2002 issue of the peer-reviewed journal *Food Additives and Contaminants*, organic foods do have less pesticide residue than conventional foods. The study, which used U.S. Department of Agriculture (USDA) data, shows that 73 percent of conventionally grown foods have at least one pesticide residue, while only 23

percent of organically grown samples of the same crops have any residues.

When they exclude residues of persistent, long-banned organochlorine insecticides such as DDT from their analysis of the USDA data, the fraction of organic samples with residues drops from 23 to 13 percent. The remaining residues

on organic produce are most likely due to pesticide drift. *For a summary of the study see www.consumer.org.*



Health Canada To Ban Some DEET Products

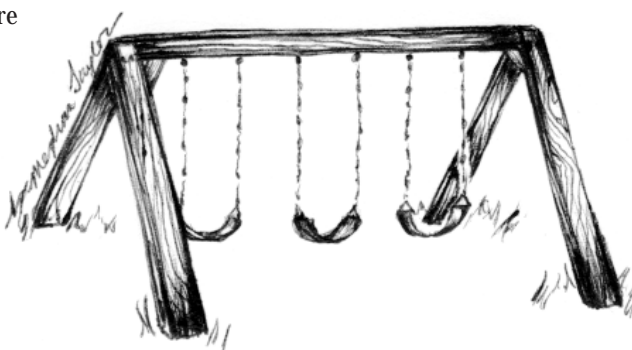
Canada, a country where the mosquito is often referred to as the national bird, recently announced that it intends to phase-out insect repellents containing more than 30% of the active ingredient DEET (N,N-diethyl-metoluamide) by December 2004. Health Canada, the agency of the Canadian government charged with promoting

good health among its citizens, cites health risks and evidence that increasing the amount of DEET does not repel insects more effectively as reasons for the decision. Products mixing sunscreen and insect repellent will also be barred because of the potential to absorb too much of the pesticide while lathering on the lotion. Recent studies on U.S. soldiers and park employees using DEET regularly found evidence of such skin reactions as large, painful blisters, rashes and a numb sensation on the lips. Park employees in Florida using DEET heavily were more likely to have insomnia, mood disturbances, and impaired cognitive functions. Researchers have also recorded several instances of brain problems in children, with the most severe cases involving seizures, coma and death. Because of dangerous synergistic interactions, Duke University professor Mohammed Abou-Donia, Ph.D., warns that DEET should not be mixed with any chemicals, including medications. The U.S. Environmental Protection Agency (EPA) decided recently not to tighten the regulations on DEET. *For a ChemicalWATCH factsheet on DEET, see pages 9-10.*

Pennsylvania Lawmakers Vote for Healthier Schools

On April 17, 2002, after nine years of grassroots organizing and lobbying by pesticide activists and concerned parents, the Pennsylvania General Assembly passed the *Pesticide Notification Act* (HB 1289 and SB 705), which requires schools to adopt integrated pest management (IPM) and provide notification of pesticide applications. According to the Beyond Pesticides report, *The Schooling of State Pesticide Laws 2002 Update*, Pennsylvania is now one of 11 states that require school districts to adopt IPM programs. The bill, which was immediately

signed into law by Governor Mark Schweiker (R), specifically requires that schools post notification signs 72 hours prior to indoor and outdoor applications and remain posted for 48 hours, provide 72 hour universal prior notification to school staff, and gives schools the option whether to provide a registry or universal system of notification to parents. The Act also prohibits pesticide applications within seven hours of students occupying the school building or using school grounds. While school pesticide



activists favor universal notification, they agree that the *Pesticide Notification Act* is a necessary improvement over the old state policy. "Studies have shown that many of the pesticides used in schools can have both short and long term health effects that range from headaches, nausea and diarrhea to learning disabilities, cancer and birth defects. There are about 15,000 Pennsylvania children who experience at least one asthma attack in the course of a year," said Robert Wendelgass, Pennsylvania Director for Clean Water Action and coordinator of the Campaign to Reduce Pesticide Exposure in Schools. "The *Pesticide Notification Act* will help parents, teachers and school officials protect these students from the known asthma attack trigger of pesticide exposure."



Pesticides Used in Simulated Terrorist Attack

As Mile High Stadium in Denver, CO crumbled, emergency response crews arrived on the scene only to be overwhelmed by the second phase of the attack. Malathion, a highly toxic organophosphate pesticide, had been packed into the bomb that had exploded in the stadium. While this was only a simulation set up by the city to test and train emergency response teams responding to a terrorist attack, government officials realize the danger of toxic chemicals, like pesticides, and the ease with which they can be obtained. According to the Washington Post, the simulated attack in Denver was timed to coincide with the final stages of the demolition of Mile High Stadium, the former home of the National

Football League's Denver Broncos. Mayor Wellington E. Webb decided that the stadium's destruction could provide an ideal backdrop for a weekend of exercises testing the region's ability to respond to terrorists and weapons of mass destruction. To help prevent such an incident, Maryland State Delegate Dan Morhaim proposed legislation, Restricted Use Pesticides – Use and Access (HB 809), that would help prevent pesticides from being used as weapons. The bill, which was supported by the Maryland Pesticide Network and Beyond Pesticides, required that anyone having access to restricted use pesticides (RUP) have a criminal background check, applicators of RUPs act under the instructions and control and within visual or voice contact of a certified applicator, and anyone purchasing, mixing or loading RUPs be certified. The Maryland Farm Bureau

opposes the bill because it says that it would be too difficult to restrict farmworker access to the chemicals, which are often stored in the same or nearby facilities used by workers as housing. The Maryland Pest Control Association lead the charge against the legislation, saying employee background checks are unnecessary and other safety provisions are too costly. See www.beyondpesticides.org for a copy of the legislation which could be introduced in state legislatures across the country.

Washington State Bans Controversial Herbicide on Lawns

While compost is usually seen as a natural alternative to chemical fertilizers, many communities were surprised to find that their local compost supplies were contaminated with the persistent herbicide clopyralid, making the compost toxic to many of their garden plants. The herbicide, which has been at the center of the GrassRoots Recycling Network's (GRRN) 'Confront Dow' campaign (see "Herbicides Threaten Recycling Industry" in the Winter 2001-2002 issue of *Pesticides and You*), has been found in compost made from recycled grass, straw, and manure in California, Washington, Pennsylvania, and New Zealand. To address the issue, the Washington Department of Agriculture banned the use of the herbicide clopyralid on lawns and turf. "This ban is meant to keep clippings from grass that has been treated with clopyralid from being sent to municipal and commercial compost facilities," said Cliff Weed, manager of the Pesticide Compliance Program for the Washington Department of Agriculture. "We focused on grass clippings because they are the major source of contaminated materials." Clopyralid, the active ingredient in the herbicide Confront, is mobile in soil and water allowing it to



seriously damage non-target plants. Evidence shows that when clopyralid-tainted compost is used to enrich soils, it can harm certain flowers, such as asters and sunflowers. Damage also has been found with vegetables, such as beans, peas and tomatoes. Residue testing of compost at the facilities revealed clopyralid levels between 73 and 80 ppb. These levels have the potential to damage crops, gardens and nurseries. The resulting occurrence of revenue losses, claim settlements, testing and additional labor cost one facility at the University of Washington \$250,000.

Oyster Growers Propose Spraying Pesticides To Kill Native Shrimp

The Willapa Bay/Grays Harbor Oyster Growers Association of Washington State wants to spray more than three tons of the pesticide carbaryl onto the tidelands of Willapa Bay and Grays Harbor in order to control native shrimp that are considered a problem for oyster production. Despite the concerns of local residents, including other oyster growers who produce oysters without pesticides and the Shoalwater Bay Tribe, the Washington State Department of Ecology has now issued a draft "special local need" permit that opponents say violates the *Clean Water Act* and allows the oyster growers to pollute water with huge quantities of the pesticide. If the final permit allows the spray, Willapa Bay and Grays Harbor would be the only place in the country where spraying carbaryl into water or on tidelands is allowed. Carbaryl, a suspected endocrine disruptor and reproductive toxicant, is harmful to both people and animals. Because its use in Willapa Bay results in such high concentrations, it poses a particular threat to salmon and

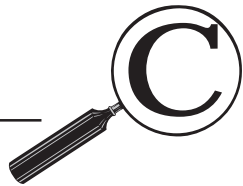
other aquatic life. Five species of salmon are present in Willapa Bay, as well as cutthroat trout. Coho in Willapa Bay are candidates for *Endangered Species Act* listing, and listing of cutthroat trout has been proposed. Carbaryl has a number of effects on salmon and trout, including impaired growth and reproductive success, bone abnormalities, and disruption of schooling behavior. It is also certain to affect their food supply. Burrowing shrimp are considered a problem for oyster production because they make the tideflats too soft for "bottom culture," or oyster production directly on the tideflats. Many oyster growers, however, use production methods that do not rely on pesticides by keeping oysters off the tideflat surface.

Welcome



We would like to welcome the most recent addition to the Beyond Pesticides staff. Jessica Lunsford, our new program associate, joins us with a Masters of Science in Public Health (MSPH) from the Tulane School of Public Health and Tropical Medicine, with an emphasis in environmental health science and environmental policy and a B.S. in anthropology and in environmental studies from Tulane University.

We would also like to welcome our summer interns, Cortney Piper and Asheesh Siddique.



DEET

What is DEET?

DEET (N, N-diethyl-*m*-toluamide) is a commonly used, yet controversial, insect repellent applied in and around domestic dwellings, to the human body and clothing, cats, dogs, horses, and pet living and sleeping quarters. Scientists have raised concerns about DEET's toxic properties when used alone and in combination with other chemicals.

Repellents are the only registered pesticides intended to be applied directly to human skin. DEET is used to control biting flies, biting midges, black flies, chiggers, deer flies, fleas, gnats, horse flies, mosquitoes, no-see-ums, sand flies, small flying insects, stable flies, and ticks. There are currently 225 DEET products registered by the EPA. (EPA, 1998)

Scientists are not completely certain how DEET repels biting insects, but it most likely affects insects' ability to locate animals they feed upon. Scientists believe that DEET disturbs the function of special receptors in mosquito antennae that sense chemicals that are produced by humans and other animals. (NPTN, 2000)

DEET Toxicity

In studies using laboratory animals, DEET generally has been shown to be of low acute toxicity, which makes sense since it is directly applied to the skin. The oral rat LD₅₀ (lethal dose for half of the test population) is two g/kg of body weight, requiring extremely high levels of exposure.

(NIH, 1990) Therefore, toxicity concerns, with some notable exceptions, focus on more subtle impacts on human health.

DEET is slightly toxic by the eye, dermal and oral routes and has been placed in EPA's Toxicity Category III, slightly toxic, (the second lowest of four categories) for these effects. (EPA, 1998) Animals topically exposed to DEET have developed ocular and dermal reactions, including erythema, desquamation, and scarring in horses; profuse sweating, irritation and exfoliation in horses; and ocular reactions in rabbits including edema, tearing, conjunctivitis, pus, and clouding in the eyes. (NYDOH, 1991) Animal experiments indicate that DEET crosses the placenta, and that it is found in the placenta and fetus and in rats three months after birth. (NIH, 1990)

Studies have shown that DEET causes adverse effects in lab animals at high doses, including reduced body weights of pups and increased mortality rates of unborn and baby rats. It does not cause birth defects in rats and rabbits, except when fed high doses. Rats and mice did not develop cancer when fed high doses of DEET over their lifetime. EPA has classified DEET as a group

D carcinogen (not classifiable as to human carcinogenicity). Further animal testing data is needed to completely evaluate DEET. (NPTN, 2000)

Duke Medical University pharmacologist Mohamed Abou-Donia, Ph.D. conducted numerous studies in rats, two of them published in 2001, which clearly demonstrate that frequent and prolonged applications of DEET cause neurons to die in regions of the brain that control muscle movement, learning, memory and concentration. Rats treated with an average human dose of DEET (40 mg/kg body weight) performed far worse than control rats when challenged with physical tasks requiring muscle control, strength and coordination - effects consistent with physical symptoms in humans reported in the medical literature, especially by Persian Gulf War veterans. With heavy exposure to

DEET and other insecticides, humans may experience memory loss, headache, weakness, fatigue, muscle and joint pain, tremors and shortness of breath. (Duke, 2002)

Adverse human effects, including skin hypersensitivity and eye irritations, have been reported. DEET is absorbed quickly through intact skin; 48% of the applied dose is totally absorbed within six hours. Accumulation on skin has been demonstrated. (NIH, 1990) Dermal application of insect repellents containing DEET can produce a variety of skin reactions in humans. Cases of localized skin irritation, large painful blisters, and permanent scarring of the skin at the crease of the elbow has been reported in soldiers who applied solutions of 50 to 75 percent DEET. Results from surveys of Everglades National Park employees indicate a variety of dermal reactions, including rashes, irritation of skin and mucous membranes, and numb or burning sensations of the lips among park workers who were highly exposed to DEET-containing repellents. Field trials of a 60% DEET formulation on 600 lumbermen resulted in cases of contact dermatitis, conjunctivitis, and aggravation of pre-existing acne conditions. Several cases of young children developing toxic encephalopathy (severe brain involvement) have been associated with the use of DEET, including one death, following repeated exposure to 10% DEET. The toxic encephalopathy was characterized by agitation, weakness, disorientation, ataxia, seizures, coma and death. (NYDOH, 1991)

Generalized seizures have also been temporally associated with the use of DEET containing insect repellent on skin. Signs and symptoms of more subtle neurotoxicity have been associated with extensive dermal application of DEET on adults, in-

The Dos and Don'ts of DEET

EPA requires that child safety claims be removed from all end-use product labels, as they are misleading and irreconcilable with the intended use and pesticidal ingredients of DEET products, and that all DEET labels inform users to take the following precautions:

- Do not allow young children to apply this product;
- Do not apply near children's hands or face;
- Apply only enough to cover exposed skin and/or clothing;
- Do not apply over cuts, wounds and irritated skin;
- Thoroughly wash all treated skin with soap and water after returning indoors;
- Wash treated clothes before wearing again; and,
- Do not spray aerosol forms inside. (EPA, 1998)

cluding insomnia, mood disturbances and impaired cognitive function. (NYDOH, 1991)

In 1987, a rash of pet poisonings and deaths following the use of Hartz Blockade™, a flea and tick spray with a formulation of 8.5% DEET and 0.45% fenvalerate, resulted in a recall by Hartz Mountain. EPA calculated that a single one-ounce application of EPA-registered Hartz Blockade™ to a cat constituted a dose equivalent to the oral rat LD₅₀, and that cats, especially kittens, are more sensitive than rats to DEET. As a result, EPA now requires additional warnings on the label. (Streitfeld, 1991) One veterinary textbook refers to seven reports of cat poisonings after DEET exposure, resulting in seizures, tremors, vomiting, and ataxia and lethargy in several cases.

Mice eliminate the majority of DEET absorbed through their skin in one to three days, but trace amounts of DEET were discovered in the mouse tissue one to three months after application. (NPTN, 2000) In humans, DEET can penetrate through human skin, and, once in the body, it is eliminated in the urine. Peak concentrations in the urine occur several hours after application. (NPTN, 2000)

Synergistic Effects

Dr. Abou-Donia's two most recent studies focus on mixtures of DEET with other chemicals commonly used in conjunction with DEET. The first studied the effects of two-months of daily skin applications with a mixture of DEET and permethrin, an insecticide commonly used in mosquito control (Abou-Donia, 2001, *Exper. Neurol.*). The second studied the effects of 60 days of exposure to DEET and permethrin, and 15 days of exposure to pyridostigmine bromide, an anti-nerve gas agent. Rats experienced severe brain and behavioral deficits (Abou-Donia, 2001, *J. of Toxicol. & Enviro. Health*, 2001). In each study, the treated animals initially appeared to be normal, but, when challenged with neurobehavioral tasks that required muscle control, strength and coordination, the rats demonstrated serious impairments. A detailed analysis of their brains show that a large number of brain cells die within the cerebral cortex (controls muscles and movement), the hippocampal formation (controls memory, learning and concentration), and the cerebellum (synchronizes body movements). Many of the surviving brain cells show signs of degeneration and damage consistent with the presence of harmful byproducts called oxygen free radicals, which can damage DNA and cell membranes in the brain and nervous system. The most severe brain cell changes and sensorimotor deficits are seen among rats exposed to combinations of DEET, permethrin and the anti-nerve gas agent. The findings confirm Dr. Abou-Donia's 1996 and 2001 animal studies demonstrating that previously thought to be harmless doses of these three chemicals prove highly toxic to the brain and nervous system when used in combination. According to Dr. Abou-Donia, "Never use insect repel-

lents on infants, and beware of using them on children in general. Never combine insecticides with each other or use them with other medications. Even so simple a drug as an antihistamine could interact with DEET to cause toxic side effects. Don't spray your yard for bugs and then take medications. Until we have more data on potential interactions in humans, safe is better than sorry." (Duke, 2002)

Environmental Fate

Because EPA has categorized DEET to be an "indoor residential" use pesticide, a limited set of toxicity data is required to determine precautionary label statements and for assessing environmental fate and hazards in case of spills. In the soil, DEET breaks down fairly slowly and has a moderate potential to move through soil and into the groundwater. (NPTN, 2000)

Regulatory History

DEET was registered in 1957 with limited health and safety information. Since EPA began reviewing DEET for health and environmental effects in the 1980's, the evaluation has been slow and incomplete. A December 1980 *Registration Standard*, EPA identified the need for additional carcinogenicity, teratogenicity, reproductive effects and mutagenicity data that, to this day, are incomplete. The Chemical Specialties Manufacturers Association (CSMA) had, at the time, formed a "DEET Steering Committee" and successfully negotiated with EPA the waiver of some of these data requirements.

In addition, the agency relaxed its prohibition against the registration of any DEET formulation that exhibits adverse effects on the cornea. Whereas previously those formulations persisting seven days or more were illegal, now 21 days or longer is considered acceptable. By July 1988, the registrants had yet to even begin the required 4 1/2 year carcinogenicity studies. At present, EPA lacks the bulk of the chronic effects information and is apparently contemplating yet another data call-in.

Most recently, a 1998 *Reregistration Eligibility Decision (RED)* factsheet issued by EPA states that the agency had deferred its decision on the combination DEET/sunscreen products until it has solicited the views of various governmental agencies and other groups. The agency has not yet updated its position. Sunscreen products are intended for frequent, generous use, and DEET products are intended for spare, infrequent use. The use of combination products may promote greater use of DEET than is needed for pesticidal efficacy and pose unnecessary exposure to DEET.

Citing health risks and evidence that higher DEET concentrations are not more effective in repelling insects, Health Canada, in April 2002, banned insect repellents with more than 30% active ingredient DEET. As of December 2004, retailers must discontinue sale of these products. Two-in-one products that mix sunscreen and insect repellent have also been banned.

DEET ChemicalWATCH Fact Sheet Bibliography

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Backyard Mosquito Management

Practices that do not poison you or the environment

By Becky Crouse

First and foremost, let's get a couple of things straight. Mosquito management does NOT mean dousing yourself and your kin in your favorite DEET product and then stepping out to enjoy the local wildlife. It is not swatting at the suckers as they bite you. And it is not investing in one of those full-body net suits for your next camping trip.

To manage mosquitoes, you have to get rid of the situations that are attracting them to your property, and, if you detect any breeding activity, kill them before they become adults. That's called LARVICIDE!

So what then do mosquitoes need? Why are they finding your backyard so darn attractive? They need suitable aquatic breeding habitats in order to complete their life cycle (a.k.a they need water). Eggs must be laid on the surface of slow-moving or standing water. Your first step in managing mosquitoes should be to remove any and all potential breeding areas – anyplace that water collects – from your yard. This will provide long-term control over mosquito populations and also controls populations before they mature and have a chance to reproduce, transfer disease, and annoy. If mosquitoes do breed, larviciding allows control measures to be used in targeted areas, while mosquito larvae are still concentrated in breeding pools and before adult mosquitoes spread throughout the community.

Adulticiding programs spray pesticides indiscriminately and do not get at the mosquitoes until they have matured and are already nibbling at your skin. They also do little to restrict breeding. Mosquitoes develop resistance to chemical pesticides over time, which render the chemicals ineffective. Adulticides present considerable risk to all living things, and kill beneficial insects and natural mosquito predators, such as dragonflies, damselflies, and beetles.

According to David Pimentel, Ph.D., an entomologist from Cornell University, close to 99.9 percent of the sprayed chemicals go off into the environment where they can have detrimental effects on public health ecosystems, leaving 0.10 percent to actually hit the target pest ("Amounts of Pesticides Reaching Target Pests: Environmental Impacts and Ethics." *Journal of Agricultural and Environmental Ethics* Vol. 8, No. 1

(1995), pgs. 17-29). He has continually questioned the efficacy of spray-based strategies against mosquitoes, conducting research for several cities in the mid-1980s.

Life Cycle of a Skeeter

There are more than 2,500 different species of mosquitoes in the world, 150 of which occur in the U.S. and a only small fraction of which actually transmit disease.

Mosquitoes go through four stages in their life cycle – egg, larva, pupa, and adult. Eggs can be laid either one at a time or in rafts and float on the surface of the water. *Culex* and *Culiseta* species stick their eggs together in rafts of 200 or more, which looks like a speck of soot floating on the water, about 1/4-inch long and 1/8-inch wide. *Anopheles* and *Aedes* species do not make rafts, but lay their eggs separately. *Aedes* lay their eggs on damp soil that will be flooded by water. Most eggs hatch into larvae within 48 hours.

Larvae live in the water and come to the surface to breathe. They feed on micro-organisms and organic matter in the water. They molt four times, growing larger after each molting, and changing into pupae after the fourth molt when they are about 1/2-inch long.

The pupal stage is a resting, non-feeding stage. This is when the mosquito turns into an adult. It takes about two days for the adult to fully develop, split the pupal skin and emerge.

Adults rest on the surface of the water to allow their body parts to harden and wings to dry. The complete life cycle can take as little as four days or as long as one month, depending on the temperature. Only adult female mosquitoes bite animals and require blood meals; males feed on the nectar of flowers.

Personal Prevention

- Remain indoors in the evenings, when most mosquito activity occurs.
- Use screened-in porches instead of open porches.
- Use herbal repellents to ward off mosquitoes, such as Skin-So-Soft or Herbal Armour. Reapply often. Herbs that repel mosquitoes include cedarwood, garlic, lemongrass,



Poster designed and illustrated by Grant Jerding (www.grantjerding.com) for the Maryland Pesticide Network (www.mdpestnet.org).

frankincense, cinnamon, geranium, eucalyptus, basil, rosemary, cloves, peppermint, lemon balm (citronella), onions, feverfew, thyme, and marigold.

- Essential oils of the herbs listed above are also good repellents, though most are volatile organic compounds and will bother someone who is sensitive to scents. To mix your own essential oil repellent, add 10 drops of essential oil to 2 tablespoons of vegetable oil, stir, and dab a few drops on your skin or clothing. Pregnant women should consult their doctors before using essential oils.
- Neem oil, used as a mosquito repellent cream and composed of 2% crude neem oil is a highly effective repellent. In various studies, its protection against the *Culex quinquefasciatus*, *Aedes* sp. and *Mansonia* sp. is greater than 75%.

Avoid repellents containing DEET, which is quickly absorbed through the skin and has caused effects ranging from large blisters to brain damage in children, with three deaths in the last 40 years tied to exposure. Studies have also found adverse effects from DEET mixed with permethrin, an insecticide commonly used for mosquito control, especially in spray programs. The combination of products caused the death of a large number of brain cells within the cerebral cortex, which controls muscles and movement, the hippocampal formation, which controls memory, learning and concentration, and the cerebellum, which synchronizes body movements. (For more information about DEET, see the ChemicalWATCH factsheet on pages 9-10.)

Household Prevention

- Maintain window screens and doors, closing all opened doors.
- Remove or regularly drain all water-retaining objects, such as tin cans, pet dishes, buckets, holes in trees, clogged gutters and down spouts, old tires, birdbaths, trash can lids, and shallow fishless ponds.
- Stock permanent water pools, such as ornamental ponds, with mosquito larvae eating fish.
- Check for standing water in plastic or canvas tarps used to cover pools and boats. Arrange tarps to drain water and turn canoes and small boats upside down for storage.
- Fix dripping outside water faucets.
- Enhance the drainage of flood canals, irrigation ditches and fields; keep street gutters and catch basins free of debris and flowing properly; and enhance drainage or create permanent deep pools in marshes.
- Remove or treat sewage leaks and lagoons, which provide excellent breeding conditions for certain species.

Monitoring

- Check ponds and sources of water for signs of mosquito larvae.

Control

- Burn **citronella candles** and torches to control mosquitoes in the immediate vicinity when there is no wind.
- The **Mosquito Magnet**, a machine much like a gas grill, burns propane gas that sends out a plume of carbon dioxide. The carbon dioxide attracts mosquitoes, which are then sucked in and killed. One magnet can control adult mosquitoes over an acre of land, though different levels of success have been reported. *For more information see www.mosquitomagnet.com or call American Biophysics Corp. at 877-699-8727.*
- Stock ornamental ponds with **mosquito larvae-eating fish**, such as mosquito fish of the *Gambusia* genus. They should be stocked in enclosed water so they will remain in the area in need of control. Only indigenous species should be used. Mosquitofish have a number of advantages over such things as goldfish and koi for biological mosquito control in ponds and other water sources: they actually eat mosquito larvae; they are voracious surface feeders with upturned mouths specially designed to get mosquito larvae where they live; they prefer the cover and protection of shallow overgrown areas along the shore which are also the preferred environs of mosquito larvae; and, since they give birth to live young (they are in the guppy family), they don't need any special sand or other substance for spawning. They are self-sustaining and self feeding. *You can order mosquito fish through J. Reilly, 5000 Trenton Street, Metairie, LA 70006, 504-887-3666; Natural Pest Controls, 8864 Little Creek Drive, Orangevale, CA 95662, 800-873-1252; or Richmond Fisheries, 8609 Clark Road, Richmond, IL 60071, 815-675-6545.*
- **Bacillus thuringiensis var. israelensis** is one of the most popular and most effective least-toxic biological controls. It is a bacterial strain that, when sprayed into larval pools, is ingested by feeding larvae and kills them. *You can buy a product called Mosquito Dunks™ at your local lawn and garden store, in hardware stores, and in some catalogs and on line from Real Goods, www.realgoods.com, 800-762-7365 and Peaceful Valley, www.groworganic.com, 888-784-1722.* The dunks are safe for birdbaths, rain barrels, ponds, ditches, tree holes, roof gutters, unused swimming pools — anywhere water collects
- **Horticultural oils** (vegetable based) are effective in killing larvae in water and sinking egg rafts on the surface. They also can kill non-target organisms including some mosquito predators that breathe from the surface.

Contact Beyond Pesticides for examples of successful community IPM programs for mosquito control.

Resources

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Managing Mosquitoes Without Poisoning People

What to do BEFORE pesticides or West Nile Virus get to your neighborhood

With the concerns of West Nile virus (WNV) spreading across the United States, it is crucial that public health officials explore practices that do not unnecessarily rely on toxic chemicals that have adverse effects on people and the environment. Since WNV has been tracked in 27 states and the District of Columbia, the concern about pesticide contamination and poisoning is growing. Claims that pesticides are integral to pest management for public health protection overshadow sound planning to adopt effective mosquito prevention measures.

As U.S. residents raise fears about potentially fatal mosquito-borne illnesses, public officials are often pressured into ordering broadcast pesticide spraying because it is a quick and public response. Yet, it may not be the most effective response. To assist policymakers and public health officials in solving this dilemma, Beyond Pesticides is working with public health professionals, mosquito control officers, and environmental health groups in the development of a mosquito management strategy that protects the public from both mosquito-borne diseases and the pesticides used to kill mosquitoes.

The *Public Health Mosquito Management Strategy* (which follows) emphasizes community education, prevention, and monitoring methods for both mosquito-borne illnesses and pesticide-related illnesses. Thousands of people become sick from pesticide exposure each year. Residents are increasingly concerned about pesticide spraying near their homes, schools, organic farms, and other sensitive areas.

While many counties have good intentions, their policies and programs may be dangerous and inadequate by

relying too heavily on spraying pesticides to kill adult mosquitoes. Reports have been filed that cite ineffective and hazardous spray programs targeting nuisance mosquitoes, or triggered by a finding of infected dead birds far from the site of infected mosquitoes. In response to these concerns, this management strategy also discusses the low efficacy of using pesticides to kill adult mosquitoes, and the

facts about West Nile virus, and mosquito-borne diseases such as St. Louis encephalitis, and dengue fever.

While spraying pesticides is not recommended, if a community decides to do this, it is important that it sprays responsibly. First, the public should be notified in advance so that exposure to dangerous chemicals can be avoided. Second, pesticide operators should be properly protected and trained on when, where, and how to spray.

Your help is needed! Beyond Pesticides would like to work with you and your community to adopt the *Public Health Mosquito Management Strategy: Managing Mosquitoes and Insect-Borne Diseases with Safety in Mind*. Together we can: 1) Identify your local public health officials (see www.beyondpesticides.org or contact *Beyond Pesticides* for more details); 2) Express concern about the dangers of pesticides

and insect-borne diseases, and the need for an effective mosquito prevention strategy; 3) Provide a copy of the management strategy to your local public health officials; 4) Organize the community in support of the strategy; and, 5) Watchdog the implementation of the community's mosquito management practices.

Please contact *Beyond Pesticides* for a mosquito management organizing toolkit (\$5.00).



Where in the States is West Nile Virus?

Alabama, Arkansas, Connecticut, Delaware, District of Columbia, Florida, Georgia, Illinois, Indiana, Iowa, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Mississippi, Missouri, New Hampshire, New Jersey, New York, North Carolina, Ohio, Pennsylvania, Rhode Island, Tennessee, Virginia and Wisconsin.

Public Health Mosquito Management Strategy

Managing mosquitoes and insect-borne diseases with safety in mind

Executive summary

The ideal mosquito management strategy emphasizes education, prevention, and monitoring for both mosquito-borne illnesses and pesticide related illnesses. This strategy will ensure that the use of pesticides will not add to the health problems already associated with insect-borne diseases. Successful control of mosquito populations requires that community leaders teach residents and business owners how to reduce breeding habitats and mosquito bites through strong public awareness campaigns.

Using the prevention and monitoring techniques outlined in this report, many communities will find that they can significantly reduce or even eliminate their reliance on pesticides while calming the public's fears over uncontrolled mosquito populations. Tracking larval and adult mosquito populations, species types, breeding locations and virus outbreaks is an essential part of any mosquito management program. Knowing when and where the virus is likely to strike allows for precise, targeted control techniques.

Spraying should be done responsibly. The decision to use pesticides should only be made after carefully evaluating all of the contributing factors to human epidemics. The public—especially vulnerable populations such as pregnant women—must be notified in advance so they can prevent exposure to potentially dangerous pesticides. Most importantly, pesticide operators should be properly protected and trained on when, where, and how to spray.

The latter half of this strategy provides information about the dangers and inefficacy of spraying pesticides. Aside from the adverse health effects posed to humans, adulticiding may actually increase the number of mosquitoes by destroying their natural predators.¹ Additionally, mosquitoes that survive the spraying may become resistant, longer-lived, more aggressive, and have an increased prevalence of the virus within their bodies.²

Further studies are urgently needed to accurately determine the health effects and the efficacy of spraying pesticides, and to help determine whether adulticiding should continue to be used in the battle to control mosquitoes.

I. Introduction

Mosquito-borne diseases are becoming more prevalent nationwide. With outbreaks of West Nile virus (WNV) in the east and moving west, St. Louis encephalitis in the south, and Dengue fever in the western part of Hawaii, there is an urgent need to develop a national mosquito management strategy. This becomes especially critical as scientists expect the recent changes in climate will increase insect-borne diseases.^{3,4} Additional risks occur to the growing number of residents living on or near wetlands, which are more likely to be mosquito-breeding habitats.

Many communities around the country are using ineffective and pesticide-intensive mosquito management strategies due to a lack of adequate information. This strategy was prepared with the assistance of public health officials, environmental health groups, and mosquito control officers to

provide policymakers and community leaders with information on effective strategies that reduce reliance on toxic chemicals, thus controlling mosquito populations with a more human-friendly approach.

Most experts agree that an efficient mosquito management strategy emphasizes public awareness, prevention, and monitoring methods. However, if these

methods are not used properly, in time, or are ineffective, communities must decide whether or not to use pesticides. They must determine if they should risk exposing vulnerable populations to potentially fatal diseases caused by mosquitoes or to chronic or deadly illnesses caused by pesticides.⁵

The guidelines in this strategy are drawn from state and local mosquito management programs that have effective and safe strategies. Connecticut, in particular, has incorporated key elements of a sound approach to prevention and management (see www.beyondpesticides.org or contact Beyond Pesticides for the state of Connecticut's *Tiered Approach to Mosquito Management*). However, since local and state programs evolve, it is important to follow the guidelines incorporated in this strategy.

Should pesticides be used, and if so, which products are the safest and how should they be applied? This strategy provides information on how to make these difficult choices. Unfortunately, until scientists can provide better evidence on



the effectiveness of spraying, there is no way to know for certain if it is worth the risks of spraying. At the same time, the proven health threats associated with pesticide exposure can no longer be ignored.

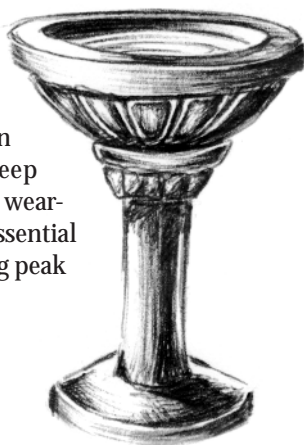
II. Ideal mosquito management strategy

The ideal mosquito management strategy emphasizes public awareness, prevention, and monitoring methods. Adulticides (pesticides intended to kill adult mosquitoes) should be used only as a last resort. A successfully implemented strategy requires the cooperative efforts of individuals, government agencies, and businesses.

1. Mosquito prevention: what people can do at home

Eliminate breeding sites: Mosquitoes need only a bottle cap of water to breed. Getting rid of mosquito breeding sites gets rid of mosquitoes. Because many types of mosquitoes do not travel far from where they hatch, individuals can have a dramatic impact on local mosquito populations.

Avoid the bite: Individuals can take necessary measures to keep mosquitoes from biting them by wearing appropriate clothing, using essential oil-based repellents, and avoiding peak mosquito feeding times.



2. Mosquito prevention: what the community can do

Conduct public awareness campaigns: Communities must increase the awareness of prevention methods for mosquito-borne illnesses and, should a community decide to spray, for pesticide illnesses. Health care providers must also be educated about the symptoms of each and should encourage the use of prevention measures. Communities should utilize all forms of educational tools: the media; websites; posters placed around schools, libraries, post offices, and markets; and, pamphlets distributed to doctors' offices and libraries. Public officials should also communicate mosquito prevention methods.

Eliminate breeding sites on public land: As on personal property, public land should be cleared of all standing water that could serve as a potential breeding habitat. Managers should be advised of the hazards of old tires behind gas stations and garages, and asked to recycle the tires or cut them in half. Gutters and ditches in public areas also need regular maintenance to prevent standing water.

Table 1. *Culex* Mosquito Life Cycle

In the United States, WNV and St. Louis encephalitis is primarily associated with the *Culex* mosquitoes.⁴⁷ Within this genus, three species, namely *C. pipiens*, *C. restuans*, and *C. salinarius* make up the majority of those mosquitoes found to be infected with WNV. Only female mosquitoes take blood meals.

Adult females may live 2-4 weeks or more, depending on climate, species, predation, and a host of other factors. Like other insects, mosquitoes are cold-blooded. They are most active at 80° F, become lethargic at 60° F, and cannot function below 50° degrees F.⁴⁸

All mosquitoes go through a complicated life cycle called "complete metamorphosis." Complete metamorphosis involves four distinct stages – egg, larva, pupa, and adult. The length of time that each stage lasts depends on a number of variables with temperature having the greatest impact.

Eggs	are laid in "rafts" on standing bodies of water. The eggs require one to two days in water before hatching into larvae.
Larvae,	or wigglers, molt three times during ten to twelve days before pupating.
Pupae,	or tumblers, metamorphose over one to two days into adults.
Adults	emerge from their pupal cases approximately twelve to sixteen days after being laid as eggs by their mother. ⁴⁹

After mating, the female requires a blood meal in order to produce over 250 eggs. It takes her three to four days to digest the blood and produce the eggs. Females transmit diseases when they live long enough to spread infection from the first blood meal victim to the second blood meal victim. Only a very small percentage of females live this long.⁵⁰ *Culex* mosquitoes are generally weak fliers and do not move far from their larval habitat, although they have been known to fly up to two miles.⁵¹

Mosquito-eating fish: Aside from traditional larvicides, biological controls, like mosquito-feeding fish of the *Gambusia* genus, have been used nationwide with great success. These hardy freshwater fish can eat their weight in mosquito larvae, according to Wayne Wurtz with the Gloucester County Mosquito Control in Pennsylvania.⁶ Predacious fish are also used in the salt-water marshes of Nassau County, New York.⁷

To avoid ecological problems, use indigenous species of mosquito-eating fish, or only introduce them in enclosed bodies of water. They have been known to occasionally trigger algal blooms after consuming algae-eating organisms.

Table 2. The Facts about West Nile Virus

What is West Nile virus?

West Nile virus (WNV) is a mosquito-borne disease that was first detected in the United States in 1999.⁵² WNV can cause a potentially fatal illness known as encephalitis or inflammation of the brain. Birds act as hosts for the virus, and mosquitoes spread it through their bites. Current evidence shows that only mosquitoes can spread the disease; humans or other animals cannot. The information in this section is primarily based on information from the Centers for Disease (CDC) website.⁵³

What is the likelihood that someone will become ill?

Most people's immune systems are able to fight the virus. Only a small percentage of the population will get the virus. Some may develop flu-like symptoms. In the United States, people older than 50 years and those with weakened immune systems have the highest risk of severe encephalitis. "Less than one percent of those infected with West Nile virus will develop severe illness," according to the CDC. Birds, horses, and other animals are also at risk. In 1999, there were 62 reported cases of severe disease, including 7 deaths; in 2000, there were 21 reported illnesses and 2 deaths; and in 2001, there were 48 illnesses and 5 deaths. According to the March 5th issue of the *Proceedings of the National Academy of Sciences*, there is a new vaccine against WNV that is ready for testing in non-human primates and horses.

What are the symptoms?

Most people who become infected will have mild symptoms that include fever, head and body aches, skin rash, and swollen lymph glands. However, a health care provider should be contacted immediately if there is high fever, confusion, muscle weakness, and severe headaches. It may take 3 to 15 days for any of these symptoms to show.

Where is WNV found?

WNV is spreading throughout the United States. In 2001, the virus had been found in 27 states throughout the Northeast, Southeast, and Midwest. The disease is also found throughout the world, including Africa, West Asia, Eastern Europe, and the Middle East. In areas where mosquitoes carry the virus, less than one percent of the mosquitoes are infected.

When is it most common?

In most parts of the United States, WNV is most common in late summer and early fall. In southern Florida and other warmer regions of the world, this disease can occur year-round. In the Northeast, residents are advised to take precautions until there are two hard frosts.

3. Monitoring mosquitoes, host species, and the virus

Monitoring is an essential part of an effective mosquito management program, and should be done regularly throughout the season. Tracking larval and adult population numbers, species types, and breeding locations provides invaluable information used to determine when, where, and what control measures might be needed. Identification of potential disease carriers and a gauge on the program's effectiveness are also afforded through population counts. Knowing when and where the virus is likely to strike allows for precise, targeted control techniques.

Monitoring can be labor intensive and costly. However, an accurate index of this information over time assists the program manager in predicting and anticipating control needs. For example, mosquito control officers will know which ponds breed the most mosquitoes, so they can target prevention and control measures. Local weather reports should also be consulted regularly to help prepare the community for possible outbreaks of mosquitoes, which usually occur after droughts followed by heavy rains.

"Birds serve as important natural hosts for the virus in the disease cycle," states a report from three professors from Texas A&M. "Public health officials often survey migrating bird populations to determine the incidence of virus and the potential for transmission to man and animal by feeding mosquitoes."⁸ As with most animals, mosquitoes will not travel farther than their habitat necessitates. If mosquitoes are not restricted by topography or climate and have an adequate food source, which is typically from birds, they will likely stay in a specific area. However, some mosquito species can fly much farther in search of a blood meal, especially if it is windy. This is why it is critical to monitor both the vector and the traditional host before determining the most effective strategy for your community.

4. Larviciding: what's safe to use

Because not all breeding sites can be eliminated, it may be necessary to use larvicides, which kill mosquito larvae. It is recommended that products containing the biological pesticide B.t.i. (*Bacillus thuringiensis var. israelensis*) be used in such places as storm drains and sewer treatment plants. *Bacillus sphaericus* works best in organically rich water in drains. B.t.i. is proven to be effective and has low levels of toxicity to humans and wildlife.⁹ When sprayed into larval pools, B.t.i. is ingested by feeding mosquito larvae and kills them.

A critical component of any successful application is monitoring to ensure that the insect population is at its most susceptible stage for B.t.i. application. B.t.i. is only effective against insects in their larval feeding stages and must be ingested. Experts say it is most efficient to use B.t.i. during the first and second stage of the larvae.

In some cases, when the larvae are in the third and fourth stage of metamorphosis, when B.t.i. is likely to be less than

60 percent effective, Methoprene (Altosid) may be necessary to kill larvae and prevent the use of adulticides.¹⁰ B.t.i. lasts approximately 30 days, and Methoprene lasts about 150 days. However, some studies find that Methoprene causes wildlife deformities by interfering with hormones.¹¹

As with any pesticide, larvicides should not be used widely because mosquitoes may become immune to them. It is also important to note that larvicides may pose a risk to vulnerable populations, and proper notification should be made through public awareness campaigns.

5. Adulticiding: use only as a last resort and spray responsibly

How communities can reach a decision to spray: Spraying should only be done after carefully evaluating the likelihood of pesticide-related illnesses and the contributing factors to a human epidemic of mosquito-borne diseases. Such factors include the ecology of the disease, the prevalence and types of mosquito and host species found in your area, and weather patterns. Specifically, this will involve: 1) identifying species that are vectoring the disease; 2) distinguishing between nuisance mosquitoes and those that vector the disease; 3) find diseased birds; and, 4) use mammals, such as mice, as sentinel species to see if mosquitoes in a given area are at high enough levels to vector the disease.

Often, spraying occurs in response to human illnesses, high numbers of mosquitoes, or dead birds. Research shows this is not only the least effective method for managing mosquitoes, but also dangerous. Most experts agree that by the time a human illness is detected, it is already a month too late to start spraying pesticides in the same area where that person was exposed. It takes approximately two to ten days for symptoms to show up and at least two to three weeks for blood tests to confirm a positive link to the virus. The efficacy of spraying will be much greater if earlier detection of infected mosquito pools and other factors mentioned above are used as spray indicators, rather than humans.

It is not efficacious to spray around the location of dead birds. Only mosquitoes can transmit the disease; birds cannot. As discussed in Table 1, some of the mosquitoes known to carry WNV usually only travel within a few mile radius of their pool. (This distance can vary, depending on habitat, geography, and mosquito species.) Since most birds can travel much farther than this, spraying around dead birds does not get rid of the source problem.¹² Some experts use sentinel species, such as chickens or ducks, to first detect infected mosquito populations. However, as mosquito species and vectors

can vary in different areas, it is critical to have a good understanding of the ecology of each prior to beginning any spray program.

Nuisance spraying: A number of mosquito control programs respond to biting or sighting complaints by spraying to kill adult mosquitoes. Given the potential health risks and environmental impacts of adulticiding, monitoring and prevention techniques must be heavily emphasized, and spraying purely to control nuisance mosquitoes should be avoided when possible. Public awareness should also be used to raise the bar on tolerance levels. At a minimum, citizens must be given the right to have no pesticides sprayed around their house or neighborhood.

Responsible spraying: Responsible spraying for mosquito-borne diseases should adhere to the guidelines provided above and below.

Most experts agree that by the time a human illness is detected, it is already a month too late to start spraying pesticides in the same area where that person was exposed.

■ *Identify and locate the infected mosquito pools or areas.*

■ *Choose the least dangerous pesticides.* In general, synthetic pyrethroids have lower human health and environmental risks than organophosphates.¹³ However, both synthetic pyrethroids, such as resmethrin and permethrin, and organophosphates, such as malathion, are neurotoxins that can cause chronic health problems. Do not use Dursban™ and Sevin™; they are highly toxic. While botanical-based chemicals, including synthetic pyrethroids, are linked to breast cancer and endocrine disruptors,¹⁴ pyrethroids are applied in smaller amounts and have shorter residual lives than malathion and other organophosphates.

■ *Spray when mosquitoes are most active.* After determining which mosquitoes carry the disease, research the biology and behavior of the vector to find out when they are most likely to be exposed when spraying. For example, *Culex* mosquitoes take refuge in grass and brush during the day, so spray *Culex* at dusk when they are active and most vulnerable.

■ *Look at your local weather forecasts to gauge temperature and wind.* According to an article in *Common Sense Pest Control*, "The best condition is during a slight breeze of three mph or less. This air movement helps to disperse the pesticide effectively, but does not move it to unwanted areas."¹⁵ In general, mosquitoes are most active at 80° F, become lethargic at 60° F, and cannot function below 50° degrees F.¹⁶

■ *Ensure that the person spraying is properly trained and certified to use these pesticides.* They should use protective clothing and equipment.

- **Monitor application procedures.** Verify strict compliance with all label instructions, including prohibitions on spraying and drifting of certain pesticides over bodies of water. Mist blower and aerial application of these materials to populated areas will result in human exposure. In most cases, spraying should be done from vehicles or by professional certified applicators on foot.
- **Monitor pesticide equipment calibration.** Comply with requirements for storage, disposal, and equipment cleaning.
- **Do not conduct aerial spraying.** This is the least efficient method of spraying. Most small planes are restricted from flying during the evening, when many mosquito species are most active, and pesticides sprayed from planes hit less of the target area.
- **Continue implementing source reduction and other prevention strategies!**

Public officials must warn the public about pesticide dangers:

City or town officials have the duty, experience, and resources to warn the public about the dangers of pesticides and provide information on ways to minimize exposure. Pesticides are extremely toxic to public health and the environment. While the following is an understatement, the EPA warns, “[N]o pesticide is 100 percent safe and care must be used in the exercise of any pesticide.”¹⁷

New York State Attorney General Elliot Spitzer recommends that local governments establish Pest Management Advisory Boards to provide public input into mosquito response plans and create more public accountability. He suggests these boards review an agency’s vector control practices throughout the mosquito season to monitor effectiveness.

Public officials should embrace and utilize the following guidelines:

- **Notify the public at least 72 hours in advance.** Inform every household, school, hospital, and business in the community about when the spraying will occur so they will have ample time to protect themselves. Alert the public that pesticides are harmful. The mechanisms described below can be used to help notify the public.
- Install a mosquito hotline. Update it each day with information about where spraying will occur and how to protect yourself from pesticides. Residents

can call into a multiple-line message service that is available 24/7.¹⁸

- Issue Public Notices to organized groups, such as school superintendents, hospital associations, chambers of commerce, police and fire departments, and village associations. This is another efficient means of notifying the public, as those organizations will be responsible for and better able to forward the notices to the right places in a timely manner.
- Inform public drinking water agencies to prevent drinking water contamination.
- Utilize the media to warn the public about spraying and to publicize the mosquito hotline.



- Place paid public service announcements with local media.
- Use county/local websites to provide information about protection measures against the disease and pesticides. This should also be updated daily with information about where spraying will occur.

■ **Provide the public with precautionary measures.** Everyone should receive guidelines on how to reduce exposure to pesticides. (See tips below.)

■ **Ensure the public still follows prevention guidelines.** As the Centers for Disease Control (CDC) states that adult spraying is the least efficient mosquito control technique, it is critical that prevention education coincide with spray announcements.

- **Monitor the public for adverse health effects of pesticide exposure.** Set up a hotline for receiving reports, collecting hospital records, and requiring physician reporting of incidents.
- **Monitor pesticide levels in the environment.** Use wipe tests of outdoor and indoor surfaces, check air conditioner filters, evaluate water samples, and conduct soil and food residue tests from gardens and farms.
- **Advise hospitals and schools.** Also notify other buildings with especially vulnerable populations to take extra precautionary measures to prevent pesticides from entering buildings.

How individuals can protect themselves from exposure to dangerous pesticides:

- Leave the area.*

* Infants, children, pregnant women, the elderly, and individuals with compromised immune systems are the most vulnerable populations and should take extra care to avoid pesticide exposure. People with multiple chemical sensitivities or other pesticide illnesses are also more vulnerable to pesticide exposure.

- Close the windows.
- Turn off air intake on window unit air conditioners.
- Take toys and lawn furniture inside.
- Remove shoes before entering homes to avoid tracking in residues.
- Cover swimming pools.
- Don't let children play near or behind truck-mounted applicators or enter an area that has just been sprayed.
- Wipe paws off pets with a wet cloth before they re-enter your home.

III. Pesticides are dangerous to public health and the environment

The two types of pesticides used in spraying adult mosquitoes include synthetic pyrethroids and organophosphates. Scientific studies show that both types are dangerous, especially to vulnerable populations. Ironically, the same population that is most susceptible to severe encephalitis is also at risk of getting sick from pesticides — the elderly and people with compromised immune systems. A study conducted by the National Research Council found that pregnant women, infants, and children also have a greater risk of getting sick from pesticides.¹⁹

According to the New York State Department of Health, more people were reported to have gotten sick from pesticide spraying than from exposure to WNV in 2000.²⁰ Pesticide spraying may also leave the public with a false sense of security, and they may not take personal precautions. Worse, communities may feel it is no longer necessary to follow the prevention guidelines that will eliminate breeding sites.

1. Health effects of pyrethroids

Synthetic pyrethroids, which include resmethrin (Scourge) and sumithrin (Anvil), are adulticides patterned after pyrethrum, an extract from the chrysanthemum flower. While similar to pyrethrum, synthetic pyrethroids have been chemically engineered to have greater toxicity and longer breakdown times.²¹ Additionally, almost all synthetic pyrethroid mosquito products are combined with synergists, such as piperonyl butoxide (PBO), which increase potency and compromise the human body's ability to detoxify the pesticide.

According to the American Association of Poison Control Centers, pyrethrins and pyrethroids are ranked number two among the classes of pesticides most often implicated in symptomatic illnesses.²² A total of 3,950 illnesses, including 1,100 children less than six years old, were reported in 1996.²³ Most of these illnesses likely required medical attention.²⁴

Symptoms of pyrethroid exposure include: dermati-

Table 3. The Facts about St. Louis Encephalitis

What is St. Louis encephalitis?

St. Louis encephalitis is a mosquito-borne disease that was most recently detected in Louisiana in 1999.⁵⁴ St. Louis encephalitis is a potentially fatal illness that causes inflammation of the brain. Birds act as hosts for the virus, and mosquitoes spread it through their bites. Current evidence shows that only mosquitoes can spread the disease; humans or other animals cannot. The information in this section is primarily based on information from the Centers for Disease Control and Prevention (CDC) website.⁵⁵

What is the likelihood that someone will become ill?

According to the CDC, there have been no outbreaks of St. Louis encephalitis since 1999. The elderly and people who work outdoors are most at risk. Mortality rates range from 3 to 30 percent, and are higher with the elderly.

What are the symptoms?

People with mild infections will usually have a fever and a headache. More severe infection is marked by headache, high fever, neck stiffness, stupor, disorientation, coma, tremors, occasional convulsions (especially in infants) and spastic paralysis.

Where is St. Louis encephalitis found?

In 1999, there were 20 reported cases of St. Louis encephalitis in New Orleans, Louisiana. However, outbreaks of the disease can occur throughout the United States. During 1974-1977, there was an outbreak in the Midwest with over 2,500 reported cases.

When is it most common?

In temperate regions, people are most at risk during the late summer or early fall. In milder climates, such as southern U.S. states, St. Louis encephalitis can occur year round.

tis and asthma-like reactions, nasal stuffiness, headache, nausea, incoordination, tremors, convulsions, facial flushing and swelling, and burning and itching sensations.²⁵ Synthetic pyrethroids are endocrine disruptors and have been linked to breast cancer.²⁶ Deaths have resulted from respiratory failure due to exposure to these chemicals. People with asthma and pollen allergies should be especially cautious. Breakdown times range from a few hours in direct sunlight, to several months in damp, dark environments. However, synthetic pyrethroids pose lower levels of human health risks than organophosphates.²⁷

2. Health effects of organophosphates

Organophosphates are a highly toxic class of pesticides that affect the central nervous, cardiovascular and respiratory systems. They include malathion (Fyfanon), naled (Dibrom) and chlorpyrifos (Mosquitomist), which are extremely hazardous to public health and the environment.

According to the American Association of Poison Control Centers, organophosphates are ranked the number one pesticide most often implicated in symptomatic illnesses.²⁸ A total of 4,002 illnesses, including 700 children less than six years old, were reported in 1996.²⁹ Most of these illnesses likely required medical attention.³⁰

Initial, short-term symptoms of exposure include: numbness, tingling sensations, headache, dizziness, tremors, nausea, abdominal cramps, and sweating, lack of coordination, blurred vision, difficulty breathing, slow heartbeat.³¹ More severe exposures can cause unconsciousness, incontinence, and convulsions, which may lead to death.³² Some organophosphates have been linked to birth defects and cancer. Break-down times range from a few days in direct sunlight, to several months in damp, dark environments.

3. Mixing chemicals is dangerous

EPA does not adequately review the synergistic effects of active and inert ingredients within the same product or those of different products before registering a pesticide. Furthermore, combinations of pesticides have not been tested to rule out their health effects on vulnerable populations.

For example, two chemicals commonly used to control adult mosquitoes may be a dangerous combination. A recent study by Duke University researchers found that combined exposure to DEET and permethrin, which is a mosquito spray, could lead to motor deficits and learning and memory dysfunction.³³ Mohammed Abou-Donia, Ph.D., a Duke University pharmacologist and co-author of this study, recommends that DEET should not be used with other chemicals or by people who are taking medication.

Dr. Abou-Donia is concerned that these chemicals

are used not only in areas where there are healthy people, but where there are vulnerable populations, such as infants, children, and pregnant women. These and other vulnerable populations have a higher risk of becoming ill due to pesticide and DEET exposure. Additionally, several cases of DEET poisonings have been reported by EPA, including three fatalities.



EPA does not adequately review the synergistic effects of active and inert ingredients within the same product or those of different products before registering a pesticide.

4. Pesticide spraying is harmful to the environment

Pesticide spraying is also harmful to ecosystems and wildlife.³⁴ Adulticides pose well-documented threats to wildlife, birds, fish, shellfish, and beneficial insects such as bees, butterflies, and dragonflies, which prey on mosquitoes. As discussed below, pesticide spraying often kills other types of mosquito predators, too. Furthermore, wildlife and ecosystems depend on mosquitoes for their survival.

It is important to note that, similar to human health risks, synthetic pyrethroids generally pose lower environmental risks than organophosphates.³⁵

5. Legal concerns of improperly trained pesticide applicators

Five spray operators who worked for a New York City contractor in 2000 filed a complaint with the Occupational Safety and Health Administration. They said they became sick because of improper training and prolonged exposure to the chemicals.³⁶ Another lawsuit, for \$125 million, was filed by commercial fisherman who link a dramatic decrease in their lobster harvest to pesticides used against mosquitoes believed to carry WNV.³⁷

IV. Pesticide spraying is not proven highly effective and is inefficient

1. Pesticide spraying is not proven highly effective

The CDC also states that adulticiding should only be used as a last resort, when all prevention methods have

failed. According to the CDC's website, "The underlying philosophy of mosquito control is based on the fact that the greatest control impact on mosquito populations will occur when they are "concentrated, immobile and accessible. This emphasis focuses on habitat management and controlling the immature stages before the mosquitoes emerge as adults. This policy reduces the need for widespread pesticide application in urban areas."³⁸

While many report that lower mosquito counts occur immediately after spraying pesticides, it is not certain what percentage of the population is reduced. Most studies of the efficacy of adulticides are conducted with caged mosquito monitoring traps, which of course is not a realistic representation of mosquitoes in their natural environment.

For example, Ray E. Parsons, Ph.D., a medical entomologist and the assistant director for the Mosquito Control Division in Houston, Texas, says it is difficult to determine the effectiveness of pesticide spraying because there are currently no accurate means of measuring *Culex* mosquito populations.³⁹ (As discussed in Table 1, *Culex* is the most common type of mosquito that carries West Nile virus.) Therefore, scientists cannot accurately determine what percentage of the population has decreased after spraying.

Pesticide spraying may increase mosquitoes: An article in the *Journal of the American Mosquito Control Association* showed that long-range effects of pesticide spraying can actually increase the number of mosquitoes by destroying their natural predators.⁴⁰ Furthermore, mosquitoes that survive the spraying may become resistant, longer-lived, more aggressive, and have an increased prevalence of the virus within their bodies.⁴¹

2. Pesticide spraying is inefficient

The CDC states that spraying pesticides intended to kill adult mosquitoes is usually the least efficient mosquito control technique.⁴² Preventive measures such as removing breeding areas are much more efficient in eliminating mosquito threats.

David Pimentel, Ph.D., a professor of entomology at Cornell University, estimates that pesticides sprayed from trucks hits less than 10 percent of the targeted spray area. "And you have to put out a lot of material to get that one-tenth of a percent on to the mosquito," Dr. Pimentel added.⁴³ In a study he wrote for the *Journal of Agricultural and Environmental Ethics*, he estimated that less than 0.0001 percent of ultra low volume (ULV) pesticide sprays reach target insects.⁴⁴ The rest of the pesticides is sprayed on unintended areas. It is also difficult for trucks to reach over and in between tall buildings or other structures.

V. Recommendations

In order to conduct adequate risk-benefit analyses of spraying adult mosquitoes when there is a disease outbreak, several key monitoring systems are needed. First, scientists must

Table 4. The Facts about Dengue

What is dengue?

Dengue is a disease caused by one of the four viruses: DEN-1, DEN-2, DEN-3, or DEN-4. It is transmitted to humans through the bite of an infected mosquito. In 2001, an outbreak in Hawaii was transmitted by the *Aedes albopictus* mosquito. However, in most parts of the western hemisphere, the *Aedes aegypti* mosquito is the most common vector of this disease. The information in this table is primarily based on information from the Centers for Disease Control and Prevention (CDC) website.⁵⁶



What is the likelihood that someone will become ill?

Generally, younger children have a milder illness than older children and adults. Dengue hemorrhagic fever is a more severe form of the disease, and is caused by the same infection as dengue. Worldwide, over 100 million cases of dengue fever occur each year.

What are the symptoms?

People who become infected will have a high fever, severe headache, backache, joint pains, nausea and vomiting, eye pain, and rash. A person with dengue hemorrhagic fever will have a fever that lasts from 2 to 7 days, and general signs and symptoms that could occur with many other illnesses (e.g., nausea, vomiting, abdominal pain, and headache). This stage is followed by the tendency to bruise easily or other types of skin hemorrhages, bleeding nose or gums, and possibly internal bleeding. The smallest blood vessels become "leaky," allowing the fluid component to escape from the blood vessels. This may lead to failure of the circulatory system and shock, followed by death, if circulatory failure is not corrected.

Where is Dengue found?

Last year, residents living in the western part of Hawaii had dengue fever. This disease can also be found in Puerto Rico. According to the CDC, "There is a small, but significant, risk for dengue outbreaks in the continental United States."⁵⁷ The areas most at risk for dengue transmission and sporadic outbreaks are southern Texas and southeastern U.S, which is where the *Aedes aegypti* is found. Outbreaks generally occur in tropical urban areas, where the *Aedes* mosquito lives.

develop better ways of measuring mosquito populations in a given area. Pesticides should not be sprayed on such a widespread basis until there can be more accurate measurements of its efficacy. It is simply not worth the risks. Existing studies demonstrate that by spraying pesticides, we are compounding the low risks of acquiring this disease with another public health threat.

Secondly, pesticide monitoring systems must be developed that accurately measure and record the location of spraying, and the types and amounts of pesticides used for each given area. This will enable pesticide illness tracking programs to more accurately determine the number of illnesses caused by using pesticides. In order to successfully implement this system, public health officials must educate doctors and nurses, and community leaders must educate the public about symptoms of pesticide poisoning.

Monitoring systems should also be established to study the diseases associated with mosquitoes.

The CDC recommends the following research priorities for St. Louis encephalitis: develop a standardized national surveillance program; characterize over-wintering mechanisms and other aspects of enzootic maintenance cycle; evaluate vector control strategies; determine biological basis for increased risk with age; and, develop more effective systems for disease prevention.⁴⁵ The CDC also recommends the following priorities for Dengue fever: develop improved laboratory-based international surveillance; develop rapid, sensitive and specific diagnostic tests; develop more effective community-based prevention programs; and, develop tetravalent dengue vaccine.⁴⁶

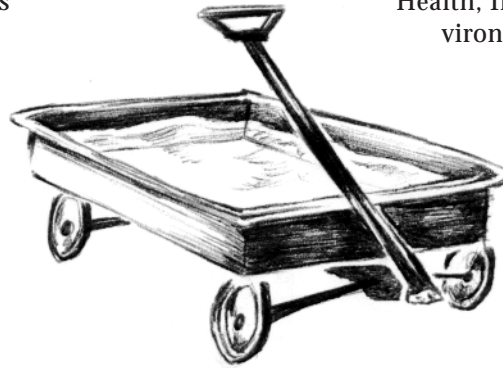
Finally, pesticide applicators and mosquito control teams should receive better training to achieve higher levels of safety and efficacy. They should be properly trained to decide when and if they should spray, choose the least-toxic pesticide, use the best methods, and spray at the right time.

VI. Acknowledgments

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Pesticides should not be sprayed on such a widespread basis until there can be more accurate measurements of its efficacy. It is simply not worth the risks.

Endnotes

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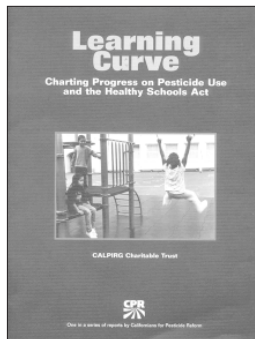
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Breast Cancer State of the Evidence: What Is the Connection Between Chemicals and Breast Cancer?

Edited by N. Evans (*Breast Cancer Fund and Breast Cancer Action, San Francisco CA, 2002*). Breast cancer rates have been dramatically rising since the 1940s. Although tremendous resources are spent on research, over 50 percent of all cases are unexplained. There is, however, mounting evidence that implicates over 85,000 synthetic chemicals used today. *Breast Cancer State of the Evidence* explores breast cancer proliferation, research, and evidence linking some of the most ubiquitous natural and synthetic chemicals to breast cancer. The report calls for the use of the Precautionary Principle where evidence of harm, rather than definitive proof, is the trigger for policy action.

Many of the products used everyday include chemicals that mimic the actions of estrogen and have the same cancer causing effects. Known as xenoestrogens these environmental chemicals exist in pesticides, fuels, plastics, detergents, and prescription drugs. In order to reduce these synthetic chemicals in the environment and in our bodies, the report recommends: i) phasing out synthetic toxic chemicals; ii) enacting laws that require companies to report amounts of chemicals used; iii) instating toxic-free government purchasing practices; iv) encouraging corporations to eliminate the use of harmful chemicals through financial incentives; and, v) establishing a breast milk monitoring program. *For a free copy of the report, contact The Breast Cancer Fund at 415-346-8223, info@breastcancerfund.org or download the report at http://www.breastcancerfund.org. nload at http://www.calpirg.org*



Learning Curve: Charting Progress on Pesticide Use and the Healthy Schools Act

C. McKendry (*California Public Interest Research Group Charitable Trust and Californians for Pesticide Reform, San Francisco CA, 2002*). One year after California's *Healthy Schools Act* reporting requirements were put in place, a new report by California Public Interest Research Group (CALPIRG) and Californians for Pesticide Reform (CPR) reveals that while many school districts are improving their pesticide policies, implementation of the Act has been inconsistent and many school districts are not in full

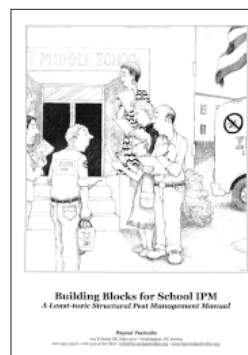
compliance with the law. *Learning Curve* also shows that the state's 15 largest school districts anticipate using pesticides with 54 different active ingredients, many of which are linked to childhood cancers, asthma and other serious health problems, compared with 42 just two years ago. "Because of the *Healthy Schools Act*, we now have a much better picture of pesticide use in California's schools," said report author Corina McKendry, CALPIRG's Pesticide Associate. "Parents and school officials can now take informed action to protect children's health and say no to toxic pesticides at schools." On the bright side, the report further finds that some have significantly improved their pest management practices. Oakland Unified has joined San Francisco Unified and Los Angeles Unified in passing a strong IPM policy that employs common sense, least toxic approaches to pest management, prioritizing children's health and saving money in

the long run. The *Healthy Schools Act*, which went into effect January 2001, requires schools to track and report on their pesticide use, including sending parents notification at the beginning of each school year listing every pesticide that schools in the district might use. Over eleven state laws, including California, also require schools to adopt IPM. *For a copy of the report (\$5.00), contact CPR at (415) 981-3939 or CALPIRG at (415) 206-9338 or dow*

Building Blocks for School IPM: A Least-toxic Structural Pest Management Manual

Edited by B. Crouse and K. Owens (*Beyond Pesticides, Washington DC 2002*). *Building Blocks for School IPM* promotes alternatives to the prevailing chemical-intensive practices by providing information on how to administer an integrated pest management (IPM) program in the school environment. IPM is a program of prevention, monitoring and control by focusing on eliminating or reducing sources of food, water and harborage for pests. It offers the opportunity to eliminate or drastically reduce pesticide use in schools, and to minimize the toxicity of and possible exposure to any products used.

The manual includes information on why schools should adopt IPM programs, how to develop and implement a program, pest management strategies to structural pests, including a practical guide to identifying, preventing and controlling common school pest problems, school IPM experts, a model policy and contract, a non- and least-toxic product guide and fact sheets on the toxicity of commonly used pesticides in schools. *For a copy (\$15 ppd), contact Beyond Pesticides at 202-543-5450 or order online at www.beyondpesticides.org.*



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"A picture is worth a thousand words."

On March 1, 2002, Beyond Pesticides launched a new web-based project that uses photography from people and organizations around the country to document hazardous pesticide practices and effective and safe pest management methods. Since its launch, the project, which links from a photo on the Beyond Pesticides homepage, has featured photos that include a healthy organic golf course, a mayor spraying for mosquitoes without protection and a house lined with "recycled" utility poles treated with toxic wood preservatives.

Send us your photos! To get your photo featured on one of the most popular pesticide reform websites, send a picture that captures a positive situation (like an organic farm or a pesticide-free school) or negative situation that needs public attention (like the most toxic looking utility pole or cropdusters flying over homes) along with a description of the photograph, identifying where it was taken, and a photo credit.



This photo of a wheelbug feasting on an Asian lady beetle, sent by Carol Kauscher of Cincinnati, OH, was featured as the April 5 Photo Story.

Email electronic photos to info@beyondpesticides.org, attention Photo Stories, in jpg, gif, or bmp format. If you send us a hard copy, the organization will be happy to return it upon request. Mail hard copies to: Photo Stories, Beyond Pesticides, 701 E Street, SE, Washington, DC 20003.

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