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About the Cover: The AMCA 2011 meeting logo was designed by Mark Denato, Art Director for Association Headquarters. The 77th Annual AMCA Meeting will be held March 20-24, 2011 at the Disneyland Hotel, Anaheim, CA.

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OUR ALL-CALIFORNIA ISSUE

This Spring issue of Wing Beats commemorates the accomplishments of California mosquito control and is being published to coincide with the 77th annual meeting of the American Mosquito Control Association, March 20-24, 2011 convening in Anaheim, CA.

With the assistance of Steve Mulligan, Consolidated Mosquito Abatement District, Selma CA, we invited mosquito researchers in the University of California system to submit manuscripts especially for this issue and received more than could be published in 44 pages. Others will follow in subsequent issues.

We invited the Fall family, founders of the California-based company BioQuip, to tell their family success story because of their excellent support of entomologists for decades.

We also invited the submission of the article on spinosad, the active ingredient in Natular™. Natular™ recently received the 2010 Presidential Green Chemistry Challenge Award, a prestigious EPA award of environmental significance that is a credit to our industry. The article we publish in this issue is the response to Wing Beats’ request for information on this award-winning product. It is co-authored by scientists from Dow AgroSciences and Clarke who participated in the development of the new larvicide.

The editors do not want to slight other deserving companies and industry partners, so this is an open invitation to tell us YOUR story. Send us a manuscript. We are not playing favorites! You write it; we’ll review it. That’s a promise! If you are a vendor at the AMCA annual meeting, talk with the authors of this editorial, who will be attending the meeting. We would be glad to work with you to get your story in print.

So, HOW do you get your story in print?

Keep reading!

INSTRUCTIONS FOR AUTHORS

The editors of Wing Beats acknowledge the varied background of authors and readers. Some articles may be scientifically technical, while others tell highly interesting, readable personal anecdotes or consist of a photo essay. We believe that our readers enjoy a variety of subjects and formats.

In order to facilitate publishing your article, the following suggestions are recommended:

• The article should be submitted as a Word document, in either DOC or DOCX format.
• Photographs, illustrations and graphs can be submitted in a variety of formats: BMP, GIF, EPS, JPEG, PDF, PNG, TIFF. Remember that a photo that looks great on your computer screen may not necessarily translate well to the printed page, especially if the image resolution is low or the document size is small. That’s why they’re called thumbnails. Also remember that your Editor can only work so much magic with the program Adobe Photoshop, and not one pixel more!
• Please do NOT submit your manuscript or your figures to the editor as a PowerPoint document (PPT or PPTX). The images are great for slides, but typically not suitable for publication.
• Give your article a title, one that is brief, but informative.
• The names of the author(s) should be included, along with title, professional association, mailing address, e-mail address, and phone number.
• Provide captions for all your photos, tables and graphs.
• E-mail your manuscripts to Wing Beats Managing Editor Jack Petersen: drijack3@hotmail.com.

From the Wing Beats Editors by Jack Petersen and Stephen Sickerman

INSTRUCTIONS FOR AUTHORS

The editors of Wing Beats acknowledge the varied background of authors and readers. Some articles may be scientifically technical, while others tell highly interesting, readable personal anecdotes or consist of a photo essay. We believe that our readers enjoy a variety of subjects and formats.

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BioQuip Products: a California Company by Louise Fall

As a mosquito control professional, you may be familiar with the name BioQuip. Perhaps you have visited the extensive exhibit of products at annual AMCA meetings. But here is some background about the company that you may not know.

This Southern California company was originally established in 1947. In 1956, Richard Fall, a student at UCLA, took over management, and shortly thereafter, ownership of what was then known as BioMetal Associates. It was located in a single garage and part of the bedroom in a small apartment. Innovative ideas and determination were the company’s only assets.

The year 1957 brought some progress – 500 square feet of rented space with room for a few tools, desk and filing cabinet. The company’s first catalog was prepared that year, printed in the home print shop of the late Jack Shanafelt, Orange County Vector Control District.

As the small business grew, it moved to larger quarters in Venice. In 1963, the company moved to El Segundo, where it was located for many years. During that period, the name was changed to BioQuip Products, which reflected more accurately the company’s purpose of producing and distributing equipment and supplies used by professional and amateur entomologists.

In 1987, the company purchased an industrial building in Gardena. By 2001, the need for additional manufacturing and warehousing space had become critical. An industrial building firm designed and constructed a facility in Rancho Dominguez that successfully combined space for manufacturing, office, warehousing, shipping, and retail sales. BioQuip moved into its beautiful new home in 2002.

BioQuip has always been a family owned and managed company. Some Wing Beats readers will remember Richard Fall, BioQuip’s General Manager for 44 years. Richard was deeply committed to vector control management, supportive and encouraging to students and professionals alike, and always eager to discuss, design and implement new or
improved product ideas. He hosted several BioQuip exhibits every year at annual conferences, but the AMCA meeting was his favorite venue for exhibiting products and talking to participants. Although Richard passed on in 2000, the company has remained committed to his vision of manufacturing and distributing superior and affordable products for entomology.

In 1960, Louise Fall, Richard’s wife, became a full-time employee. She was Office Manager, established a book department that now includes 1,600 in-print book titles, and has written the text for all the products, supplies, educational materials, and books described in the print catalog and on the web site. Louise became Operations Manager in the 1980s, and BioQuip’s CEO in the 1990s.

The company was indeed fortunate to have Louise and Richard’s sons, Chris and Ken, join its management team. They have been part of BioQuip since they were toddlers, sleeping in the family’s station wagon parked outside the office when their parents needed to go back to work in the evening. Both men are creative, experienced and committed to continuing the company’s mission. Although Louise remains President, Chris and Ken are now responsible for the BioQuip’s operations and management.

Christopher Fall is Vice President – General Manager. Chris wears many different hats, being CFO, overseeing the daily operations of the company, preparing ads for journal publications, and administering implementation of a new and complex custom-constructed computer system, to name a few.

Kenneth Fall is Vice President – Manufacturing. Ken also wears many hats. In addition to overseeing the Production Department, he spends time developing new, improved and custom products and the tooling to manufacture them, designs and constructs the display area for meeting exhibits, and is BioQuip’s Facilities Manager.
BioQuip has been committed to encouraging and supporting students since its earliest years. It has funded an annual Undergraduate Scholarship, currently $2,000, for over 40 years. The company also established the Richard P Fall Memorial Scholarship in 2000. Both scholarships are administered by The Entomological Foundation.

California vector management professionals have been extremely influential in helping BioQuip develop and improve many products widely used by control districts in the US and throughout the world. Listening and responding to their comments and suggestions is one of the primary benefits of attending annual national and regional mosquito control meetings.

During the banquet at a California Mosquito Control Association meeting in the early 1980s, Bob Washino, University of California, Davis, mentioned to Louise Fall that the points on feather-weight forceps were too wide for...
handling mosquitoes. Within the next year, featherweight forceps with narrow tips had been added to the product line. Thousands of these flexible, stainless steel forceps are sold each year.

By 1979, Don Rohe, California Department of Health Services, and Richard Fall, had worked together to design an effective EVS CO₂ mosquito trap. Modifications to the trap’s operation and efficiency have continued up to the present including improvements to the battery holder, trap housing, and fan suggested by Robert Cummings, Orange County Vector Control District.

In 1986, an improved version of the gravid mosquito trap originally designed by Paul Reitter, US Centers for Disease Control, was released with design improvements provided by Robert Cummings and Richard Fall.

In 2008, improvements by Ken Fall, to the LED array designed by Lee Cohnstadt and Leonard Munstermann, Yale University, for use in CDC traps resulted in a trap that features cutting-edge technology for sampling *Anopheles* mosquitoes, sand flies and black flies.

BioQuip’s history demonstrates that the American dream of building a successful small business is still possible in an age of overseas imports and multinational corporations. The support of vector control professionals and their districts has been a major factor in its success.

Southern California boasts a large number of attractions for visitors. If you’re attending the AMCA meeting, there’s another attraction you may want to add to your list of places to visit: BioQuip’s showroom, open Monday through Friday from 8:00 to 5:00. It’s only 30 to 45 minutes from Anaheim. Map and directions will be available at BioQuip’s exhibit.

The Fall family and BioQuip sincerely appreciate the support of the vector control community demonstrated over the past 50 years.

![Figure 10: BioQuip Showroom during 2010 Open House.](image)
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We may be familiar with the fact that 5 species of malaria parasites (*Plasmodium*) cause considerable human morbidity and mortality in many tropical and sub tropical regions of our world. However, almost nothing is known about the natural history and impact of several hundred other *Plasmodium* species and strains vectored by mosquitoes and other hematophagous invertebrates on birds, frogs and reptiles. *Plasmodium relictum*, observed in the mosquito *Culex quinquefasciatus* Say by Ronald Ross in 1897, was the first malaria parasite for which the complete life cycle was elucidated (Ross. 1911). It has caused extinctions and devastating declines in island bird populations. Classical examples include the decline of native forest dwelling honeycreepers below 1,200 m on the Hawaiian Islands when *P relictum*-infected *Cx quinquefasciatus* were unintentionally introduced (Atkinson et al. 2000). Island bird populations are especially vulnerable to pathogen introductions due to the lack of an immune response necessary to properly fight off infections since they are geographically isolated from the mainland and have never been exposed to such pathogens.

Since the devastating decline of avian populations in Hawaii, efforts have begun to monitor avian populations of other islands, such as the Galápagos Islands. There is a total of three mosquito species currently inhabiting the Galápagos Islands: *Cx quinquefasciatus*, *Aedes taeniorhynchus* Wiedemann, and *Ae aegypti* L. All three species of mosquitoes are known vectors of disease agents affecting wildlife and a concern for all endemic wildlife of these islands (Bataille et al. 2009).

In collaboration with investigators from San Francisco State University and Instituto de Ecología, Mexico, we recently conducted work on Socorro Island, an island in the Pacific Ocean approximately 700 km west of the port city of Manzanillo, Colima, México. Socorro Island is one of four volcanic islands.
To increase the probability of a successful reintroduction of the Socorro dove, all possible threats have to be considered, including pathogens that may be present on the island. This motivated us to find out if avian malaria occurs in mosquitoes and birds on the island; see Figures 1 and 2. None of the birds examined to-date tested positive for Plasmodium parasites but 11 Plasmodium strains were isolated from multiple pools of *Ae. taeniorhynchus* (very abundant along the coastline) and a single pool of *Cx. quinquefasciatus* (a few of which were collected in the vicinity of the Mexican Navy barracks). At least 10 of the Plasmodium strains isolated are known to infect birds. Interestingly, some of the strains that make up the Revillagigedo Archipelago Biosphere Reserve. It shares several biogeographical attributes with the Galápagos Islands, including a high degree of biotic endemcity. Birds, a few reptiles and no endemic mammals inhabit the island. Apart from multiple migrant sea birds, eight endemic terrestrial birds (yellow-crowned night heron *Nyctanassa violacea gravirostris*, Socorro red-tailed hawk *Buteo ja-
maicensis socorroensis*, Socorro ground dove *Columbina passe-
rina socorroensis*, green parakeet *Aratinga holochlorae brevipes*, Socorro wren *Thryomanes sissoni*, Socorro mockingbird *Mimodes graysoni*, tropical parula *Parula pitiayumi graysoni*, and Socorro towhee *Pipilo erythrophthalmus socorroensis*) and two introduced breeding species: the mourning dove *Zenaida macroura* (introduced in around 1978) and the northern mockingbird *Mimus poly-
gloittos* currently inhabit the island. Unfortunately, two endemic birds have gone extinct, the Socorro dove *Zenaida graysoni* and the elf owl *Micrathene whitneyi graysoni* (Rodriguez-Estrella et al. 1996). Before the Socorro doves were completely exterminated, captive populations of these birds were established in several European zoological gardens and an attempt to reintroduce these birds to the island is underway as a collaborative effort between the Island Endemics Foundation and the Mexican Navy (Martínez-Gómez et al. 2010).
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from Socorro were closely related to those found in Africa.

Our efforts are not confined to the Socorro Island as we are investigating jointly with many investigators from UCLA, UC Berkeley, SFSU, Institute of Ecology (Vilnius University of Akademijos, Lithuania), Station d’Ecologie Expérimentale du CNRS (France) and Center for Ecology & Conservation, School of BioSciences University of Exeter (UK) the roles of culicine mosquitoes in the transmission of avian malaria in Cameroon. Our objective is to understand the infection and transmission cycles of *Plasmodium* in birds and mosquitoes that inhabit deforested and forested areas; see Figure 3. To date we have discovered that species of *Coquillettidia* are major vectors of many avian *Plasmodium* strains and species (Njabo et al. 2009) and mosquitoes within the genera *Mansonia*; see Figures 4 and 5. *Aedes (Neomelaniconion)* and *Culex (Culex)* are also often infected; see Figure 6.

Global warming, deforestation, and rapidly expanding agricultural and semi urban settings are also affecting distribution of mosquito species and the pathogens that they transmit. Consequently, wildlife are being exposed to new pathogens by invading mosquito species that are more opportunistic feeders and act as bridges carrying diseases from one vertebrate species to another. This is quite a dynamic field of science of which, quite frankly, we have only begun to scratch the surface. An area of research that we think could turn out to be quite rewarding is investigating the use of mosquitoes as bio-indicators. Most mosquito species are quite restricted in their mating behaviors and distribution and so as we observe change of habitat and hosts we should also observe changing patterns of mosquito diversity. For example, *Culex*
molestus mates underground while Cx quinquefasciatus mates above-ground, but in confined spaces. To examine changes in mosquito diversity we have to ensure we are able to efficiently capture the diversity of mosquito species. Unfortunately our trapping methods need much work, particularly for those species with narrow host and habitat ranges which are species most likely to be the affected by environmental changes. Avian malaria and other pathogens are spreading worldwide and mosquito abatement to curb mosquito populations to save birds and other wildlife may become an important aspect as we endeavor to maintain vertebrate species diversity in our changing world.

REFERENCES CITED


Using shot gun sequencing techniques, the Broad Institute and the J Craig Venter Institute published the assemblage of the 579 million base pair *Culex quinquefasciatus* genome that encodes for 18,883 genes (Arensburger et al. 2010); see Figure 1. The *Culex quinquefasciatus* genome is almost twice as large as that of the major Sub Saharan Africa malaria vector *Anopheles gambiae* (278 million nucleotides encoding 12,457 genes) and half the size of the dengue virus vector *Aedes aegypti* (1380 million nucleotides encoding 15,419 genes). However, despite the smaller size than that of *Ae aegypti*, the *Cx quinquefasciatus* genome encodes significantly more genes than the other two medically important species. The increased number of gene families may explain why *Cx quinquefasciatus* and its sister nominal species *Cx pipiens*, which likely has a similarly high number of genes, has so successfully spread to all rural and above ground and below ground cosmopolitan areas on all continents except Antarctica. Through the use of comparative genomics, we can now compare the *Cx quinquefasciatus* genome with the *An gambiae* and *Ae aegypti* genomes, sequenced in 2002 and 2007, respectively. We can use these genomes to find similarities among mosquitoes that distinguish them from other flies, and those unique differences that define each genus.

From a more operational and mosquito control perspective, access to a full genome sequence will also help immensely. When it became evident that members of the *Cx pipiens* complex are major vectors of West Nile virus in North America their status elevated from being considered a nuisance to a major disease vector heightening more concerted and focused control efforts. Efficient control obviously requires thorough knowledge of the biology to target appropriate stages, breeding and resting sites and the availability and implementation of control tools. It was soon discovered in Central California that control was more easily said than done for multiple reasons. When population monitoring tools, particularly in urban areas, were switched from EVS and CDC traps to gravid traps, populations were found to be larger in urban environments than originally thought. Predominant larval sites, particularly in rural agricultural areas, have still not been fully identified and dispersal behaviors between small

Photo by A J Cornel

**Figure 1:** *Culex quinquefasciatus* from Johannesburg colony (from which specimens were full genome sequenced) feeding on finger.
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towns and surrounding rural areas are also not well understood. Over and above these behavioral issues adulticiding efficacies in agricultural settings have been compromised because of resistance to pyrethroids. Targeted approaches to find aspects of the Culex and other mosquito genes and biochemistry to help with the discovery of alternative environmentally safe insecticides with unique modes of action are clearly needed to increase our arsenal of chemicals available for control.

Our recent investigations using the full genome sequence as the foundation for finding genetic markers revealed that the genomes of members of the complex in California are highly polymorphic even among specimens collected in close proximity. These polymorphisms will serve as excellent genetic markers to examine gene flow and dispersal of these mosquitoes. Detailed studies examining dispersal between rural vs urban and above vs below ground environs are now feasible. All of these studies will ultimately enable us to make improved recommendations for effective control.

Much progress has been made in understanding chemoreception in mosquitoes and we can credit these breakthroughs to the availability of mosquito genomes. Recent noteworthy contributions in this field lead by UC Davis investigators include a better understanding of chemoreception and repellent action of DEET in Cx quinquefasciatus (Syed and Leal 2008) and design of effective trap and kill oviposition traps for Cx quinquefasciatus (Barbosa et al. 2010).

These are just a few examples of how genomes have and will be used to improve our overall understanding of mosquito biology that would lead to developing better technologies to control mosquitoes whether chemically or genetically based.

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Recent articles in Wing Beats by Joe Conlon have lamented the fact that few products are available in our industry, and older chemistries and products are under severe regulatory pressures. New, effective and reliable control products are desperately needed to meet the needs of industry professionals.

The story of the discovery and development of spinosad as a mosquito larvicide is one that goes back to 1982 – and stretches from the United States to a small Caribbean island. Both luck and skill play a large part in the story.

Dr John Mynderse was a chemist with the Eli Lilly Company ... and he needed a vacation. So he headed to the sun-drenched beaches of the Caribbean. However, John was a bit of a workaholic and so rather than spending his entire vacation sipping fruity beverages, he indulged himself. Dr Mynderse had a real passion: the collection of soil samples from odd places. His goal (and hope) was that he would discover pharmaceutical chemicals produced by soil microorganisms that would ultimately be useful in the treatment of human disease.

Soil sample collections accompanied Dr Mynderse home from many trips where they would subsequently be screened in the laboratories of Eli Lilly Co, Indianapolis, IN. On this particular occasion, John’s Caribbean vacation – and professional diligence – proved extremely lucky. A sample taken at random from the soil surrounding an abandoned rum distillery yielded an incredible find: a previously unknown, spiny soil-dwelling microorganism (an actinomycete – much like a bacterium), subsequently named Saccharopolyspora spinosa.

It took many years to confirm the actinomycete’s biological properties, as it had to be cultured many times and the different extracts tested against a wide range of human and agricultural pest targets. Once the insecticidal activity was confirmed, the active components had to be isolated. From there, strains had to be improved and culture conditions optimized to produce spinosad.

This took place only after the soil sample collected by Dr Mynderse was transferred, along with the entire spinosad project, to Dow AgroSciences (DAS), formerly Dow-Elanco, as part of a merger between Elanco of Eli Lilly Co and Dow Chemical in 1989.

While the spinosad project looked promising, an immense challenge lay ahead. The insecticidal properties of spinosad were further delineated, including the vital role of spinosyns A and D. Evaluating efficacy, safety, and additional

Figure 1: The abandoned Caribbean rum distillery, where the soil sample containing spinosad was discovered in 1982.
strains and fermentation conditions that would produce economical quantities followed. Even then, spinosad for mosquito control almost did not happen!

At that time DAS was primarily an agricultural chemical company focused on the development of products for crop markets with little experience with public health pests like mosquitoes. Despite the fact that during insecticidal screening spinosad had proven to be effective versus mosquitoes, neither the insect nor the market was pursued.

Instead, DAS focused efforts to ensure spinosad’s place as one of the world’s most successful crop protection agents.

DAS spinosad-based agricultural products have been available since the first US EPA registration was achieved in 1997. These products continue to be used successfully for the control of crop pests in more than 73 countries. In 1999, spinosad was awarded the prestigious “Presidential Green Chemistry Challenge Award” for, in large part, its favorable environmental profile.

The overwhelming bulk of responsibility associated with this development fell to Clarke’s Product Development Department, headed by Dr Mike Willis. A veteran of tours of duty since 1984 with the likes of American Cyanamid, Aventis, BASF and Bayer, Mike’s team was further tasked with “...developing six new larvicide formulations, all defined as organic.” No small task.

As Mike explains it, among the challenges faced, was determining “the impact of the physical properties of spinosad on biological efficacy, and delivering it in the most efficacious way for mosquito control.” To that end, the group researched and “looked at implementing formulation technology that did not exist in public health, and delivering that technology to mosquito control.”

Spinosad had previously been recognized as an organic product by the Organic Materials Review Institute (OMRI). To develop organic larvicide formulations using spinosad as the active ingredient was only half the battle - - actually only 0.5 to 20% of the battle, but that’s jumping ahead in the story.

Marie Saunders, Clarke’s Chief Formulation Scientist, had some tall mountains to climb over the years, having spent nearly 30 years at the formulation bench working on a wide array of chemistries including insect growth regulators. From her perspective the biggest challenge was “finding inert ingredients that were already on the OMRI
approved list” and to do so “…across six formulations, all with different carrier properties, from corn cob to sand to tablets.” Again, no small task.

In 2008, six years and countless thousands of hours later, six new mosquito larvicide formulations received US EPA registration. These spinosad-based formulations were collectively given the trade name Natular™. Two of the six products were designed for single brood applications, and the remaining four developed as multi-brood, extended-release formulations. One is specifically designed for use outside the US in potable water sites, and as such, it is not subject to OMRI listing. The other five domestic formulations are OMRI listed and can be used to control mosquitoes in organic production sites.

Marie is particularly proud of the tableted formulations, which evidence the desire of the group to bring new technology to our control community. She explains “The challenge of developing an organic pharmaceutical grade formulation, and then finding the equipment to actually create a pharmaceutical grade tablet …all the while making an extended release product that would last as labeled, but not persist in the environment … it’s one of the biggest highlights of my career.”

She goes on “You start at the bench, and by hand – through the challenges and early failures – ultimately scale up to commercialization and a point where eventually millions of tablets will be manufactured in an organic facility. Well, it’s such a point of pride.”

Spinosad represents the first new active ingredient for use as a mosquito larvicide in more than 20 years. Because of its unique mode of action, and the fact that it represents an entirely new class of chemistry, spinosad should control mosquito populations that have demonstrated resistance to other chemicals, or other chemical classes, highlighting spinosad’s utility as a rotational larvicide.

This has been demonstrated across the US since 2008, when blind trials facilitated by Dr David Dame were performed in California, Florida...
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and Minnesota, at Merced County Mosquito Abatement District, Florida Keys Mosquito Control District and Metropolitan Mosquito Control District, respectively. The results achieved through the efforts of these cooperating districts initiated the process of operational validation of spinosad’s effectiveness for mosquito control.

That validation process has continued over the past two years. The integration of the Natular™ spinosad-based formulations into organized control and surveillance Integrated Mosquito Management (IMM) programs has provided insightful and invaluable information on this new active’s ability to eliminate mosquito production and mitigate disease transmission.

This past summer Clarke was awarded the US EPA’s Presidential Green Chemistry Challenge Award for its Natular™ formulations. The award recognizes “outstanding chemical technologies that incorporate the principles of green chemistry into chemical design, manufacture and use, and that have been, or can be, utilized by industry in achieving their pollution prevention goals.”

At a time when IMM programs are being challenged by both the potential elimination of older chemistries used for mosquito control and increased oversight by regulatory agencies, the importance of the addition of spinosad as a rotational larvicide for use in public health cannot be overstated. It also appears that there is still room for both luck and skill in the discovery and development of new, environmentally-friendly products for larval mosquito control.
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Chris Pederson,
Outside Sales Consultant

My customers always come first. We work together as a team to accomplish the same end goal: to deliver a quality product when you need it. It’s a good feeling to know that I play a part in keeping customers’ operations running smoothly.

Wendy Decorah,
Customer Service & Inside Sales

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TJ Leibee, Service Team Member

Do you fear you don’t have sufficient documentation in the event your operation was sued?

Derek Wright, National Technology Manager

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How are your outreach programs... do they feel stale? Are you tired of talking about the same thing over and over again? Or are you trying to increase visibility in your local schools?

We all wrestle with how to provide students with important information in a way that stimulates their desire to learn. And we are constantly challenged to find ways to help teachers incorporate our programs into their already tight schedules.

With an increased focus on improving standardized test scores driven by the No Child Left Behind (NCLB) Act of 2001, teachers are losing the flexibility, the creativity, and the ingenuity to inspire their students. Practically every minute of every day is strictly accounted. Lessons honing bubble-marking skills and remedial ‘three R’s’ have replaced music, art and science. Even with severe budgetary deficiencies, schools have difficulty taking advantage of free public health outreach programs.

And if these challenges weren’t enough, California has recently passed legislation requiring the new Education and the Environment Initiative (EEI) Curriculum for grades K-12 that must be incorporated into the current state standards. If you think you’ve been spared, think again... this curriculum is poised to become a national model.

At the San Gabriel Valley Mosquito & Vector Control District (SGVMVCD), we experienced a sharp decline in the number of outreach requests we received after NCLB was implemented. And with the exception of 2004 when we experienced our first West Nile virus epidemic in southern California, requests remained low until we made drastic changes in our outreach programs and embraced these challenges. Aligning our programs to State standards and, more recently, the EEI curriculum, was a win-win situation for both the District and for schools.

But we still felt there was something significant lacking. When we visited a classroom, we were severely limited by the time available to us and the amount of materials we could provide. Inviting students out for a field trip was better, but was disruptive to our work routine and did not provide students with the freedom to truly explore and learn.

Take a few moments to think back to your elementary years... what do you remember the most - besides recess? For me, it was the field trips, and these are now practically a thing of the past. This is truly unfortunate, because the lessons learned by stepping outside of the classroom, are the ones students really remember!

At SGVMVCD we think we’ve found a solution: The Ecologically Sustainable Methods and Research Training Laboratory, aka the EcoSMART Lab. We’re creating a dedicated space at our facilities where we will be able to host up to 60 students at a time. The EcoSMART Lab will provide public health education in a sound ecological context, and use technology and innovative student-led learning to build the connections and train future leaders.
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OUR VISION

- Provide a unique, high-tech and interactive field trip experience with busing assistance.

- Give students a comprehensive understanding of our environment – from the geologic forces that created it to the smallest critters that inhabit it.

- Teach vector ecology in its broader context showing how public policies and individual choice influence ecological balance and public health.

- Partner with other agencies and businesses to bring ‘all the pieces together’ (habitat, water, public works, conservation, economics, etc) and satisfy our joint outreach goals.

- Provide dedicated laboratory space for student-led research and service learning projects to help encourage those interested in the field of vector control.

Our Living River will recreate the upper reaches of the watershed while the River in the City will show the fate and impact of storm flows and residential runoff on the ecology of the San Gabriel River and on public health. There is an unknown world living underneath our urban streets. We’ll give kids a glimpse into this realm and demonstrate how urbanization and low impact development (LID) storm water management standards, if not designed and managed carefully, can actually increase mosquito populations and disease risks above historic levels.

An interactive native tree will demonstrate the ecological web of life inexorably linking species together and show what happens when diversity is threatened. As recent research has revealed, a loss of diversity increases the risk of vector-borne diseases. We will teach about the history of vector-borne disease in California, bringing a new and exciting twist to the current ‘gold rush’ curriculum. All of this can be accomplished while addressing State standards and EEI objectives. This facility will give students the opportunity to use scientific tools, technical equipment, and teamwork to solve real-life problems.

New and emerging public health concerns driven by changing climate patterns and our globalized economy make the likelihood of introduction of new vectors and vector-borne disease very real. With nearly 70% of emerging diseases being zoonotic in nature, bridging this critical gap between the natural world and human existence in the minds of our youth must happen. They will be the decision-makers ten years from now and this is our window of opportunity.

We hope this facility will put vector control on the radar as a positive force for maintaining healthy environments. Districts across the US work hard to minimize negative impacts from vector control activities, yet we are still viewed as indiscriminate pesticide...
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Pete Torell
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applicators. It’s time to change this stereotype and highlight the great strides we have made managing vectors of public health concern from an ecological perspective.

We have some exciting dreams, but creating such a facility will not come cheaply. Our budget for this project is approximately $750,000 and securing grant funding for a brick and mortar project has proven difficult. With an initial donation from the City of Industry Manufacturers Council, we have hired a grant writer, grant notification services, and an architectural firm to help us design this space and create the construction documents. We have applied for several grants, and while they have thus far been unsuccessful, we have hopes that our current application for a Nature Education Facilities Grant through California State Parks will garner success. We are also reaching out to community partners (governmental agencies and businesses) for materials, display elements, programmatic assistance, and construction funds.

Our facility will be built using Leadership in Energy and Environmental Design (LEED) strategies and serve by example, and through curriculum, to demonstrate how individual choice can make a difference. We are eager to get this project moving and hope it will inspire others to ‘think outside the box’ when it comes to teaching vector biology in their community.


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Public Information Officer
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San Gabriel Valley Mosquito and Vector Control District
1145 N Azusa Canyon Road
West Covina, CA 91790
626-814-9466
As the day of reckoning regarding mosquito control activity compliance with the Clean Water Act (CWA) permitting requirements draws near, it is well to review the potential points of contention for the various sides where litigation is to be expected. An insight into the rationales that may drive any upcoming lawsuits involving mosquito control districts can be found in the comments activist groups submitted to the public docket regarding the Pesticide General Permit (PGP). Indeed, Charlie Tebbutt, who litigated the Talent Irrigation, Gem County and National Cotton Council cases for environmentalist clients, stated recently “…any potential challenge will be a test of how well EPA responds to our very clear and direct comments.”

Let’s take a look at some of the comments to see from what mindsets these challenges might come. You might notice, as I did, that the majority of these comments conform, to some degree, to the current administration’s foundational principles of regulation based on 1) Transparency, 2) The Rule of Law, and 3) Sound Science. These are most laudable principles and our profession fully supports them. Furthermore, it will be exceedingly difficult to successfully defend mosquito control practices that aren’t conceived and executed with these principles in mind. The problems, however, truly begin in their implementation – for the devil is in the details, so to speak.

The major environmental groups commenting included:

- Center for Biological Diversity
- Pace Environmental Litigation Clinic
- National Environmental Law Center
- San Francisco Baykeeper
- Massachusetts Audubon Society
- Beyond Pesticides
- Earth Care Ministry
- Environmental Law and Policy Center, plus The Sierra Club
- Pesticide Watch Education Fund
- Advocates for the West
- Farmworker Justice
- US Department of the Interior, Office of Environmental Policy and Compliance
- Stern Shapiro Weissberg & Garin LLP

**COMMENTS ON THE SCOPE OF THE PGP**

Activist groups made a number of observations regarding jurisdictional problems they saw in the PGP. The first of these, “EPA should reject any assertions that the amounts reaching water should be treated as de minimis, as most of these aerial pesticides have specific FIFRA labeling forbidding any discharge to water…” conforms to the language of the Clean Water Act and hence lies within the intent of the “rule of law” provision. To my knowledge, the statute does not recognize de minimis deposition as being acceptable. Thus, our argument could be considered moot if the CWA is enforced as written.

Other comments were of a more nefarious nature. A coalition of groups, National Environmental Law Center, Environment America, San Francisco Baykeeper, Washington Toxics Coalition, Missouri Coalition for the Environment, Association to Preserve Cape Cod, Westport River Watershed Alliance, Ipswich River Watershed Association, Jones River Watershed Association, Merrimack River Watershed Council, Berkshire Environmental Action Team, and Massachusetts Watershed Coalition stated that, “Subtle effects of pesticides may endanger life processes without demonstrating immediate toxic effects…” and “Discharges of pesticides containing a known or suspected human carcinogen or endocrine disruptor should also be excluded from coverage under the general permit.”

The qualifiers used in these comments are extraordinarily ambiguous and would provide great fodder for litigation. “Subtle,” “without immediate toxic effects” and “suspected” are open to a great deal of interpretive uncertainty – the kind upon which trial lawyers thrive.

**NOTICE OF INTENT**

The coalition of environmental groups noted above also commented that, “In situations where an NOI is required, EPA should allow meaningful input from concerned members of the public before any discharge occurs. Most applications of pesticides occur at fairly regular, predictable intervals (especially those, such as mosquito spraying and aquatic weed control, that are likely to be the most controversial). For such applications, a 30-day comment period is surely achievable (at least absent emergency conditions), and would certainly yield more robust public feedback.”

In terms of the transparency principle, this would be hard to argue against. Why shouldn’t the public have input into the decisions to spray pesticides in their vicinity?
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This certainly sounds reasonable on the surface, but we know how problematic this would become in extremely short order. The validity and reliability of the input would likely be questionable on any number of levels and result in delays that would effectively compromise entire programs. In addition, the notion of mosquito control operations being predictable reveals a profound misunderstanding of integrated mosquito management.

“Instead, EPA should set clear, scientifically-derived guidelines for the establishment of ‘action thresholds’ allowing pesticide use for each of the four use categories.”

How do you derive the computation of action thresholds from science? Each community should establish their own based on criteria that the taxpayers stipulate. The federal government has no business dictating mosquito tolerance to communities.

DISCHARGES TO IMPAIRED WATERS

“EPA should clarify that the “pollutants” regulated by the draft permit include all inert ingredients.”

We knew that this would be coming eventually.

“EPA should exclude from coverage under the general permit all discharges to waters that are impaired generally for “pesticides,” are impaired for substances known to exacerbate the harmful effects of pesticides, and/or are impaired by any constituent of the pesticide being discharged.”

This does not exclude individual permitting for the substances in question, but could prevent us from providing a valuable public health service based on impairments brought about by homeowner pesticide applications.

MONITORING

“In addition to any specified high-risk pesticides, EPA should require post-application ambient monitoring for any pesticide discharges that are made on a scheduled, programmatic basis by government agencies (such as annual springtime mosquito spraying by local vector control districts). These discharges are wholly predictable, and such monitoring thus can generally be made a part of the routine planning and budgetary process. Moreover, agencies generally should have (or have the wherewithal to obtain) the financial resources and expertise to perform such monitoring.”

Here we are back to the “predictability” problem. Also note that the activists seem to think that you have (or ought to have) access to limitless funds to conduct water testing that would provide little or no meaningful data beyond that already known through the registration process. Their ignorance regarding all facets of our operations is truly startling.

I lumped all of these into a single section because they call upon EPA to usurp our best professional judgment in conducting our operations. Notwithstanding the tacit attempt to commandeer our programs that the entire permitting process represents, I find these recommendations particularly professionally insulting because they assume that mosquito control professionals would knowingly choose the least environmentally-friendly option unless forced to do the right thing by a beneficent federal government. To their credit, EPA has made no indication that they would follow this path and it’s unlikely that they would do so. Nonetheless, be aware that lawsuits might spring from an activist sentiment that a central controlling authority should dictate the availability and use of control methodologies.

“EPA should require the use of the least toxic alternative (or require that non-toxic methods of pest control be tried first), and set objective standards for when pesticide use is allowed.”

This was a common theme
throughout the docket comments and would likely resonate with a great deal of the citizenry who don’t consider programmatic mosquito control to be of much innate worth. Many evidently continue to believe that we default to the most toxic pesticides available because, well…that’s just the way we do things. The fact that there may be valid reasons for our control choices seems never to occur to them.

EMERGENCIES

“The circumstance constituting such an ‘emergency’ should be determined only by an environmental agency with the proper institutional authority to make such a determination – it should not be determined by a government agency with no primary mandate to protect the environment, and certainly never by the applicator.”

The arrogance of this statement is revealing – and stunning in its implications. It does, however, emphasize the principle that “emergencies” should be invoked with care.

“EPA should ensure that whatever administrative processes led to the ‘emergency’ declaration were subject to adequate public notice and comment protections, and specify that a permit violation occurs when such a declaration is invalidated (by the agency or a court) after the fact.”

Actions involving professional judgment that can be adjudicated after the fact in court are particularly worrisome and allow for significant judicial mischief and costs. Although this type of action should be assumed as a potential, codifying it into the permit is frightening in its implications.

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Job Description: The director will be responsible for the management of a mosquito control program that encompasses the entire Florida Keys and extends from Key West to North Key Largo, a distance of approximately 120 miles and 90 islands. The District has an operating budget of approximately $10,000,000, 85 full-time and 25 part-time employees. The District is surrounded by the Florida Keys National Marine Sanctuary and encompasses eight state parks, the Key West National Wildlife Refuge, Great White Heron National Wildlife Refuge, Key Deer National Wildlife Refuge and the Crocodile Lake National Wildlife Refuge. The director must be able to maintain a close working relationship with local, state and federal agencies that may, in some way, have over-sight authority or be able to assist in the enhancement of certain aspects of the overall mosquito control program. This is especially applicable when it involves control operations in environmentally sensitive areas such as wilderness lands. The Florida Keys Mosquito Control District is an independent taxing authority and is governed by a board of five elected commissioners which will determine the suitability of the applicant and to which the director reports to directly.
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[Contact Information]
It would be patently obvious to anyone involved with mosquito control that this is completely unworkable on many levels. Yet, it makes some sense and its lack would be embarrassingly difficult to defend in court. We might all want to think about how we would successfully address this under oath.

“Where local residents find a given PDMP to be insufficiently thought through, these affected persons should be given the opportunity to convince EPA to impose tougher restrictions, or to disallow the pesticide discharge altogether.”

This type of mentality provides great fodder for the media. If your expertise isn’t assumed, all manner of mischief can be brought to bear by a sufficiently motivated plaintiff.

**ADVERSE EVENT REPORTING**

“EPA should not rely on an applicator’s lay assessment (as persons not studied in aquatic toxicology or zoology) as to whether an observed condition qualifies as a ‘toxic’ effect.”

Here is a clear window into the activist mindset. To paraphrase a recommendation in the old Army Cavalry Officer’s manual, the activists regard us as stupid, but cunning – and bear watching at all times. To be sure, we should be conducting activities in such a way that the absurdity of such a mindset is manifest. Take every opportunity to invite activist groups to your facilities to witness firsthand the science brought to bear in the control of mosquitoes. The vast majority, of course, will not take you up on your offer because they wouldn’t want to acknowledge that there’s much more to effective mosquito control than merely randomly spraying toxins into the environment. In the end, this willful ignorance allows them to confidently make outrageous (and factually incorrect) claims with the sincerity required to convince the easily manipulated.

I could easily have written many more pages outlining the vulnerabilities in the permitting process that the activists intend to exploit – but I think you get the point. It may come to pass that none of these comments are litigated. It’s possible, but I think unlikely. If the activist end game is to cripple or eliminate mosquito control activities, the Clean Water Act, as a hazard-based statute, provides a worthy vehicle. At a minimum, these comments should mobilize a sustained effort by the vector control community to prepare to answer these types of questions in a positive context to the citizenry and in legal defense. It won’t do to merely state that we know best – end of story. We need to be ready to proudly and unequivocally defend our practices to a public that gets their knowledge base from media sound bites and sundry internet bilge.

Until a solid legislative fix can be obtained, we’re in the unenviable position of counting on the good graces of the Agency and the courts to allow us to continue protecting the public. To the extent EPA realistically accommodates our needs, they set the table for myriad lawsuits. The activist plaintiffs in these lawsuits may not win, but the costs of continually defending yourselves in court would be prohibitive – and don’t think the activists don’t know this. On the other hand, our efforts to comply with the ruling compromise the rationale underlying a legislative solution via CWA amendment. It’s a conundrum with which we must deal in the most constructive manner possible. As a legislative fix isn’t likely in the near future, we should begin sowing the seeds for when the time is ripe. This entails continually contacting your legislators and making your case. The more they know about your operations and the nature of the threat that this permitting system poses to your capability to protect the voters of your/their jurisdiction, the more likely a decisive fix can eventually be obtained. You can rest assured that the AMCA will be doing its best to seek an equitable solution and will be asking your support with this critical process.

I have to end this with a quote from a comment posted by the Californians For Alternatives to Toxics to the NPDES docket. In a demonstration of breathtaking irony evidently lost on the authors, they stated that, “Here we find EPA close to admitting that FIFRA rules, and damn CWA or ESA! The public can only wonder why applicators should have to bother with a permit when the FIFRA labeling requirements seem to be covering all the bases already.”

I couldn’t have said it better myself.
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**Company Announcement:**
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