2005-2010

Mosquito Control — Retrospective Report

SOUTHERN NEVADA HEALTH DISTRICT
ENVIRONMENTAL HEALTH DIVISION | VECTOR CONTROL PROGRAM

West Nile virus (WNV), a mosquito borne disease, was first identified in the mosquito and human populations of Clark County in 2004. As a result of this emerging public health threat, mosquito control and surveillance responsibilities were transferred from Clark County to the Southern Nevada Health District through an interlocal agreement in July 2005. The five-year agreement, which expired in July 2010, provided the health district with funding to develop a Vector Control office capable of abating mosquito breeding sources using public health statutes and utilizing federal grant funding for mosquito disease surveillance. The health district's ability to couple mosquito control activities with WNV disease surveillance across Clark County provided the community with a single point of contact.

Since July 2004, the Office of Epidemiology has conducted 101 investigations relating to West Nile virus. Of those 101 investigations, 49 were confirmed cases of West Nile fever or West Nile neuroinvasive disease; 12 were probable cases; 26 were presumptively viremic blood donors with no symptoms; and 14 were not cases. There was one fatality out of the 61 cases with clinical illness.

This report describes the efforts of Southern Nevada Health District's Vector Control office to manage and develop mosquito control and disease surveillance activities in Clark County during the five-year existence of the interlocal agreement.

Mosquito Control

The principal goal of the health district's mosquito control program is to use an integrated pest management approach to eliminate or reduce mosquito breeding habitats. Environmental management, to eliminate the breeding source, is the first course of action, followed by placing mosquito fish in appropriate breeding habitats. If neither of these options is feasible or effective, staff treats the mosquito breeding areas with chemical or biological insecticides. The insecticides used to control mosquitoes are registered by the EPA and are carefully chosen for larviciding and adulticiding applications. Mosquito adulticiding is not a routine activity and is conducted to control biting mosquitoes in areas where larviciding is impractical to control the population.

Seventeen species of mosquitoes live in Clark County, of which 10 are known to be vectors of disease. In Clark County the peak mosquito breeding season is generally April through October, but with moderate winter temperatures, several of these mosquito species can breed year round or during the winter as adults.

Citizen Complaints of Mosquito Breeding

A major component of urban mosquito control efforts is abandoned residential swimming pools. According to RealtyTrac, Nevada had the highest foreclosure rate in the nation for almost 4 years. In fact, during the third quarter of 2010, one in every 29 homes received a foreclosure filing, which is almost five times the national average.

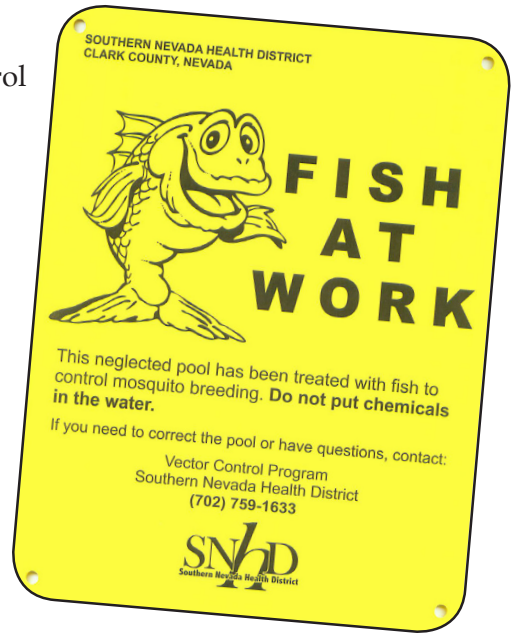
The impact of the foreclosure crisis on mosquito control was evident with the staggering increase of stagnant swimming pool complaints at abandoned homes. In 2006, the first full calendar year of mosquito control, staff responded to 1,046 citizen complaints of residential mosquito breeding sites; in 2008, the number rocketed to 2,854. The dramatic 173 percent increase created a significant challenge to staff and was a driving force behind programmatic direction including breeding source treatments, recovery of abatement costs, development of legislation, and management of citizen complaints. Since implementing the stagnant swimming pool response program in 2005, staff has responded to 10,626 citizen complaints.

Stagnant Pool Treatment Methodology

Prior to 2007, all stagnant pools were treated primarily with formulations of Altosid, a growth regulating hormone, which provided up to 90 days of mosquito control. Although effective, this treatment method cost an average of $50 per swimming pool. To save costs, Vector Control modified the treatment strategy to utilize microbial larvicides, surfactants, and mosquito fish (*Gambusia affinis*).

Mosquito fish, which are abundant in the wash channels of Clark County, were harvested, transported to the health district and maintained in 100 gallon holding tanks for staff to take into the field. Once introduced in stagnant pools, 'Fish at Work' signs were posted to inform neighbors of the treatment and to discourage introduction of household chemicals into the pool.

The combination of these treatments provided long term and sustainable mosquito control at an average cost of $5 per swimming pool. Using this updated treatment methodology, Vector Control reduced chemical expenses by $25,000 from FY2008 to FY2009.

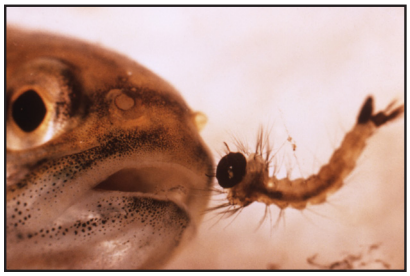


Cost Recovery Methodology

Upon treating a residential pool, Vector Control notified the legal homeowner of the nuisance by posting a notice on the door and mailing an abatement letter to the owner of record. Initial control treatments and homeowner notifications were provided as a community service; however, in 2006 the Southern Nevada District Board of Health approved a $127 fee to recover staff time and costs associated with repeated treatments of the same neglected pools. In December 2007, Vector Control initiated a process to invoice negligent homeowners for the subsequent treatments. Since implementing the invoice process Vector Control issued $352,624 in fees and recovered $53,112, or 15 percent.

The recovered fees, coupled with the reduction in chemical cost, lowered non-salary expenses to $39,277 in FY2009, a 51 percent reduction from $80,485 in FY2008.

Many legal homeowners, particularly banks and corporations, were not responsive to reimbursing the health district for the control treatments. As a result, Vector Control developed legislation to authorize the health district to take permanent abatement actions, such as draining bodies of water where repeated violations occurred and developing a property lien assessment process to effectively recover costs.



Legislation and Regulation Development

Chapter 439 of the Nevada Revised Statutes (NRS), Administration of Public Health, enables the health district to investigate and control occurrences of communicable disease, including mosquito borne diseases. Although NRS 439 provided the health district with broad authority to access properties and treat sources of communicable disease, it did not provide specific authority for mosquito abatement and cost recovery.

In 2009 Vector Control submitted an update to NRS 439, ultimately becoming part of Assembly Bill 249, which specifically addressed the extermination and abatement of mosquitoes, flies, other insects and rats. Staff provided testimony to the Nevada State Committee on Health and Education, and ultimately the language was adopted and incorporated as NRS 439.471 – 439.479.

With authority provided by NRS 439, Vector Control started developing the Southern Nevada Health District's "Regulations Governing Vector Control." The regulations establish definitions and set standards for the identification, notification and abatement of vector-related public health nuisances and provide enforcement and fee recovery actions. Once approved, the regulations will provide Vector Control with a definitive set of tools to remediate mosquito breeding sources, including the authority to drain stagnant swimming pools.

Common Area Breeding Sources

The health district routinely inspected and treated between 85 and 100 known mosquito breeding sources throughout the five-year period. These areas include flood channels, road side ditches, catch basins, pastures, irrigated fields, wastewater treatment ponds and wetland ponds. Local public agencies and private property owners were contacted to maintain drainage in channels and ditches; remove or thin vegetation in wetland and wastewater ponds; remove debris from street gutters and drains; and improve field irrigation methods for agriculture use.

Mobile GIS and Data Management

In March 2009 Vector Control purchased a mobile GIS data management system and ruggedized field computers to replace pen-and-paper data collection methods. The system, Sentinel GIS, was specifically designed for surveillance, prevention and control of vector borne diseases, including WNV. Once implemented, the system provided staff with tools to collect, organize and interpret mosquito control and collection data in the field. Additionally, real time situational awareness of environmental factors enabled staff to more thoroughly investigate possible areas of mosquito breeding.

Utilizing a mobile GIS data management system increased data collection efficiencies and enabled staff to spend more time focusing on surveillance, prevention and control of vector borne diseases. Benefits included automatic call-backs for mosquito breeding interventions and trapping activities, tracking chemical usage, and distributional maps of breeding and trapping sites throughout Southern Nevada.

West Nile Virus Surveillance

Vector Control's mosquito surveillance program has been partially funded by the Epidemiology and Laboratory Capacity for Infectious Diseases grant (ELC), which is provided by the Centers for Disease Control and Prevention (CDC) and administered by the Nevada State Health Division. Since 2006, Vector Control has received a total of $447,370 and used the grant monies to acquire equipment, implement a laboratory infrastructure, pay for arboviral testing fees, procure mobile GIS software and hardware, train staff, and conduct remote county WNV surveillance.

Vector Control has utilized a variety of mosquito and WNV surveillance methods, including sentinel chicken flocks, mosquito trapping and migratory bird sampling.

Chicken Flocks

In 2004, Vector Control began using captive sentinel chicken flocks to survey for WNV, St. Louis encephalitis and western equine encephalitis. Chickens have proven to be good sentinel animals due to their susceptibility to infection, low mortality, and relative incompetence as amplifying hosts.

Five sentinel flocks were established throughout Clark County in areas likely for WNV transmission, where mosquito breeding, bird migration and human habitation interacted. The flocks were set up at the Nature Preserve in Henderson; Floyd Lamb State Park in North Las Vegas; Overton Wildlife Management Area in Overton; Moapa Valley High School in Logandale; and a private residence in Mesquite. Additionally, a sentinel flock was established in Ash Meadows National Wildlife Refuge in Nye County. During the months of June through October, each flock of 10 chickens was bled on a bi-weekly interval. Whole blood samples were submitted to the Nevada Department of Agriculture's Animal Disease Laboratory (ADL) for viral antibody analysis. The sentinel chicken flocks did not develop antibodies for WNV, SLE, or WEE.

In 2006, the sentinel chicken flock surveillance component was dropped in favor of expanding the mosquito surveillance component.

Migratory Bird Surveillance

Migratory bird sampling was most intensive early in the program due to increased involvement from counterpart agencies including the US Department of Agriculture's Wildlife Services, animal control agencies, veterinarians and the general public. In 2008 Vector Control's surveillance efforts in migratory birds were reduced to compensate for the increased community generated mosquito breeding complaints.

Mosquito Trapping

Mosquito trapping and testing remains the cornerstone of the health district's arbovirus surveillance program. In comparison to migratory bird or sentinel chicken flock sampling, mosquito surveillance provides an up-to-date indicator of WNV vectors in an area. Mosquito sampling also provides information on the type of mosquitoes present, their estimated infection rate, and can be used as a trigger for control measures. In Clark County, the major mosquito breeding months are

generally April through October, with the breeding season shorter in the higher elevations of Nye, Lincoln and White Pine Counties. The breeding season is weather dependent and varies slightly from year to year.

Portable encephalitis vector surveillance (EVS) traps, designed to attract host-seeking female mosquitoes using carbon dioxide as an attractant, were used extensively throughout Southern Nevada. Traps were set overnight in potential mosquito breeding areas such as washes, drainage ditches, rivers and pools of standing water, as well as in human and equine population centers. From the collection site, live mosquitoes were frozen on dry ice and transported to the health district where they were sorted by species and gender, and then pooled for submission. (One pool consists of no more than 50 adult females of a single species from the same trap.) Once pooled, the mosquitoes were placed into vials, packed in ice and shipped overnight to the Nevada Department of Agriculture's ADL in Reno for analysis.

Laboratory Infrastructure

Utilizing the ELC grant, Vector Control purchased laboratory equipment including an ultra-low freezer (-84°C), a household freezer, digital photo microscope and mosquito trapping equipment. The grant has enabled Vector Control to develop a solid foundation to support WNV surveillance activities for years to come.

Remote County Surveillance

Since 2005 Vector Control has maintained a WNV surveillance presence in remote areas of Southern Nevada, including Nye, Lincoln and White Pine Counties through the support of the ELC grant funds. Mosquito surveillance focused on population centers and natural breeding areas within the counties, such as lakes, wildlife refuges, golf courses and stagnant swimming pools.

Pahrump Outbreak Intervention

In September 2005, Vector Control assisted Nye County Emergency Management with controlling an outbreak of WNV in horses in Pahrump. Nye County requested Vector Control's involvement since the agency did not have the equipment, or the expertise necessary to survey and control the mosquito populations. The investigation identified improper irrigation practices at a pistachio farm, which created pools of stagnant water. Mosquitoes trapped in the area were positive for WNV, and Vector Control initiated immediate larval and adult control measures. In total, 30 WNV infected horses were reported, none of which were vaccinated against the virus. Vector Control delivered a presentation to the Nye County Commissioners outlining specific mosquito control and WNV prevention measures. Although the virus has been identified in Nye County since 2005, there has not been subsequent mosquito, horse or human outbreaks.

Continuing Education

Mosquito control and surveillance is a very dynamic science requiring continuing education through conferences, online classes and field training. Through the years, Vector Control staff has attended annual conferences of the Mosquito and Vector Control Association of California, Utah Mosquito

Abatement Association, American Mosquito Control Association (AMCA), CDC conferences on West Nile virus and International Conference on Emerging Infectious Disease, and the International Conference on Diseases in Nature Communicable to Man.

In 2009, the AMCA accepted two project abstracts submitted by Vector Control for presentation at the 2010 annual conference. The abstracts highlighted Vector Control's reduction of non-salary expenses by 51 percent in FY2009, and staff's efforts in drafting AB249. Ironically, staff withdrew from the conference presentation due to budget constraints.

In 2010, two Vector Control staff members successfully defended thesis projects for the University of Nevada, Las Vegas (UNLV) Masters of Public Health program. The first thesis project, "Design Standards within Constructed Wetlands for the Reduction of Mosquito Populations in Clark County, Nevada," provides a guideline for building healthy wetlands in Southern Nevada. The second thesis project, "Vertical Transmission of West Nile virus in *Culex spp*. mosquitoes of Clark County, Nevada," attempted to identify the passage of WNV from female adult mosquitoes to their larval progeny. Although no positive adult or larval mosquitoes were identified in 2010, the project presented a framework for a future study when West Nile positive mosquitoes are identified in the future. UNLV's School of Community Health Sciences recognized both staff members with 'Outstanding Thesis' awards for their academic work.

Interlocal Expiration

In anticipation of the interlocal agreement's expiration, Vector Control delivered a series of presentations to the Southern Nevada Regional Planning Coalition (SNRPC), ultimately receiving a resolution of support from the coalition's Technical Committee to work with the jurisdictions to develop a new cost-sharing interlocal agreement. Vector Control facilitated four meetings with jurisdictional representatives from Clark County, City of Las Vegas, City of Henderson, City of North Las Vegas, City of Mesquite and City of Boulder City. Staff provided a detailed breakdown of program components per jurisdiction and the approximate cost based on the activities. Ultimately the jurisdictions were unable to fund the Vector Control program.

Since July 1, 2010 the code enforcement agency for each of the jurisdictions assumed the responsibility of green pool abatement, and the health district's mosquito control activities have been limited to treatment and abatement of common areas and maintaining mosquito surveillance. As part of the transition, Vector Control provided classroom and field training for jurisdictional staff. Classroom training included representatives from the Nevada Department of Agriculture, the mosquito control industry and Vector Control staff.

While the health district no longer receives or responds to green pool complaints, staff continues to treat common areas, conducts mosquito surveillance and is developing "Regulations Governing Vector Control in Clark County" for future implementation. Currently, staff is working with local jurisdictions to establish interlocal agreements for mosquito control and surveillance of the aforementioned common areas.

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