MINNESOTA OFFICE OF THE LEGISLATIVE AUDITOR

Metropolitan Mosquito Control District

SUMMARY

The Metropolitan Mosquito Control District (MMCD) was created in 1958 as a local joint powers agreement. Legislation passed in 1959 recognized the District in state law (*Minn. Stat.* §§473.701-473.716). The District is responsible for controlling mosquitoes, black flies, and disease-carrying ticks in Anoka, Dakota, Hennepin, Ramsey, Scott, Washington, and the eastern part of Carver counties. MMCD is governed by a 17-member commission composed of county commissioners from participating counties. The Legislature has given the Metropolitan Mosquito Control Commission discretion in how it carries out its mosquito and black fly control responsibilities.

The Metropolitan Mosquito Control District controls mosquitoes and black flies and monitors disease-carrying ticks.

Over the past several years, environmental groups, some legislators, state and federal agencies, and localities have raised questions about the District's operation. Concern has been expressed about the public oversight and accountability of the District, the effectiveness of its control program, how it notifies the public about its treatment activities, and the effect of the insecticides used by the District on humans and the environment.

Because of these concerns, the Legislative Audit Commission directed us in April 1998 to evaluate the Metropolitan Mosquito Control District. In our study, we asked:

- **What does scientific research say about the effects of insecticides used by the Metropolitan Mosquito Control District on humans and other species not targeted for control?**
- **How is the District funded, organized, and staffed?**
- **Is the District effective at reducing larval and adult mosquito populations?**
- **How well does MMCD inform the public of its mosquito control activities?**
- **Are changes needed to make the District more accountable to the Legislature and the public? How are mosquito control services provided in other states?**

To answer these questions, we reviewed previous reports and studies about the Metropolitan Mosquito Control District, state statutes and laws, District policies and procedures, and minutes of Commission meetings. We also reviewed U. S. Environmental Protection Agency (EPA) documents and scientific literature on the insecticides used by MMCD. We analyzed financial audit reports and budget documents. We interviewed Commission members, District staff, members of the Technical Advisory Board and Scientific Peer Review Panel, staff from other public agencies, and representatives of environmental groups. We visited the District's regional offices, observed field operations, and analyzed treatment databases to gain an understanding of MMCD's operations. Finally, we surveyed citizens who had telephoned the District in 1997 and conducted telephone interviews with representatives of state agencies and mosquito control programs in other states.

SAFETY ASSESSMENT OF INSECTICIDES USED TO CONTROL MOSQUITOES

The District uses insecticides that are approved by EPA and registered with the Minnesota Department of Agriculture.

The Metropolitan Mosquito Control District uses a variety of insecticides to kill mosquito larvae, adult mosquitoes, and black flies. First, it uses a natural soil bacteria (*Bacillus thuringiensis israelensis* or *Bti*) to kill mosquito and black fly larvae. Mosquito breeding sites larger than three acres are treated by helicopter and smaller sites are treated by ground crews. Second, it deploys briquets and pellets containing methoprene, a growth regulator that stops mosquito larvae from hatching into adults. Methoprene briquets are applied by hand to sites that are three acres or less and are hard to reach. Methoprene pellets may be applied by helicopter to larger sites or by ground crews to smaller sites. Third, it uses synthetic insecticides (resmethrin and permethrin) in public parks, recreation areas, and neighborhoods to kill adult mosquitoes. MMCD applies resmethrin using ultra-low-volume foggers mounted on trucks or all-terrain vehicles or hand-held foggers. Permethrin is applied to foliage with power backpack misters.

The District uses insecticides that are approved by the U. S. Environmental Protection Agency and registered with the Minnesota Department of Agriculture for use in insect control.

- **Our conclusion from reviewing the scientific literature is generally consistent with EPA's position that *Bti* and methoprene, the insecticides the District uses to kill mosquito and black fly larvae, pose little risk to people and most nontarget species.**

EPA has found that when *Bacillus thuringiensis*, of which *Bti* is a variety, is applied at label rates the risks to nontarget species are minimal to nonexistent. EPA also found that methoprene is of low toxicity and poses little risk to people and most other nontarget species.

In 1985, MMCD created a 10-member independent research panel to oversee research on the effects of the District's larval insecticides. The Scientific Peer Review Panel (SPRP) was composed of experts in biology and toxicology from several universities in the United States and Canada, as well as state and federal

government agencies. Two panel members were selected by environmental groups. In 1987, the SPRP began the Wright County Long-Term Experiment to study the effects of *Bti* and methoprene in Minnesota wetlands.

While environmentalists are concerned about adult insecticides, some scientists also remain concerned about the effects of larval insecticides.

- **The Scientific Peer Review Panel found that *Bti* and methoprene treatments had no adverse effects on aquatic micro-organisms (zooplankton), the reproduction of red-winged blackbirds, or the numbers of 18 other bird species.**

But research results on the effects of *Bti* and methoprene on midges, a nonbiting fly, were inconclusive. Early research results found that after three years (1991-93) of treatment *Bti* and methoprene had an adverse effect on the numbers of aquatic insects, particularly midges and other primitive flies. However, analysis of samples collected in 1997, after several years of treatment, concluded that few statistically significant differences in the numbers of midges were found between treated and untreated sites for either *Bti* or methoprene. Environmentalists and some scientists remain concerned about the effects of *Bti* and methoprene on other species, especially midges.

Resmethrin and permethrin, the insecticides used by MMCD to kill adult mosquitoes, are more controversial than larval insecticides.

- **Studies by EPA and the World Health Organization found that resmethrin and permethrin are broad-spectrum insecticides with the potential to harm other types of insects and aquatic organisms, but they should not be harmful to humans or the environment if applied according to label instructions.**

Product labels state that permethrin and resmethrin are extremely toxic to fish and other aquatic organisms and may not be applied directly to water. They are also toxic to bees. But experts have concluded that they should not pose hazards to the general public or attain levels of environmental significance when used at the recommended doses and applied in the prescribed manner.

Permethrin and piperonyl butoxide, an active ingredient in resmethrin, are classified as possible human carcinogens by EPA.

In 1993, the Minnesota Department of Health (MDH) assessed the risk to humans of the adult insecticides used by MMCD. The department concluded that "exposure to [resmethrin and permethrin] through ingestion or skin contact does not pose a health risk to humans under the scenarios described . . . . Brief inhalation of the pesticides should not pose a health risk. Nevertheless, children should be prevented from having prolonged inhalation exposure to the pesticides."[1] MDH advised, for example, that children should not be permitted to follow the insecticide applicators as they work. The risk assessment assumed worst-case scenarios for exposure to the insecticides and included a wide margin of safety for people who might be sensitive to the chemicals.

EPA has classified permethrin and piperonyl butoxide, an active ingredient in resmethrin, as possible human carcinogens. This means that there is limited

1 Minnesota Department of Health, "Risk Assessment on Scourge and Punt Materials Used by the Metropolitan Mosquito Control District for the Control of Adult Mosquitoes," March 17, 1993.

evidence of a cancer causing link in animals. However, these products must be applied judiciously and in strict conformity with EPA label requirements.

The use of pesticides will alter the ecology of the environment, if nothing else, by killing mosquitoes. Some scientists recognize this and say that MMCD is using the most appropriate chemicals available for mosquito control. Other scientists, conservationists, and environmentalists argue that the use of any insecticides is unacceptable. For example, waterfowl experts are concerned about the killing of mosquitoes because they are part of the food chain in Minnesota wetlands. We are unable to reconcile these competing points of view because they represent different scientific perspectives and value judgments. Ultimately, decisions about whether to continue using insecticides to kill mosquitoes are policy decisions that are best made by the Legislature using the best scientific information available.

The Department of Agriculture said the District has a good record of complying with regulations.

We examined MMCD's compliance with pesticide application regulations and found that:

- **To the best of our knowledge, MMCD usually has applied insecticides according to label instructions and in compliance with state regulations.**

We talked with Minnesota Department of Agriculture staff and reviewed their enforcement files. Department of Agriculture staff told us that the District has a good record of complying with pesticide rules and regulations. Records show that between 1979 and 1997, MMCD reported 15 incidents or spills of control materials. The department conducted three routine inspections of MMCD regional offices since 1994 which resulted in several noncompliance notations at one office. Between 1986 and 1997, the department investigated seven citizen complaints against MMCD, two of which resulted in enforcement actions.

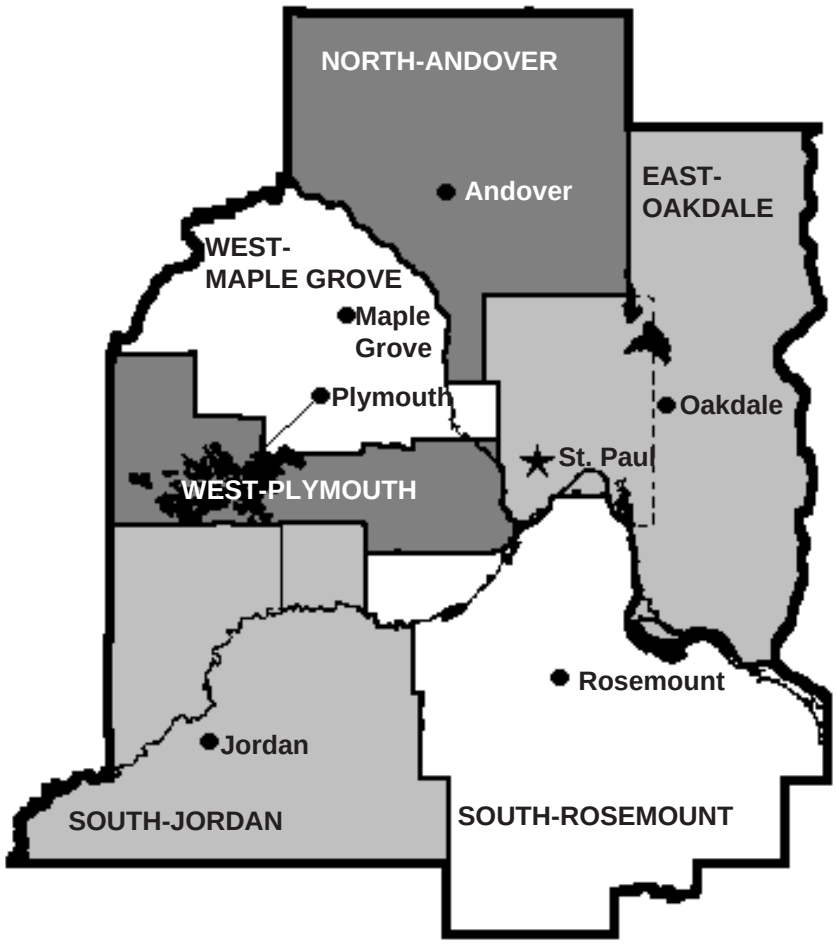
ORGANIZATION, FINANCING, AND STAFFING

The District employed 47 full-time and 164 seasonal staff in 1998.

The Metropolitan Mosquito Control Commission sets policy for the District and delegates implementation to a professional staff. The Commission appoints a director who is responsible for managing the operations of the District and must be an entomologist. In 1998, MMCD employed 47 full-time staff and 164 seasonal staff, the majority of whom were responsible for providing insect control services. Administrative, communications, and technical services staff are housed in the District's headquarters office in St. Paul, while staff who monitor and control insects work out of six regional offices (see Figure 1).

As a special taxing district, the Commission is authorized to levy property taxes. The District's 1998 budget of approximately $8.6 million came from a property tax levy (72 percent), Homestead and Agricultural Credit Aid (13 percent), other miscellaneous revenues (4 percent), and a portion of the District's fund balance (10 percent). Mosquito and black fly control activities accounted for 89 percent of the budget in 1998, of which about 44 percent funded salaries and wages.

Figure 1: Metropolitan Mosquito Control District Regions and Offices, 1998



SOURCE: Metropolitan Mosquito Control District.

In 1995, the Legislature reduced the District's revenues, but current spending is close to pre-reduction levels.

In 1995, the Legislature reduced the District's revenues by reducing its property tax levy and state aid payments by 50 percent, resulting in a 22 percent reduction in actual expenditures in 1996. The District responded by laying off staff and reducing mosquito control services. The District's expenditures increased 11 percent between 1996 and 1997 and its approved 1998 budget increased 11 percent. As a result, the District's 1998 budget has approached its spending level of 1995, when its actual expenditures were $8.8 million.

In the late 1980s and early 1990s, the District maintained a substantial fund balance—over $15 million in 1989. The District's unreserved fund balance had declined to about $6.1 million in 1997 and was projected to be about $5.3 million at the end of 1998.

Concern has been expressed about how the District deals with several issues related to staffing. In the past, some people have criticized the District for using its seasonal positions to provide political favors. Although we were not able to check every case,

- **We found no evidence that MMCD has used seasonal positions to provide political favors.**

Since 1996, responsibility for hiring seasonal staff has been decentralized; group leaders in each regional office interview and select seasonal employees. *Minnesota Statute* §473.704, subd. 5 forbids family members of commissioners from working at MMCD, and financial audit reviews of personnel records in 1996 and 1997 did not find a problem in this area. However, in two instances over the past two summers, children of MMCD staff have worked as seasonal staff. We do not know if any favoritism was involved in their hiring and, in any case, the state law cited above does not apply to District staff. In neither instance was the individual assigned to work in the same office as their parent.

Another criticism of MMCD staffing has been that the District employs too many full-time staff given the seasonal nature of its work. We reviewed the responsibilities of full-time employees and concluded that:

- **It does not appear that the District has been over staffed in its administrative area.**

The District has eight administrative staff and it contracts for services that it does not require on a full-time basis or that require technical expertise.

Staff responsible for insect control activities are divided between technical services staff in St. Paul and field staff housed in six regional offices. The seven technical services staff, including several entomologists, are responsible for collecting and analyzing the insect samples and information essential to the District's operations. Since the 1996 budget cut, the responsibilities of individual technical services staff have been expanded to absorb the responsibilities of terminated staff.

We are not able to say whether MMCD employs too many full-time field staff. Field staff include 5 group leaders responsible for managing 6 regional offices and 27 team leaders—between 4 and 7 in each regional office. One group leader manages both the Maple Grove and Plymouth regional offices. The group leader in the Rosemount office is also the District's specialist on insect-borne disease. The team leaders are represented by Local 132 Construction and General Laborers Union of the AFL-CIO. A 1995 state law prevents the District from terminating employees before January 1, 1999 (except for cause) if they are covered under the terms of a collective bargaining agreement.

MOSQUITO CONTROL ACTIVITIES

The District's mission is "to promote health and well being by protecting the public from disease and annoyance caused by mosquitoes, black flies and ticks, in an environmentally sensitive manner." The District's primary focus is on 15 mosquito species that are either aggressive human biters or potential carriers of disease. It has identified over 65,000 mosquito breeding sites covering about 189,000 acres in the Twin Cities area.

The District treated 15 percent fewer acres in 1998 than in 1997, reflecting changed weather conditions.

MMCD claims that the main goal of its mosquito control activities is to kill mosquito larvae, with limited localized adult mosquito control to reduce mosquito annoyance in public parks and at public events and to prevent disease transmission. We examined the District's treatment data to verify whether the District focuses on killing mosquito larvae. Table 1 shows that the District treated almost 197,500 acres with insecticides in 1998, a 15 percent reduction from 1997. The data also show that:

- **Except for 1996, MMCD has treated more acres to kill mosquito larvae than to kill adult mosquitoes.**

The District's treatment of mosquito larval breeding acres represented 68 percent of all acres treated in 1995 and 64 percent of all acres treated in 1998. In 1996, however, the District treated nearly 46 percent fewer mosquito larval breeding acres and 85 percent more acres to control adult mosquitoes than it did in 1995. This change was partly the District's reaction to its reduced 1996 budget and partly related to 1996 being a drier than normal summer. Each year since 1996 the District has increased the number of larval breeding acres treated and reduced the number of acres treated to kill adult mosquitoes. MMCD treated about 37 percent fewer acres for adult mosquitoes in 1998 than in 1997. According to the District, drier weather conditions determined the number of acres treated, not any purposeful intent on the District's part to reduce the acres treated for adult control.

MMCD has a policy of only applying insecticides when pretreatment counts of mosquito larvae or adults meet or exceed certain established thresholds. We examined MMCD 1998 treatment data to determine whether the District has followed its own policy for deciding when to apply insecticides and found that:

- **In nearly all cases in 1998, the District treated mosquito breeding sites by helicopter and sprayed for adult mosquitoes only after pretreatment thresholds had been met.**

Of 5,083 breeding site treatments in 1998, 95 percent met the District's predetermined treatment threshold. Of 3,763 adult mosquito treatments in 1998, the District met the established threshold in 99 percent of the treatments. Consequently, we concluded that:

- **In 1998, MMCD followed its treatment thresholds for mosquito larvae and adults. However, it appears that MMCD has not followed its 1998 adult treatment policy.**

In 1998, almost 2/3 of all acres treated with insecticides were treated in order to control mosquito larvae.

Table 1: Acres Treated by MMCD with Larval and Adult Insecticides, 1995-98

Mosquito Larvae Control	1995[a]	1996[a]	1997[b]	1998[c]
Methoprene briquets (150-day timed-release)	7,303	421	501	371
Methoprene briquets (90-day timed-release)	0	0	0	961
Methoprene pellets	8,212	10,654	8,851	10,432
Methoprene liquid	668	565	1,645	425
Bti granules	131,589	68,355	106,755	113,538
Total	147,772	79,996	117,752	125,727
Mosquito Adult Control				
Permethrin	6,305	5,914	7,035	6,175
Resmethrin	61,858	120,472	106,441	65,586
Total	68,163	126,387	113,476	71,761
Grand Total	215,935	206,383	231,228	197,488
Black Fly Control				
Bti liquid (in gallons)	3,606	3,025	5,445	4,032

NOTES: Treatments with Laginex liquid and sand-based materials used in Wright County research and in regional offices on an experimental basis are not reflected. Numbers may not sum due to rounding.

[a]The 1995 and 1996 acres are based on Metropolitan Mosquito Control District computer treatment records.

[b]The 1997 acres are estimated using the Metropolitan Mosquito Control District's audited inventory records. Estimates are based on assumptions regarding the use of materials at different application rates.

[c]The 1998 acres are based on Metropolitan Mosquito Control District computer treatment records through mid-September. The figure for *Bti* liquid (in gallons) used for 1998 is from the District's inventory records for 1998 through September 12, 1998.

SOURCES: Metropolitan Mosquito Control District treatment data for 1995, 1996, and 1998; Office of the Legislative Auditor, *Metropolitan Mosquito Control District Financial Audit for the Year Ended December 31, 1997,* Consumable Inventory Work Papers Folder 5.

The District needs to review its policy for providing adult mosquito treatments to for-profit enterprises.

The District's adult treatment policy emphasizes that it provides localized adult mosquito control for public parks and recreation areas, public events, potential disease situations, and in response to citizen requests, but public events operated for profit will not be treated. We found examples of the District providing adult treatments for private functions and for-profit enterprises. District staff told us that they provide adult mosquito treatments to for-profit enterprises based on a 1996 discussion with the executive committee of the Commission. However, provisions for treating for-profits were not incorporated into the District's adult mosquito treatment policy when it was revised in June 1998. It was not clear to

us whether MMCD does not treat for-profits, treats them for a fee, or treats them at no charge. We recommend that:

- **The Metropolitan Mosquito Control Commission should review the District's existing policies and procedures and adopt a comprehensive, well articulated adult mosquito treatment policy.**

Further, MMCD should reexamine its adult treatment procedures to ensure that its practices conform with its adult treatment policy.

In 1998, the main reasons for adult mosquito treatments were customer requests and treatment of parks and events. However, about 17 percent of the acres treated (up to 39 percent in some regions) were classified as "other" or were missing a reason for treatment. Though flawed, the adult treatment data suggested that treatments done to prevent transmission of diseases have been a small proportion (fewer than 3 percent) of the District's adult treatment activities.

The predominant insecticides used by the District, *Bti* and methoprene, were also the least costly per acre treated in 1997.

Our review of MMCD treatment and inventory records found that:

- ***Bti* accounted for 9 out of 10 acres treated to kill mosquito larvae, while resmethrin accounted for 9 out of 10 acres treated to kill adult mosquitoes between 1995 and 1998.**

Our analysis also showed that these insecticides were the least costly to use per acre. *Bti* granules cost between $4.82 and $8.47 per acre, compared with over $52 per acre for methoprene pellets and over $388 per acre for methoprene briquets in 1997. Similarly, resmethrin cost between $1.00 and $1.66 per acre, compared with over $7.60 per acre for permethrin in 1997. We were unable to estimate what proportion of the District's total budget was dedicated to larval versus adult control activities. However, larval insecticides accounted for over 91 percent of total insecticide costs in 1997.

Refused Treatment Requests

Since 1982, state law has given private property owners the right to restrict access to MMCD "except for control of disease bearing mosquito encephalitis outbreaks." MMCD provides a 100- to 600-foot buffer zone in all directions around each "no treatment" property depending on the type of insecticide used and the method of application.

While MMCD records refused treatment properties on maps and paper card files, the District has not maintained a computerized database of these properties since 1995. In 1995, about half of the approximately 57,000 acres of refused treatment property actually contained mosquito breeding areas, representing about 14 percent of all mosquito breeding acres in the region. Currently, MMCD allows both private property owners and public property managers, including the Commissioner of Natural Resources, to refuse treatment for larval and/or adult mosquito control operations, even though the state law specifically allows the District to enter Department of Natural Resources (DNR) property for mosquito control purposes.

Language in state law on the District's access to public property is unclear and contradictory.

We concluded that language in state law related to MMCD's access to public property is unclear and contradictory. *Minnesota Statute* §473.704, subd. 17 says the District may enter any property "subject to the paramount control of the county and state authorities." A 1982 amendment to this subdivision requires the Commissioner of Natural Resources to allow the District to enter DNR property for mosquito control purposes, but the original "paramount control" language remains.[2] In other words, state law allows counties and state authorities the right to determine what mosquito control activities occur on their land, but then goes on to remove that right from the DNR. We suggest that:

- **The Legislature should consider whether state law should allow the Department of Natural Resources and local units of government the right to refuse access to MMCD, except for monitoring and treatment of mosquitoes that can carry diseases.**

Over 40 percent of the refused treatment acres in 1995 were requests from federal or state agencies, or local governments, including the Minnesota Department of Natural Resources. Staff from these entities cited issues related to compatibility with conservation and ecological goals and concerns about insecticides as reasons for refusing treatment. We think that there are some situations when DNR and local units of government should be allowed to determine whether mosquito control activities are conducted on public property. Specifically, we believe that entities managing public land for ecological and natural resource reasons should have the right to refuse mosquito control treatments. Agencies, such as MMCD, that want an exception from the paramount control of these public land mangers should have to prove to the Legislature why such an exception is warranted. The Legislature may also want to consider extending the ability to refuse access to MMCD to cities and townships, giving these entities the same rights that are currently available to county and state authorities and to private landowners.

We also recommend that:

- **The Metropolitan Mosquito Control Commission should develop a refused treatment policy that addresses both larval and adult mosquito control operations.**

Currently, the only policy statement related to refused treatment is included in the District's adult mosquito treatment policy. The District does not have a written policy for refusing larval control treatments, although the right to refuse treatment applies to larval insecticides. We believe a comprehensive refused entry policy would be beneficial for the District, private landowners, public agencies, and units of government in the Twin Cities area.

In the past the District has maintained a refused treatment request indefinitely. According to MMCD staff, the District is considering requiring an annual renewal of refused treatment requests. Given the sensitive nature of this issue, we believe

2 In contrast, state laws relating to local mosquito abatement boards (*Minn. Stat.* §§18.041-18.161) provide that local mosquito abatement plans are subject to DNR approval, modification, and revocation. (*Minn. Stat.* §18.121, subd. 2.)

that an annual renewal requirement belongs in a refused treatment policy that has been reviewed and approved by the Commission.

State law and MMCD's current buffer zones create the potential for conflict between persons who do not want treatment and neighbors who do. To balance these interests, MMCD could reduce the size of its buffer zones or adopt other methods of addressing refused treatment situations. Aside from these approaches, balancing these interests becomes a policy issue that the Legislature may want to address.

Insect-Borne Disease Prevention

In addition to controlling mosquitoes that cause annoyance, MMCD monitors and controls for mosquitoes that can carry diseases. The tree hole mosquito, which breeds in tree holes and artificial containers such as waste tires and can transmit LaCrosse encephalitis, is the primary focus of District disease prevention activities. District staff identify and remove breeding sites, evaluate areas around previous cases of LaCrosse encephalitis, provide public education, and conduct limited adult spraying.

- **Epidemiology staff at the Minnesota Department of Health told us that the District has played a valuable role in preventing the transmission of mosquito-borne diseases and monitoring deer ticks.**

The District works closely with the Department of Health to monitor and control insect-borne diseases.

The District works closely with the Department of Health (MDH), the state's public health agency responsible for disease surveillance and prevention, in the area of insect-borne disease management. The District depends on MDH for information on cases of LaCrosse encephalitis. In turn, MDH relies on the District for mosquito surveillance and control measures to reduce disease transmission. MDH has also relied on MMCD to provide education and technical assistance to counties in southeastern Minnesota.

Data Management Issues

The District uses treatment records to summarize its mosquito control activities and inform its Commission, county boards, legislators, and the public about its activities. The District contracted with an outside firm for data entry services until 1997, when it brought the function in house. We found that there were too many errors in the District's computerized treatment records for 1997 to be used to reliably describe mosquito control activities. We recommend that:

- **The District should establish rigorous quality control standards for its treatment data if it intends to use these data to accurately assess its activities, conduct future planning, and inform the public about its activities.**

District staff established procedures during the summer of 1998 to periodically compare and reconcile insecticide inventory records with treatment data. This process aided in the identification and correction of problems with the 1998 treatment data.

In addition to problems with data management, we found a number of seemingly isolated problems with MMCD's operations. Examples include the untimely filing of insecticide applicator licensing papers and fees with the Department of Agriculture in 1997, mistaken application of insecticides in both 1997 and 1998 at a scientific and natural area that the Department of Natural Resources had asked not to be treated, and failure to maintain useable data files for refused treatment properties. Taken together, these problems suggest a lack of attention to detail and vigilance on the part of District staff. It is the responsibility of District management to place greater emphasis on quality controls necessary to identify, correct, and avoid these problems in the future.

EFFECTIVENESS OF MOSQUITO CONTROL

The goals of MMCD's insect control efforts are to reduce the regional populations of mosquitoes. However, entomologists told us that it is difficult to measure the reduction in adult mosquito populations resulting from larval control activities. In 1996, after considering factors such as weather, mosquito breeding habitat, people's behavior and perceptions, and costs, an Interagency Panel on MMCD Effectiveness concluded that predicting what "would have been" without intervention would be difficult. We found that:

- **The results of District-sponsored studies on the overall effectiveness of mosquito control efforts have been inconclusive.**

Comparisons of adult mosquito populations have shown lower mosquito populations outside the District or before the District was created. Therefore, the District has tested the effectiveness of larval insecticides and used the results of those material efficacy tests to measure the effectiveness of its mosquito control efforts. The District attempts to achieve 95 percent mortality of mosquito larvae and adults when it uses insecticides. This goal is based on EPA guidelines. We found that:

The effectiveness of most insecticides used by the District has been reasonable.

- **Most of the insecticides used by the District to kill mosquito larvae have not met the goal of 95 percent mortality.**

The average control achieved with *Bti* granules, the larval insecticide that accounted for most of the breeding acres treated, ranged from 78 to 89 percent in 1995-97. On the other hand, methoprene briquets and pellets used to kill cattail mosquito larvae have performed the best (92 to 99 percent mortality). It could be argued that, while the goal of 95 percent mortality might be ideal, the rates of control achieved for the above products are reasonable. However,

- **We have some concerns about how MMCD has calculated and presented information on the effectiveness of methoprene products used to control floodwater mosquitoes.**

First, we were not able to replicate MMCD's control figures for 1996 and 1995 using the District's own data. According to District staff, a former staff person had completed these analyses and current staff were unable to locate the information on how those calculations were made. Second, the calculations for 1997 contained typographical errors that changed negative rates to positive rates, indicating a positive effect when none was shown. While these errors did not change the results in this instance, they raise concerns about methods and quality controls used to calculate material efficacy. Third, in 1996 and 1997, the District's evaluation of mosquito control achieved with methoprene briquets was based on a sample of only five sites. Finally, annual fluctuations in the effectiveness of methoprene briquets and pellets are evident in Table 2. The District has updated information on the effectiveness of methoprene reported in its *1997 Operational Review and Plans for 1998*. Instead of achieving 77 percent control based on 69 sample sites as reported, the District achieved 73 percent based on 39 sample sites. Because effectiveness rates may affect District decisions about insecticide use, we recommend that:

- **The Metropolitan Mosquito Control District should critically examine how it measures the effectiveness of methoprene products to control floodwater mosquito larvae and reevaluate its use of these products considering both efficacy and cost factors.**

The effectiveness of methoprene products used to kill floodwater mosquitoes has been inconsistent.

Table 2: Average Percent Control with Methoprene for Floodwater Mosquitoes Reported by the Metropolitan Mosquito Control District, 1995-97

Percent Control Reported	1995	1996	1997	1997 MMCD Corrected
Briquets	82% (*N*=106)	55% (*N*=5)	81% (*N*=5)	NA NA
Pellets	88% (*N*=63)	80% (*N*=66)	77% (*N*=69)	73% (*N*=39)

NOTE: NA = Additional data were not available.

SOURCES: Metropolitan Mosquito Control District, *1997 Operational Review and Plans for 1998*; Electronic-mail message from Mark Smith, Technician, October 26, 1998.

In its 1996 operational review, the District noted that: "Performance of methoprene products must improve if MMCD is to achieve the target rate of at least 95 percent control in treated mosquito breeding sites."[3] The District's 1997 operational review did not express any concerns about the effectiveness of methoprene products and its use of methoprene products has not changed. In 1998, the District increased the number of sites sampled to test effectiveness of

3 Metropolitan Mosquito Control District, *1996 Operational Review and Plans for 1997*, March 1997: 35.

methoprene pellets, but only five sites could be analyzed for briquets. In its 1999 budget, the District suggests that it will increase the number of sites examined to document material efficacy.

We also reviewed the District's research on the effectiveness of resmethrin and permethrin. During the early 1990s, the District sponsored several studies on resmethrin and permethrin. While permethrin appears to kill mosquitoes for up to five days, the District's own research appears to question the effectiveness of resmethrin at controlling mosquitoes one day after treatment. We found that:

- **In 1996, the District tested the effectiveness of resmethrin and permethrin, the insecticides used to kill adult mosquitoes, and estimated that the average adult mosquito reduction in treated sites was about 57 percent.**

The District collected pre- and post-treatment adult mosquito counts in 1998 to evaluate the effectiveness of the adult insecticides. Comparison of these counts showed a 90 percent reduction in the number of adult mosquitoes following treatment. We have some concerns about using this data to measure effectiveness, such as the data were not collected as part of a designed, supervised research effort and counts were taken using the "slap test" sampling method, a less standardized, more subjective method than others available. We recommend that:

- **The District should assign a high priority to measuring the effectiveness of adult control materials in scientifically designed and supervised field studies in 1999 and use the results of these studies to evaluate the role of adult mosquito treatments in its overall mosquito control program.**

PUBLIC ACCOUNTABILITY AND GOVERNANCE

Public notification of adult insecticide applications is a concern of some legislators, state agencies, and environmentalists.

Much of the recent criticism of MMCD has focused on the issue of notifying the public when insecticides are applied to kill adult mosquitoes. Staff from the Department of Health have emphasized that MMCD has a responsibility to inform people about when and where insecticides are being applied so that people can choose to avoid exposure. In the past, the District's Technical Advisory Board has also recommended that MMCD increase its efforts to notify people of adult mosquito treatments.

In the past, MMCD has used a telephone information line and a web site to inform people about scheduled adult mosquito treatments. MMCD has also called people who want individual notification of treatments (typically adult or helicopter applications) in their area. The District has issued press releases during the summer and posted areas treated on public land during the treatment.

Currently, Minnesota statutes do not contain language related to public notification for mosquito control programs. During the 1997 legislative session a public notification bill was introduced, but did not pass. Afterwards, the District

The District maintains a telephone information line and a web site to inform people about adult mosquito treatments.

and the authors of the proposed legislation reached a "negotiated agreement," under which MMCD placed an advertisement in newspapers notifying the public of possible adult mosquito insecticide applications and posted notices at the main entrances of public land, leaving the signs in place for five days. Although the agreement lacks the force of law, we recommend that:

- **MMCD should continue the level of public notification provided during the summer of 1998.**

We think the District should continue to publish an annual advertisement in newspapers in the spring of each year, containing information on the nature of mosquito control treatments and accurate, objective information on the insecticides used. Our review of other states showed that this is a commonly used method of public notification. We also think the District should continue posting notices of adult mosquito treatments at the entrances of public parks and recreation areas. This will provide people with information allowing them to avoid exposure to insecticides if they so choose. If the Legislature finds in the future that the District has not provided these notifications, then it should consider adding public notification requirements to state law.

Relationship with the Public

In its 1998 survey of Twin Cities residents, MMCD found that 61 percent of the people surveyed were aware of the District, similar to results of prior surveys. We surveyed a random sample of citizens who called MMCD to request or refuse service or get information in 1997 and concluded that:

- **There is a high level of satisfaction among people who had requested service from the Metropolitan Mosquito Control District in 1997.**

Nearly 80 percent of the people we surveyed said they were "satisfied" or "very satisfied" with the District's response to their request.

The District should be careful to present the most accurate information possible to the public.

Despite high satisfaction ratings from some segments of the population, the Metropolitan Mosquito Control District has found itself in an adversarial position in recent years as environmentalists question the District's operations. During the summer of 1998 there was an intense public relations debate between the District and environmental groups, and we became aware of a certain level of mistrust among the parties involved. In this type of atmosphere, we believe it is crucial for the District to exercise the utmost care in presenting the most accurate information possible to the public. Unfortunately, the District might have contributed to feelings of mistrust by making claims that are hard to support, such as the assertion that requests for no treatment impair its ability to protect public health and prevent LaCrosse encephalitis. While we have noted that MMCD provides valuable disease prevention services, we have also observed that most of the District's adult mosquito treatments are directed at nuisance mosquitoes. In addition, state law gives the District authority to take necessary mosquito control measures in situations of disease outbreak, regardless of refused treatment requests. We think MMCD should make more of an effort to present balanced, accurate information to the public.

Governance

As far as we can determine,

- **The Metropolitan Mosquito Control Commission generally has complied with state laws designed to provide public accountability.**

Based on our analysis, the Commission and the District have complied with relevant enabling legislation, the state's Open Meeting and Ethics in Government acts, and purchasing, tax levy, budgeting and accounting, and audit controls contained in state law. The District has been subject to annual financial audit reviews by the Office of the Legislative Auditor that have not found problems with its financial controls. However, we found that the Commission did not submit a required financial report to the Legislature in 1996 and it has not always classified as "public" information on citizens who request or refuse service as required by state law. We recommend that:

- **In the future, the Commission should submit biennial financial reports to the Legislature and classify as "public" information on citizens who request or refuse service.**

MMCD is governed by a 17-member commission composed of county commissioners appointed annually by their respective county boards. An executive committee, made up of three officers, plus one member from each county not represented by an officer, meets monthly. The full commission meets about six times a year to review agenda items, "ratify" decisions of the executive committee, and approve policy for the District.

The District is currently governed by a 17-member commission, but the size and composition of the Commission should be reviewed.

A Technical Advisory Board (TAB) reviews the goals, plans, operations, and research of the District and reports to the Commission. The TAB, composed of professionals representing state agencies, the University of Minnesota, and industry and environmental groups, enables the District to obtain advice from public agencies, as required by state law.

After reviewing how mosquito control services are provided in other states, it is clear that there is no ideal structure for providing these services. In most states, local units of government (cities and/or counties) provide mosquito control services with varying degrees of state involvement. Only 4 of the 28 states we contacted have state-operated mosquito control programs—Delaware, Connecticut, Kentucky, and Maryland. Maryland, with a budget of $1.9 million and 21 permanent staff, has the largest state-operated program. Six other states provide limited funding and technical assistance to locally operated mosquito control programs. In other states, including Minnesota, state law provides for the creation and funding (such as the ability to levy property taxes) of locally operated mosquito control districts. Finally, some states play a limited role related to public health monitoring of insect-borne diseases.

We also examined several alternative governance structures the Legislature could consider to increase oversight of the District. These options include placing the District under the jurisdiction of the Metropolitan Council, placing it in a state agency (such as the Department of Health or the Department of Agriculture), or

returning it to a local joint powers board. Lacking compelling reasons for a major restructuring, we do not recommend major changes in the governance structure of the Metropolitan Mosquito Control District at this time. However, we suggest that:

- **The Legislature should consider reducing the size and changing the composition of the Metropolitan Mosquito Control Commission.**

By adding other public representation to the Commission, the Legislature would open the Commission to outside perspectives, help the District respond to outside criticisms, and increase public oversight of the District. Three or four public members could be appointed by the Governor. These members could be selected to represent public park managers, the scientific community, environmental groups, or other expertise. Alternatively, the Legislature could add state agency representatives (such as the commissioner or the commissioner's designee from the department of Health or Agriculture) to the Commission, along with representatives from the scientific and environmental communities. To prevent the Commission from becoming too large, the number of county commissioners serving on the board could be reduced perhaps to seven members, one from each county participating in the District.

We also recommend that:

- **The Metropolitan Mosquito Control Commission and director should evaluate and formalize in a written policy statement the composition, structure, roles and responsibilities, and appointment process of the Technical Advisory Board.**

The TAB membership, role, and responsibilities have never been formalized, and some Metropolitan Mosquito Control Commissioners and TAB members appeared to be unclear about its role. Also, the process used to determine membership on and appointment to the TAB was unclear to some agencies. The Commission may want to evaluate the composition of the advisory board and consider what technical skills and areas of expertise need to be represented on the TAB.