
Mosquito Control Activities

CHAPTER 3

The activities of the Metropolitan Mosquito Control District (MMCD) involve monitoring mosquito and black fly larval and adult populations, and applying insecticides to kill these insects in the Twin Cities area. In this chapter we review the District's mosquito and black fly control activities. We examine the number of acres treated with insecticides and procedures used to determine if treatments are needed. We asked the following questions:

- **How has the Metropolitan Mosquito Control District's use of insecticides for mosquito larvae and adult control changed since 1995?**
- **Does the District follow its own policies and procedures in deciding when to apply insecticides to control mosquitoes and black flies?**
- **How has the District managed requests from property owners who refuse the District access to their property?**

To address these issues we reviewed MMCD's policies and procedures, made site visits and observed operations in the field, analyzed the District's treatment databases, and interviewed staff from the District and other public agencies, as well as staff from cities in the Twin Cities area.

**The
Metropolitan
Mosquito
Control District
treated
15 percent
fewer acres in
1998 than in
1997.**

The District treated almost 197,500 acres with insecticides in 1998, a 15 percent reduction from 1997. Mosquito larval breeding acres represented about 64 percent of all acres treated in 1998. Of the insecticides used by MMCD, the District used the least costly insecticides for most of its treatments. *Bti* accounted for most (90 percent) of the acres treated to kill mosquito larvae, while resmethrin accounted for most (91 percent) of the acres treated to kill adult mosquitoes in 1998.

We found that in nearly all cases the District applied insecticides when treatment thresholds indicated that treatments were warranted, staff from the Department of Health think the District plays a valuable role in the prevention of mosquito-borne diseases, and the District usually has applied insecticides according to label directions and in compliance with state regulations. However, we also identified concerns with the District's adult and refused treatment policies and practices, and management of its treatment data.

MOSQUITO CONTROL ACTIVITIES

The District says its primary focus is to kill mosquito larvae.

MMCD claims that the primary focus of its mosquito control activities is to kill mosquito larvae, with localized adult mosquito control to prevent disease transmission and to reduce mosquito annoyance in public parks and at public events. We examined the District's treatment data to determine if the District focuses on killing mosquito larvae. Table 3.1 summarizes the acres treated by MMCD with insecticides from 1995 to 1998. The District treated almost 197,500

Table 3.1: Acres Treated by MMCD with Larval and Adult Insecticides, 1995-98

<u>Mosquito Larvae Control</u>	<u>1995^a</u>	<u>1996^a</u>	<u>1997^b</u>	<u>1998^c</u>
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
<i>Bti</i> granules	<u>131,589</u>	<u>68,355</u>	<u>106,755</u>	<u>113,538</u>
Total	147,772	79,996	117,752	125,727
<u>Mosquito Adult Control</u>				
Permethrin	6,305	5,914	7,035	6,175
Resmethrin	<u>61,858</u>	<u>120,472</u>	<u>106,441</u>	<u>65,586</u>
Total	68,163	126,387	113,476	71,761
Grand Total	215,935	206,383	231,228	197,488
<u>Black Fly Control</u>				
<i>Bti</i> 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.

^aThe 1995 and 1996 acres are based on Metropolitan Mosquito Control District computer treatment records.

^bThe 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.

^cThe 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.

Treatment of mosquito breeding acres represented 64 percent of all acres treated in 1998.

acres in 1998, a 15 percent reduction from 1997 and a 4 percent reduction from 1996. The data also show that:

- **Except for 1996, the 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 dramatically increased the number of acres treated with insecticides to kill adult mosquitoes. The District treated nearly 46 percent fewer mosquito larval breeding acres (from 147,772 to 79,996 acres) and 85 percent more acres to control adult mosquitoes (from 68,163 to 126,387 acres) in 1996 than it did in 1995. Since 1996, the District has increased the number of breeding acres treated and decreased the number of acres treated to kill adult mosquitoes. By 1998 MMCD treated about 57 percent more breeding acres than in 1996 and about 43 percent fewer acres for adult control than in 1996.

Acreage treated with insecticides to kill adult mosquitoes increased 85 percent from 1995 to 1996.

In addition to being affected by a reduced budget in 1996, changes in acres treated were related to the rainfall for the time period examined. Generally, 1996 was a drier than normal summer, while 1997 was wetter than normal. The average rainfall in 1996 was 31 percent lower than the 38-year average for the Twin Cities area. This below normal rainfall resulted in only 6 broods of mosquitoes during the summer of 1996 compared with an average of 9 to 12 broods per year.¹ Average rainfall in 1997 was 9 percent higher than the 39-year district average and produced 9 broods of mosquitoes.² District staff have told us that weather conditions were the primary reason for the reduction in acres treated for adult mosquito control in 1998. There was no purposeful intent on the District's part to reduce acres treated for adult control.

Our review of MMCD's treatment and inventory records found that:

- ***Bti* granules 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.**

Table 3.2 shows the total cost and cost per acre for insecticides used by MMCD to kill mosquito larvae and adults in 1997. These data show that:

- **The predominant insecticides used by MMCD, namely *Bti* and resmethrin, were the least costly per acre treated. But larval insecticides, which are more expensive per acre than adult insecticides, accounted for over 91 percent of insecticide costs in 1997.**

¹ Metropolitan Mosquito Control District, *1996 Operational Review and Plans for 1997*, March 1997: 25, 34.

² Metropolitan Mosquito Control District, *1997 Operational Review and Plans for 1998*: 24-25.

The annual costs of the helicopter contract (\$827,900 in 1997) can also be added to the costs of larval control. In addition, District staff estimate that about 90 percent of the truck fleet supports larval control activities. District staff are involved with larval control activities for about eight months and adult control activities for three months of the year. Control operations staff salaries and wages

Table 3.2: Costs of Mosquito Control Insecticides, 1997

<u>Larval Control Materials:</u>	<u>Application Rate</u>	<u>Cost per Acre</u>	<u>Total Costs</u>
150-day methoprene briquets - floodwater mosquitoes ^a	220 per acre	\$388.73	\$ 215,742
cattail mosquitoes	330 per acre	583.10	
cattail mosquitoes	440 per acre	777.46	
30-day methoprene pellets - floodwater mosquitoes	2.5 lbs. per acre	52.90	526,247
cattail mosquitoes	4.0 lbs. per acre	84.64	
Methoprene liquid	1 oz. per acre	5.71	12,675
<i>Bti</i> granules - bulk	5 lbs. per acre	4.82	48,253
	8 lbs. per acre	7.71	
<i>Bti</i> granules - bags	5 lbs. per acre	5.29	800,336
	8 lbs. per acre	8.47	
<i>Bti</i> liquid	6 oz. per acre	0.92	101,479
<u>Adult Control Materials:</u>			
Permethrin	25 oz. per acre	7.68	54,039 ^b
Resmethrin - hand-held machine	2.5 oz. per acre	1.66	107,895
cold fogger	1.5 oz. per acre	1.00	
Total for adult control			161,934
Total for larval control			<u>1,704,732</u>
Grand Total			\$1,866,666
Share of costs for adult control			8.7%
Share of costs for larval control			91.3%

^aRepresents 1996 price for briquets of \$388.73 per case. MMCD purchased briquets for both 1996 and 1997 in 1996. Price of briquets in 1998 was \$441.14 per case.

^bThe cost of mineral/soybean oil used to dilute the concentrated permethrin mixture is included in the total cost. The cost per acre is based on the diluted mixture.

SOURCE: Office of the Legislative Auditor, *Metropolitan Mosquito Control District Financial Audit for the Year Ended December 31, 1997*, Consumable Inventory Work Papers Folder 5, N11.

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

Since 1995, the District has reduced its use of methoprene briquets, the most expensive larval control product.

totaled over \$3 million in 1997, but the District does not use detailed cost codes to account for employees' time. Therefore, we were unable to estimate what proportion of the District's total budget is dedicated to larval versus adult control activities.

Table 3.1 also shows how MMCD's use of insecticides changed in 1996 as a result of the budget reduction. Instead of using 150-day timed-release methoprene briquets, the most expensive larval control material, for small hand-treated sites, the District used methoprene pellets and, to a lesser extent, *Bti* granules. Acres treated with methoprene briquets decreased 94 percent between 1995 and 1996 (from 7,303 to 421 acres).³ At the same time, the acres treated with methoprene pellets increased nearly 30 percent. MMCD made this decision based in part on the higher cost of the briquets and concerns about their effectiveness.⁴ The acres treated with *Bti* granules declined in 1996, most likely because of drier than normal conditions, and have increased each year since then.

Larval Control Activity

The District's mosquito control services target the most productive mosquito breeding locations for human-biting mosquitoes. Since its formation in 1958, the District has identified and mapped over 65,000 potential and known larval breeding sites. District staff record the number and kind of larvae found and treatment information for every site on section cards. The District updates section maps annually to reflect changes in breeding sites.

We examined where the District has focused its larval control efforts between 1995 and 1998. Figure 3.1 shows the number of breeding acres treated by priority area by year.⁵ In 1995, before MMCD's budget cut, the District treated 143,314 breeding acres, 63 percent of which were in Priority Area 1, 28 percent were in Priority Area 2, and 9 percent were in Priority Area 3.⁶ With the reduction in its 1996 budget, the District treated fewer acres with larval insecticides in all priority areas and concentrated its larval control efforts in Priority Area 1. In 1996, the District treated 75,033 acres with larval insecticides, 77 percent of which were in Priority Area 1 and 22 percent of which were in Priority Area 2.

³ In addition to reducing its use of briquets, the District has changed how the briquets were used. In 1995, approximately 93 percent of the 7,303 acres treated with briquets were floodwater mosquito breeding sites and 7 percent were cattail mosquito breeding sites. In 1998, cattail mosquito breeding sites accounted for about 67 percent of the 371 acres treated with 150-day, timed-release briquets.

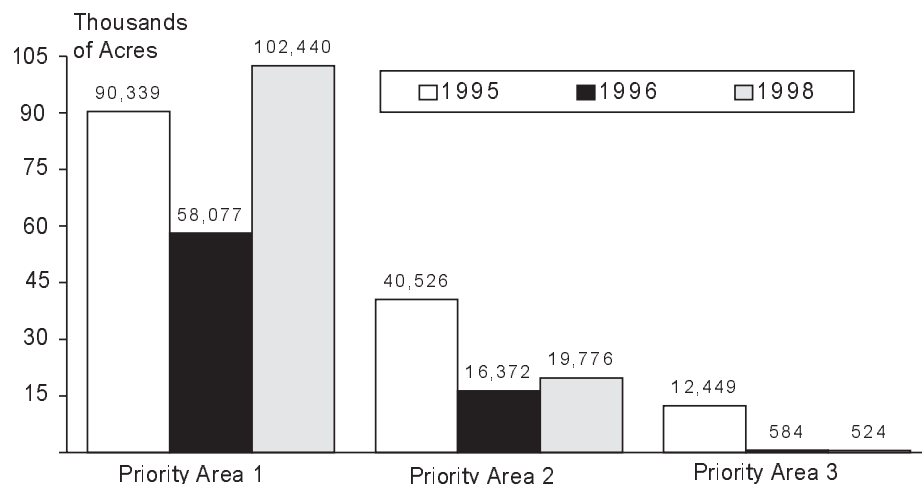
⁴ Metropolitan Mosquito Control District, *1996 Operational Review*: 21. The efficacy of control materials is discussed in Chapter 4.

⁵ We used 1997 priority areas in this analysis because when MMCD updates its master breeding site data it does not retain priority area data for prior years. Consequently, our analysis reflects the number of 1997 priority area acres that were treated in 1995 and 1996. In 1995, the District used two priority areas. In 1996, the District added Priority Area 3 and Priority Area 1 and 2 "satellites," which include population centers located in Priority Areas 2 and 3 such as Jordan, Hastings, Forest Lake, Rogers, Randolph, and Hampton. In 1997 and 1998, the District modified but did not significantly change the priority areas.

⁶ The priority areas were not identified in treatment databases for between 3 and 6 percent of the acres treated in each year. Therefore, data on acres treated by priority area do not correspond with total acres treated.

**In 1998,
83 percent of
the mosquito
breeding acres
treated were in
Priority Area 1.**

Figure 3.1: Breeding Acres Treated by Priority Area, 1995-96, 1998



NOTE: Analysis does not include 1997 data because of concerns about data quality.

SOURCE: Program Evaluation Division analysis of Metropolitan Mosquito Control District treatment data.

The Metropolitan Mosquito Control Commission approved a 1997 budget for the District that was 7 percent higher than the 1996 budget, and the District predicted that the 1997 budget would allow it to “recover some of the services lost in 1996.”⁷ With an 11 percent increase in its commission-approved 1998 budget, MMCD planned to hire additional seasonal inspectors, increase helicopter services, and purchase more insecticides. In 1998, the District planned to “significantly” increase service to Priority Area 1 and to increase service to Priority Area 2 “to a lesser extent.”⁸ Our analysis shows that:

- **The District expanded treatment of mosquito breeding acres primarily in Priority Area 1 between 1996 and 1998.**

In 1998, the District treated 76 percent more Priority Area 1 acres than in 1996.⁹ By 1998, the number of acres treated in Priority Area 1 exceeded the 1995 figure and accounted for 83 percent of the acres treated (102,440 of 122,740 acres treated). In Priority Area 2, the District treated 19,776 acres in 1998, 21 percent more than in 1996, but still 51 percent fewer than in 1995. In 1998, 16 percent of the acres treated were in Priority Area 2. The District treated even fewer acres in Priority Area 3 in 1998 than in 1996; by 1998, the District was treating 524 Priority Area 3 acres.

⁷ Metropolitan Mosquito Control District, *1997 Budget*, January 6, 1997: ii.

⁸ Metropolitan Mosquito Control District, *1998 Budget*: 9, 13.

⁹ Our analysis does not include the District’s 1997 treatment data because of concern about the quality of the data, which is discussed later in this chapter.

We examined whether the District used its established treatment thresholds before applying insecticides.

MMCD has established thresholds for the number of mosquito larvae that must be present before it will treat sites. The treatment thresholds vary by type of mosquito and priority area. For example, the treatment threshold for floodwater mosquito breeding sites treated with a helicopter is an average of two larvae per dip in Priority Area 1.¹⁰ Breeding sites treated by District staff on the ground require only a presence of mosquito larvae before treatment. In some instances, these sites consist of shallow depressions, tire ruts, and similar features. Staff focus ground treatments on sites with a history of producing larvae.

Breeding sites treated by helicopter accounted for 89 to 92 percent of the acres treated by MMCD with larval insecticides in 1995, 1996, and 1998. Our analysis focused on 1998 breeding sites treated by helicopter to determine if the District treated sites that met its thresholds.¹¹ We found that:

- **Nearly all of the mosquito breeding sites treated by helicopter in 1998 met the treatment thresholds.**

Of the 5,083 breeding site treatments made by helicopter in 1998, the District treated 95 percent of the sites after a pretreatment count established that the threshold had been met. The District labeled 60 percent of the 254 treatments that did not meet pretreatment thresholds “FAST” (First Air Sites Treated) sites, or sites that were treated because of a history of breeding mosquitoes rather than pretreatment counts.¹²

Adult Control Activity

The use of insecticides to kill adult mosquitoes has been the focus of recent criticism of MMCD. In this section we examine changes in how and where adult insecticides were applied, the District’s adult mosquito treatment policy, reasons for adult treatments, and use of treatment thresholds.

The increased use of insecticides to kill adult mosquitoes was a significant change in MMCD control efforts following the 1996 budget cut. According to the District, it increased adult control to provide service in areas not receiving larval control. At a November 1995 Technical Advisory Board (TAB) meeting, some board members expressed concern about this strategy before it was implemented. The TAB then passed resolutions recommending that “the District continue to

¹⁰ The treatment threshold for floodwater mosquitoes in Priority Area 2 is an average of 5 per dip. For spring *Aedes* the thresholds are 0.1 and 0.5 in Priority Areas 1 and 2, respectively. To determine pretreatment larvae counts for sites treated by air, MMCD field staff lower a dipper into the water at several locations in a breeding site to collect a sample of larvae. Staff determine an average number of larvae per dip and send the sample to the District’s laboratory, which identifies the species and stage of larval development. If the laboratory analysis confirms that a sample consists of larvae of human-biting mosquitoes that are still feeding and meet the threshold, field staff are given the “green light” to treat the site.

¹¹ Our analysis did not include acres treated with sand-based insecticides or Lagenex liquid.

¹² Other treated sites not meeting pretreatment thresholds included: 40 sites that were close to Priority Area 1 and treatment provided protection to Priority Area 1 residents; 28 sites where staff used “professional judgment” to determine that treatment was needed; and 30 cattail mosquito breeding sites. MMCD staff told us that 0.25 larvae per dip threshold for cattail mosquitoes is a guide; treatments will be done if a site has a history of breeding cattail mosquitoes.

The District reduced the number of acres treated to kill adult mosquitoes in 1998 because weather conditions did not produce large mosquito populations.

emphasize larval control” and “not necessarily respond to increased mosquito annoyance with an increase in adulticide use.”¹³ At a spring 1997 TAB meeting, after members saw the actual increase in acres treated for adult control, they again expressed concern and recommended that the District focus primarily on control of mosquito larvae.¹⁴ This concern continued into 1998 when the TAB cautioned against increasing the use of adult control insecticides as an automatic response to citizens’ requests for mosquito control services.¹⁵

The District decreased the number of acres treated to kill adult mosquitoes from about 113,500 acres in 1997 to about 71,800 acres in 1998, primarily because weather conditions did not produce significant infestations of adult mosquitoes. We used 1996 and 1998 treatment data to examine changes in how and where adult insecticides were applied.¹⁶ Table 3.3 summarizes the acres treated by method of application and by regional office. The data show that:

- **The reduction in acres treated with resmethrin using a truck-mounted cold fogger accounted for most of the change in acres treated to kill adult mosquitoes between 1996 and 1998.**

Changes in the use of other insecticides and application methods were relatively small. In 1998, the Anoka and Jordan regional offices each accounted for about one-fourth of the acres treated for adult mosquitoes, while the Oakdale office accounted for less than one-fifth of all acres treated. Each regional office treated at least 44 percent fewer acres for adult mosquito control between 1996 and 1998, with the exception of the Jordan office, which treated 67 percent more acres.

Adult Mosquito Treatment Policy

The District emphasizes that it provides limited localized adult mosquito control for highly frequented public parks and civic functions and in potential disease situations. The District’s current (revised June 1, 1998) adult mosquito treatment policy also includes citizen requests in its treatment protocol. The policy states:

The MMCD treats functions open to the public, and public owned park and recreation areas . . . upon request and at no charge if the event is not for profit. Public events operated for profit will not be treated. The District will also respond to citizen requests and will treat adult mosquitoes in a potential disease situation.¹⁷

¹³ Metropolitan Mosquito Control District, Technical Advisory Board Meeting Minutes, November 30, 1995: 3.

¹⁴ Metropolitan Mosquito Control District, Technical Advisory Board Meeting Minutes, April 3, 1997: 2.

¹⁵ Mr. Laurence N. Gillett, chair of the Technical Advisory Board, to Ms. Margaret Langfeld, chair of the Metropolitan Mosquito Control Commission, April 14, 1998, letter.

¹⁶ MMCD applies permethrin during the day to perimeter vegetation of mosquito harborage areas using backpack sprayers carried by staff or mounted on all-terrain vehicles. It applies resmethrin using hand-held ULV sprayers for daytime applications when preferred vegetation is missing and ATV- and truck-mounted cold foggers at dusk or dawn.

¹⁷ Metropolitan Mosquito Control District, Adult Mosquito Treatments, *Administrative Manual*, June 1, 1998: 1.

Table 3.3: Acres Treated to Kill Adult Mosquitoes, 1996 and 1998

<u>By Method of Application</u>	<u>1996</u>	<u>1998</u>	<u>Percent Change</u>
Permethrin			
Staff-carried backpack	2,113	3,661	73.3%
ATV-mounted backpack	3,907	2,503	-35.9
Resmethrin			
Hand-held ULV	1,681	1,448	-13.9
ATV fogger	10,485	11,645	11.1
Truck-mounted cold fogger	<u>108,054</u>	<u>52,263</u>	-51.6
Total	126,240 ^a	71,520 ^b	-43.3
			<u>Percent Change</u>
<u>By Region</u>	<u>1996</u>	<u>1998</u>	<u>Change</u>
North Region - Anoka	32,207	17,980	-44.2%
South Region - Jordan	11,773	19,614	66.6
South Region - Rosemount	5,533	2,951	-46.7
West Region - Maple Grove	23,510	9,955	-57.7
West Region - Plymouth	24,737	9,616	-61.1
East Region - Oakdale	<u>28,626</u>	<u>11,645</u>	-59.3
Total	126,387	71,761	-43.2

NOTE: Numbers may not sum due to rounding.

^aInformation on the method of application was missing for 147 acres in 1996.

^bInformation on the method of application was missing for 242 acres in 1998.

SOURCE: Program Evaluation Division analysis of Metropolitan Mosquito Control District treatment data.

Acres treated with resmethrin using a cold fogger accounted for most of the acres treated to kill adult mosquitoes in 1996 and 1998.

The policy discusses a number of ways that treatment may be initiated. Parks and recreation directors may schedule season-long treatment for a particular park with one request to the District or they and community event organizers may make requests a minimum of seven days before a special event. Citizens or neighborhoods of citizens, along with public officials, may request treatments for functions or for “perceived annoyance.” MMCD team leaders may initiate treatments if they become aware of high adult mosquito counts in populated areas and confirm these high adult mosquito counts through sweep net or other collections. MMCD-initiated treatments must be cleared by the District’s director or group leaders. Finally, treatments may be initiated in response to health concerns such as LaCrosse encephalitis.¹⁸

¹⁸ *Ibid.*

Examples of areas that may be treated for adult mosquitoes are listed in the policy. Although not intended to be inclusive “if they are not for profit,” the examples include: park and recreation areas, school events (such as graduation and athletic events), public events (such as county fairs and Fourth of July celebrations), city- or county-owed golf courses, and youth camps (such as boy scout, girl scout, and church camps). The District may treat LaCrosse encephalitis sites where at least two adult tree hole mosquitoes have been found and borders of areas not receiving larval control.¹⁹ The policy states that District staff are supposed to inform callers that there are private companies that can do adult mosquito control on their property or for a private function.

District staff revised the adult mosquito treatment policy and procedures in 1998, the first revision since 1994. Most of the changes involved clarifying or updating language to reflect the current District organization, product labels, and application methods. After comparing the current policy with past priorities, reviewing treatment practices, and interviewing District staff, we concluded that:

- **The District’s current adult mosquito treatment policy and practices give more emphasis to responding to citizen requests than did earlier adult treatment priorities.**

In 1993, the District set priority categories for adult mosquito control (see Figure 3.2).²⁰ For evening cold fog treatments with resmethrin, the highest priority treatments were for potential disease carrying mosquitoes, public park and recreation areas, school events, and public golf courses. Neighborhood treatments and treatment of mosquito harborages not associated with parks were Category 3 priorities in 1993. For backpack treatments with permethrin, no reference was made to citizen requests or neighborhood treatments.

Contrary to its policy, the District provided adult mosquito treatments for some for-profit enterprises and private functions in 1998.

While the current policy does not overly emphasize providing service to citizens, MMCD staff told us that early in the 1998 mosquito season, the District director visited regional offices and emphasized to staff the need to respond to citizen requests and provide customer service. During our site visits we noted that adult treatments in some regions focused on daytime spraying of harorage areas (stands of trees and shrubs) on individual private properties. We found that:

- **It appears that the Metropolitan Mosquito Control District does not follow its 1998 adult mosquito treatment policy.**

We found some instances of the District providing adult treatments to for-profit enterprises, such as drive-ins, entertainment venues, and raceways. District staff told us that these treatments were justified either because the venues were frequented by area citizens or because the treatment would provide protection to residents living near the treated harorage area. We also found instances of the District providing adult treatments for private functions either in public parks or at private residences, such as graduation parties and wedding receptions.

¹⁹ The District’s adult treatment policy also contains sections on requests for no treatment, which are discussed later in this chapter, and notification procedures, which are discussed in Chapter 5.

²⁰ Metropolitan Mosquito Control District, *Annual Operations Report, 1993*, July 1993: 20-22.

Figure 3.2: MMCD 1993 Adult Mosquito Treatment Priorities

Cold Fogging - Resmethrin

<u>Category</u>	<u>Description</u>	<u>Priorities</u>
1	Areas treated on request	<ul style="list-style-type: none"> • MMCD initiated for areas with high levels of potential disease carrying mosquitoes • Public park and recreation areas • School events • Publicly-owned golf courses
2	Reviewed by MMCD staff before treatment	<ul style="list-style-type: none"> • Charity events • Community service groups, clubs and organizations whose function is open to the public (such as service clubs, churches) • Privately-owned golf courses hosting special events open to the public (such as celebrity golf tournaments for a charity group) • Business/corporate functions open to the public and free or charity fund raisers
3	Directive from MMCD staff or director	<ul style="list-style-type: none"> • Neighborhood treatments • Harborage treatments not associated with park and recreational areas or events • Areas not routinely treated in the past

Backpack Treatments - Permethrin

<u>Category</u>	<u>Description</u>	<u>Priorities</u>
1	Regular or scheduled treatments	<ul style="list-style-type: none"> • Public park and recreation areas
2	Areas treated on request	<ul style="list-style-type: none"> • MMCD initiated for areas with high levels of potential disease carrying mosquitoes • Community sponsored events or functions (such as county fairs) • School events • Publicly-owned golf courses
3	Reviewed by MMCD staff before treatment	<ul style="list-style-type: none"> • Charity events • Community service groups, clubs and organizations whose function is open to the public (such as celebrity golf tournaments for a charity group) • Business/corporate functions open to the public and free or charity fund raisers

SOURCE: Metropolitan Mosquito Control District, *Annual Operations Report, 1993*, July 1993: 20-22.

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

In a discussion with District staff late in our evaluation, we were told that the District provides adult mosquito treatments to for-profit enterprises, such as restaurants and privately-owned golf courses, based on a discussion that took place at a May 22, 1996 executive committee meeting. At that meeting, staff noted that since for-profit properties pay taxes, they should receive a basic level of service, perhaps for a fee. However, the minutes from that meeting show that the executive committee did not take any formal action on this issue. Instead, committee members directed staff to look into the possibility of having for-profit enterprises pay for the cost of the insecticide and let these customers know that the District was planning to change its adult treatment policy. Our review of meeting minutes indicates that the full Commission did not review or approve a change in adult treatment policy based on the May 1996 executive committee discussion. Indeed, provisions for treating for-profit enterprises were not incorporated into the District's adult treatment policy when it was revised in June 1998. Finally, District staff had difficulty articulating the District's adult mosquito treatment policy. It was not clear whether the District does not treat for-profits, treats for-profits for a fee, or treats for-profits 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, we recommend that:

- **The Metropolitan Mosquito Control District should reexamine its adult treatment procedures to ensure that practices conform with its current adult treatment policy.**

The District's 1998 adult treatment policy clearly states that it will provide mosquito control services for "not for profit" events and people requesting mosquito control services for their property for a private function will be referred to private companies that do mosquito control. In addition to clarifying its adult mosquito treatment policy, the District may also want to review its treatment procedures to ensure that the practices conform with its current policy.

Reasons for Adult Treatments

We used MMCD's treatment data to try to determine the reasons for adult mosquito treatments. We found that:

- **Our ability to analyze and make definitive conclusions about the reasons for adult mosquito treatments was limited because of problems with the data.**

Customer requests, parks, and events were the reasons for most of the acres treated for adult mosquitoes in 1998.

In 1995, the District identified three possible “causes” for adult treatments: park, event, or other.²¹ We were unable to identify a specific cause for 45 percent of the acres treated because about 27 percent of the acres were missing a cause code and another 18 percent were coded as “other.”²²

Starting in 1996, the District expanded the possible reasons for adult treatments to six options: customer response, park, event, LaCrosse encephalitis, Western Equine encephalitis (*Culex tarsalis*), and other. Table 3.4 shows that the primary reasons for adult treatments were customer responses, parks, and events in 1996 and 1998.²³ In 1998 about 17 percent of the acres treated were coded as “other” or were missing a code. The percent of acres coded as “other” was quite high in some facilities. Similar concerns are evident in the 1996 data. This makes it difficult for us to make year-to-year comparisons with confidence. In addition, the wide range in the use of different codes among regional offices suggests that staff may not consistently code the reason for adult mosquito treatments. It is unclear how or whether staff made distinctions among park, event, or customer response treatments. A customer request for a treatment at a function in a park could be coded as “park,” “customer response,” or “event.” We recommend that:

- **MMCD should improve and clarify criteria and instructions on how to code the reason for an adult mosquito treatment to improve the consistency of the data collected by staff in the regional offices.**

Table 3.4: Percentage of Acres Treated for Adult Mosquitoes by Reason, 1996 and 1998

Reason for Treatment	1996		1998	
	District-wide Average	Range for Regions	District-wide Average	Range for Regions
Customer response	40%	6-63%	35%	17-60%
Park	36	16-54	27	4-42
Event	12	2-37	19	5-32
LaCrosse encephalitis	1	0-2	2	0-10
Western Equine encephalitis	1	0-3	0	N/A
Other	9	4-27	16	3-39
Missing data	2	0-4	1	0-2

SOURCE: Program Evaluation Division analysis of Metropolitan Mosquito Control District treatment data.

²¹ The District uses a field form to record information on adult treatments. This form contains options for the “cause” of a treatment. On the 1995 field form the park and event options were shown as one option—park/event. Staff filling out the form were supposed to specify a “p” or an “e.” This may have led to some inaccurate coding.

²² The percentage of 1995 adult control treatments missing a cause code or coded as “other” varied by region. For instance, in one region 44 percent of the records were missing a “cause” code. Another region coded 39 percent of its treatments as “other.”

²³ Analysis did not include 1997 data because of concerns about data quality. Analysis of 1998 adult treatment data included treatments through the middle of September.

Ideally, if MMCD does an adult mosquito treatment in response to a citizen request for treatment in a public park where an event will be held, then all regions should record the same reason for the treatment. We believe the reason for treatment is important information and, if used consistently, could reflect shifts in MMCD policy regarding customer responsiveness or treating for events. This information would also enable MMCD to respond to requests for information about why it is applying adult insecticides.

Though flawed, the adult treatment data suggested that:

- **Adult mosquito treatments done for reasons related to disease prevention accounted for fewer than 3 percent of the District’s adult mosquito treatments.**

When a reported case of LaCrosse encephalitis (LAC) occurs, one element of the District’s response is to spray for disease carrying adult mosquitoes in the vicinity of the case. The District also continues to monitor and treat past sites of reported LAC cases as needed. In 1996 and 1998, the reasons “LaCrosse encephalitis” and “Western Equine encephalitis” combined accounted for a small proportion of all adult treatments. In some regions, such as southern Hennepin County and Rosemount, these treatments were more prevalent than in other regions.

We also tried to determine where MMCD has applied insecticides to kill adult mosquitoes and how many times individual parks were treated. Unlike larval breeding sites, the District does not use unique site codes for adult mosquito harborage sites.²⁴ Therefore, it was not possible to analyze the number of times a specific park was treated or the number of acres that represent repeat treatments in the same location. Figure 3.3 shows where resmethrin was applied in 1998 and illustrates that more resmethrin was applied in certain townships in Anoka, Hennepin, and Scott county than other areas.

Treatment Thresholds

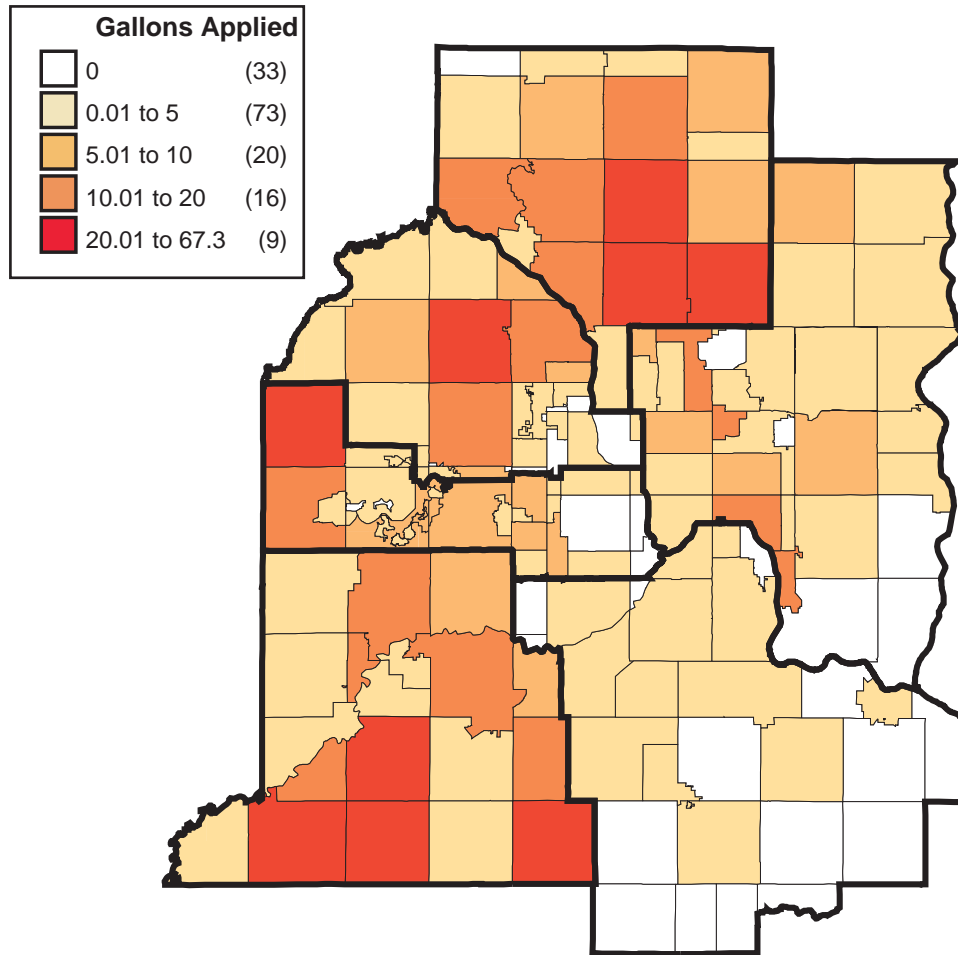
MMCD has a policy of killing adult mosquitoes with insecticides only after a pretreatment mosquito count in the area meets or exceeds an established threshold. District staff emphasized to us that the District makes it a practice to determine that threshold levels of mosquitoes are present before adult insecticides are applied. We focused on the District’s 1998 adult treatment file to determine if the District is meeting thresholds before treating an area with adult insecticides. MMCD takes adult pretreatment counts in one of four ways: a CO₂ trap, a sucomatic, a sweep net count, or a slap count.²⁵ A CO₂ trap left up overnight must collect over 130 mosquitoes for the threshold to be met. The District uses

²⁴ Some regional offices use site codes for individual parks. However, for a large park the site code does not provide information on what sections of the park were treated. It should also be noted that District staff use treatment forms and maps to record all adult insecticide treatments. The forms and maps, which identify treatment locations, are maintained in paper files.

²⁵ CO₂ traps use dry ice to attract mosquitoes. Sucomatics are like large vacuums; as field staff walk through harborage areas to stir up the resting mosquitoes, the sucomatic draws them into a net. For a sweep net collection, a person stands in one spot and sweeps a net to capture mosquitoes. Field staff do slap counts by standing in a location and counting mosquitoes that land on them.

The amount of resmethrin applied by township in 1998 varied from 0 to 67 gallons.

Figure 3.3: Application of Resmethrin by Township, 1998



NOTE: The amount of resmethrin used by the Oakdale facility according to its treatment records was over 15 percent higher than the use according to the inventory. Therefore, townships in Ramsey and Washington counties may reflect higher resmethrin use than actually occurred.

SOURCE: Metropolitan Mosquito Control District.

sucomatics to take counts of tree hole mosquitoes, the primary carrier for LaCrosse encephalitis. The threshold for sucomatic samples is two mosquitoes per five-minute collection. Thresholds for sweep net and slap counts are two mosquitoes in two minutes or five mosquitoes in five minutes.

Based on our analysis of adult treatment data, we found that:

- **With few exceptions, the District provided adult treatments in 1998 only after pretreatment thresholds had been met.**

There were 4,003 treatment records in MMCD's 1998 adult treatment file. Of the 3,763 treatments that we were able to analyze, the District met the established threshold before treatment in 99.5 percent of the treatments.²⁶

Insect-Borne Disease Prevention

In addition to monitoring and controlling annoyance mosquitoes, MMCD has insect-borne disease management responsibilities in the Twin Cities area. Since 1987, the District has monitored and controlled for the tree hole mosquito, the primary carrier of LaCrosse encephalitis. It also monitors populations of the mosquito (*Culex tarsalis*) that can carry Western Equine encephalitis, other mosquitoes that carry diseases, and the number and distribution of deer ticks in the Twin Cities area.

LaCrosse encephalitis (LAC) is a potentially serious disease affecting the brain and central nervous system. Although adults can get the illness, most cases occur in children. Of 66 cases reported in Minnesota since 1985, all but one have involved children 16 years of age or younger. Most cases of the illness occur in a relatively small area of the state. In the Twin Cities area this includes the Lake Minnetonka area and extends southeast to Dakota and Washington counties (see Figure 3.4).²⁷

Tree hole mosquitoes, which can carry the LAC virus, breed in containers that hold water, either tree holes in hardwood forests or artificial containers such as waste tires. They rarely travel more than half a mile from their breeding site and they feed during the day. Research has found that LaCrosse encephalitis can be prevented by removing tree hole mosquito breeding sites.²⁸

The District monitors and controls mosquitoes that can be carriers of disease.

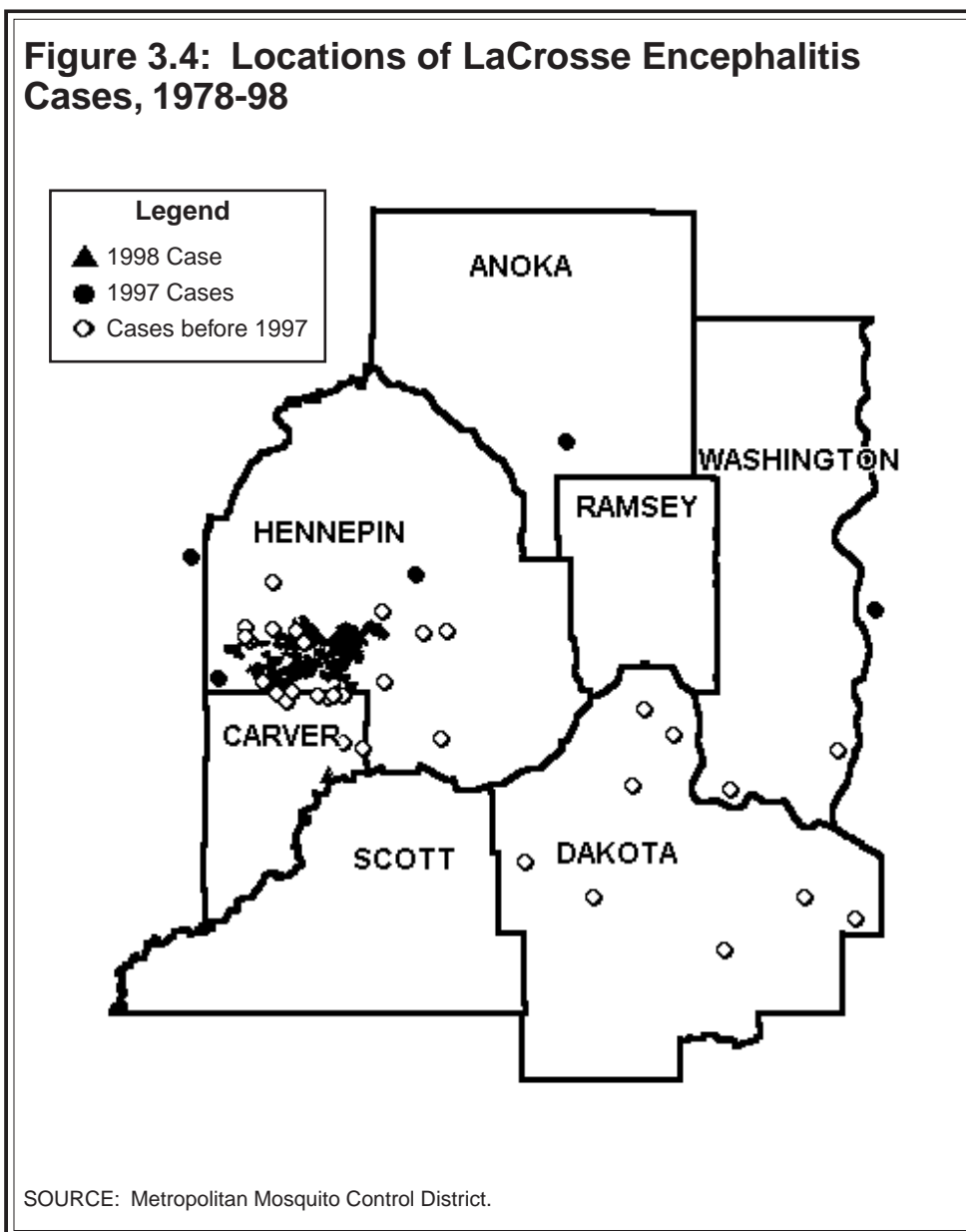
²⁶ This assumes that all sweep net and slap counts were of two-minute duration. We were unable to tell whether 6 percent of the treatments had pretreatment counts that would justify treatment because 191 records were missing a count, 17 records had a count of zero, and 32 treatment records did not indicate what type of sample collection method had been used.

²⁷ Outside of the Twin Cities area, most cases of LaCrosse encephalitis have occurred in the state southeast of the Twin Cities along the Mississippi River. Almost two-thirds of reported cases have been in Goodhue, Houston, Wabasha, and Winona counties. Winona and Houston counties contract with LaCrosse County, Wisconsin for disease prevention services, including mosquito monitoring and inspection for artificial containers. Historically, few insect-borne disease prevention services have been available in other counties.

²⁸ C. W. Hedberg, J. W. Washburn, and R. D. Sjogren, "The Association of Artificial Containers and LaCrosse Encephalitis Cases in Minnesota, 1979," *Journal of the American Mosquito Control Association* 1 (1985): 89-90.

Most cases of LaCrosse encephalitis occur around Lake Minnetonka and in the southeast portion of the Twin Cities area.

Figure 3.4: Locations of LaCrosse Encephalitis Cases, 1978-98



MMCD’s monitoring activities include identifying the areas that constitute the highest LAC risk, such as areas around previous cases and stands of hardwood forest near concentrations of population, especially schools or daycare centers. Each reported LAC case location is monitored approximately every two weeks. District staff visit the case site, search for containers holding water, and clean up breeding sites by moving old tires, emptying other containers, and filling tree

The District's response to a reported case of LaCrosse encephalitis includes public education, breeding site removal, adult mosquito spraying, and monitoring.

holes.²⁹ They also monitor the populations of tree hole mosquitoes in high risk areas using sucomatics to collect adults and egg traps (ovitrap) to detect egg laying activity.³⁰ The District's public information efforts focus on informing the public and school children about the tree hole mosquito habitat and the need to identify and empty artificial containers.

We observed the District's response to a probable case of LaCrosse encephalitis in August 1998. Once informed of the probable case and possible exposure locations by the Minnesota Department of Health, MMCD began planning its response, assembling overview and section maps, and dividing sites into areas assigned to different teams. The District focused on the area within approximately a half a mile around the victim's home. Staff knocked on doors to hand out literature and inform neighbors about the case and its cause, searched yards for containers and possible breeding sites, collected samples of adult mosquitoes, and sprayed for adult mosquitoes. When an artificial container was found, the water was emptied from the container. If mosquito larvae were found in a container, a sample of the water and larvae was collected.³¹

In this case, the Department of Health identified a public horticultural area as a possible exposure location. At this location, MMCD staff looked for tree holes, focusing on stands of hardwood trees. When a wet hole was found, a sample of the water and larvae was taken. Tree holes were filled with dirt.

The results of these efforts are summarized in Table 3.5. MMCD continued to monitor the case site and the other possible exposure site every other week and used egg traps to monitor egg laying activity.

The District also monitors for *Culex tarsalis* populations, the carrier for Western Equine encephalitis, a viral disease that can affect humans but is found more often in animals. Surveillance activities consist of monitoring three sentinel chicken flocks in Anoka, Hennepin, and Scott counties. Blood samples are drawn from the chickens weekly and sent to the Department of Health for analysis to determine if the virus is present. District staff also monitor larval and adult populations of this mosquito.

The Asian Tiger mosquito (or *Aedes albopictus*), an aggressive human biter that can transmit diseases, is not established in the Twin Cities area. In 1991, this mosquito was discovered at a tire recycling facility in Scott County. An emergency response that included adult treatments and clean up of the tires, with the Pollution Control Agency's assistance, eliminated the infestation. Additional infestations of this mosquito were discovered and controlled in 1996 and 1997 in

²⁹ In 1997, the District picked up over 36,000 waste tires either from high risk areas or because of a customer request. The District has helped to clean up tires stockpiled by commercial garages. In past years, MMCD has received some funding from the Minnesota Pollution Control Agency for its tire removal operations and some counties have reimbursed MMCD for tires removed in their jurisdictions.

³⁰ The tree hole mosquito can be found throughout the district. Not all tree hole mosquitoes are infected with the LaCrosse encephalitis virus.

³¹ The District raises larvae samples to adults and sends them to the Department of Health, which tests to see if they were carrying the encephalitis virus.

Table 3.5: Summary of Metropolitan Mosquito Control District Response to a Probable Case of LaCrosse Encephalitis, August 1998

Total residences contacted	1,000
Personal contacts	400
Brochures distributed	815
Properties inspected	992
Tree holes found	127
Artificial containers found	387
Tree holes/containers breeding larvae	118
Tree holes/containers breeding tree hole mosquito larvae	91
Sucomatic adult collections	88
Adult treatments	15

NOTE: Information represents activity in the neighborhood of the child with LaCrosse encephalitis and at a public horticultural area.

SOURCE: Interview with Jeff Luedeman, Metropolitan Mosquito Control District Vector-Borne Disease Specialist, August 22, 1998.

Wright and Scott counties. MMCD continues to monitor several waste tire operations for the presence of the Asian Tiger mosquito.

The District also monitors the distribution of deer ticks, carriers of Lyme disease, in the Twin Cities area.

Since 1990, the District has monitored the distribution of deer ticks in the Twin Cities area. MMCD staff capture small rodents (mainly white-footed mice) from a network of 100 sites and collect any ticks attached to the rodents. In 1997, 728 animals were collected, killed, and combed for ticks. Deer ticks were found in 24 sampling locations. Most ticks were found in the northeastern part of the Twin Cities area—Anoka, northern Ramsey, and Washington counties.

The District also collaborates with a University of Minnesota researcher to monitor the presence of the ehrlichiosis agent. Ehrlichiosis is a bacterial disease that can affect humans and is carried by ticks and found in rodents. Staff draw blood from white-footed mice they collect and send it to the University for analysis. In 1997, there was one confirmed isolation of the ehrlichiosis agent in rodent blood.³²

The District works closely with the Minnesota Department of Health, the state's lead public health agency responsible for disease surveillance and prevention, in the area of insect-borne disease management. These agencies are in the process of developing a memorandum of understanding that will outline their respective responsibilities.³³ Generally, the District monitors and controls for mosquitoes that can transmit diseases and informs the public of these activities. The

³² Metropolitan Mosquito Control District, *1997 Operational Review*: 17-18.

³³ We reviewed a draft of the memorandum dated July 20, 1998.

MMCD and the Department of Health work together to monitor and control insect-borne diseases.

department contacts county health departments, as well as the District, and informs the public about disease cases. MMCD reviews results of surveillance activities. If MMCD sees any unusually high populations of tree hole mosquitoes during its surveillance activities it notifies MDH which issues a warning.

The preliminary agreement also states that upon a request from the Department of Health, the District may provide mosquito-borne disease surveillance and control outside the District. In 1997, the District provided these services at a LaCrosse encephalitis case site in Delano, just outside of the District boundary. Representatives of the District have also participated in Department of Health meetings held in southeastern Minnesota and have served as a resource for counties outside the Twin Cities area.

- **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, such as LaCrosse encephalitis, and monitoring deer ticks.**

Department of Health staff said they do not doubt that MMCD efforts to remove artificial containers, monitor past LAC case sites, and educate the public have reduced the risk for LaCrosse encephalitis transmission. For disease prevention, the Health Department considers spraying for adult mosquitoes to be secondary to eliminating breeding sites.

MMCD has one full-time staff member designated as the insect-borne disease specialist. Since 1998 the person in this position has also served as a region group leader and has estimated that he spends about 40-50 percent of his time on insect-borne disease activities. Among other responsibilities, the insect-borne disease specialist is supposed to ensure that staff in other regional offices are properly trained in monitoring procedures. Given the prominence and priority of public health issues, we suggest that the District should consider increasing the insect-borne specialist position to a full-time position.

Refused Treatment Requests

MMCD statutory language states that District employees may “enter upon any property” for mosquito control purposes, “subject to the paramount control of the county and state authorities.”³⁴ In 1982, the Legislature amended language related to the District’s access to private and public property. One amendment gives private landowners the right to refuse the District access to their property “except for control of disease bearing mosquito encephalitis outbreaks.”³⁵ A second amendment requires the Commissioner of Natural Resources to allow the District to enter Department of Natural Resources property for mosquito control purposes.³⁶ Although state law restricting the District’s access to property does not specifically apply to public lands managed by DNR, cities, and townships, the

³⁴ *Minn. Stat.* §§473.704, subd. 17.

³⁵ *Minn. Laws* (1982), ch. 579, subd. 6.

³⁶ *Ibid.*

**Since 1982,
private land
owners have
had the right to
refuse the
District access
to their
property.**

District's current procedures allow both private property owners and public property managers to refuse access for larval and/or adult mosquito control activities. This section discusses MMCD's policy and procedures for refused treatment properties and presents information on refused treatment properties.

The District's adult mosquito treatment policy, revised June 1, 1998, contains a section titled "requests of no treatment." The policy recognizes that private citizens may request that the District not perform adult mosquito control on their property and states that the District will honor these requests. The policy states that "the District will maintain a buffer around citizens who request that [the District] stay a distance away from their property for cold fogging operation."³⁷ The policy also states that if a community requests that the District not treat its property, "the District will attempt to honor the request but retains the right to make the decision based on health or severe annoyance. If infestations reach levels which affect health or cause severe public annoyance, the District retains the ability to do adult mosquito control."³⁸

The District's *Field Operations Manual* contains procedures for refused treatment requests taken by staff at the headquarters office or staff at the regional offices. The District revised its refused treatment procedures in April 1998. The procedures were similar in prior years with the exception that in 1998 requests were required to be in writing. According to MMCD staff, this change was made to address concerns about being able to accurately locate a property and to minimize possible misrepresentations made on the telephone.

For all requests received, staff at the regional office fill out a "Refused Entry/No Control Field Form," update the section maps and cards identifying the property in question as a refused entry or treatment area, attach a copy of the map to the field form, and file the request.³⁹ Staff mark the refused treatment status of the request using the options listed in Figure 3.5. Then staff send a copy of the field form with the updated map to the headquarters office. The procedures indicate that staff at headquarters will enter the information into a computerized database maintained at the headquarters office.

The adult mosquito control procedures also contain instructions on treatment restrictions for refused treatment property. Specifically,

- **MMCD has provided a 100- to 600-foot buffer zone in all directions around each refused treatment property depending on the type of insecticide being used and the method of application.**

³⁷ Metropolitan Mosquito Control District Adult Mosquito Treatment Policy, *Administrative Manual*, June 1, 1998: 2. The June 1998 revision of the adult mosquito treatment policy did not change the refused treatment language.

³⁸ *Ibid.*

³⁹ The Refused Entry/No Control Field Form collects information on the date of the request, name, address, type of property (public or private property or other), location of property (county, township, section), legal description, acres, wetland type, and status of and reason for the request.

Figure 3.5: Options on Refused Treatment Form

Mosquito Larval Control	Adult Mosquito Control
1. Refused entry/Keep out	1. Keep away
2. Monitor only/No control	2. Keep away and notify before backpacking
3. Notify/Get permission to monitor	3. Keep away and notify before cold fogging
4. Change from refused entry to monitor only or special response	4. Keep away and notify before any adult control
5. Remove from refused entry	5. Remove from keep away list

SOURCE: Metropolitan Mosquito Control District, Refused Entry/No Control Field Form.

MMCD policies and procedures provide for a buffer zone for property owners who refuse mosquito control treatments.

The District's no treatment buffer zones for refused treatment properties are:

- a 100-foot radius for treatments of harborage areas with permethrin applied with a backpack carried by an applicator or mounted on an all-terrain vehicle (ATV);
- a 600-foot radius for evening applications of resmethrin applied with a truck- or ATV-mounted cold fogger; and
- a 200-foot radius for resmethrin applied with a hand-held cold fogger.⁴⁰

The District established these buffer zones by doubling the swath width of the application device to provide a wide margin around a refused treatment property. For example, a truck- or ATV-mounted cold fogger has a swath width of 300 feet in each direction; the District doubled this distance to establish its buffer zone of 600 feet.⁴¹ Some other states address the refused treatment issue by turning off the applicator in front of a refused treatment property or by notifying people prior to treatment and asking them to close their house windows or leave their property.⁴²

Prior to adult control applications, procedures direct MMCD staff to examine the map of the area to be treated to become familiar with the area, identify bodies of water, refused treatment property, and other features with treatment restrictions, and plan the treatment routes based on weather conditions.⁴³ Staff also call people

⁴⁰ Metropolitan Mosquito Control District, Adult Mosquito Control Procedures, *Field Operations Manual*, May 1998: 7, 10.

⁴¹ The product labels for Scourge (resmethrin) and Permethrin 57% OS do not contain recommended buffers for refused treatment properties.

⁴² Florida, Michigan, New York, Virginia, Washington, and South Cook County, Illinois.

⁴³ This is not a comprehensive list of tasks conducted prior to an adult control treatment, but represents those tasks related to refused treatment properties.

who have requested notification of treatment in their area. If there is any question about an area to be treated (such as too close to fish, refused entry, or a sensitive person) staff are directed to discuss the situation with their team leader or group leader before treating the area.⁴⁴

- **Our analysis of refused treatment properties was limited because, contrary to its internal procedures, the District has not maintained a computerized database of refused treatment properties since 1995.**

In 1995, property owners or managers of approximately 57,000 acres of land had restricted access to MMCD. Comparing these data with the District's master breeding site file showed that approximately 26,100 acres (or 45 percent) of the refused treatment acres in 1995 were located in wetland mosquito breeding sites, representing about 14 percent of all breeding acres. Most refused treatment acres were located in Anoka and Scott counties, with over 7,000 and 6,000 acres each, respectively. Approximately 28 percent of these acres were located in Priority Area 1, with 34 percent in Priority Area 2, and 38 percent in Priority Area 3.

About 42 percent of the refused treatment acres in 1995 were requests from public agencies. To gather current information, we interviewed representatives of public agencies we could identify who have refused access to MMCD (see Table 3.6). The acres represent a combination of breeding sites producing mosquito larvae and property that could be treated to kill adult mosquitoes. Some public refused-access property contains large mosquito breeding sites, such as the U.S. Fish and Wildlife and Department of Natural Resources (DNR) land located in the Minnesota River valley. Most public agencies we contacted have refused both larval and adult control treatments.

Public land managers who refused treatment did so for conservation and ecological reasons or because of concern about insecticides.

The District has entered into memoranda of agreement with DNR, the Suburban Hennepin Park District, and Minneapolis Parks to clearly articulate specific details of their refused treatment requests. The specifics of each memorandum of agreement vary among these entities, making generalization difficult. For example, the 1995 agreement with Hennepin Parks specifies treatment conditions based on the nature of specific parks or recreation areas. No treatment of any kind is allowed in some nature centers, while some wetlands in other parks may be treated with larval insecticides.⁴⁵

We asked agency representatives why they refused treatment and their responses fell into several categories. The U.S. Fish and Wildlife Service, DNR, nature centers, and some others cited issues related to compatibility with conservation and ecological concerns related to killing both mosquito larvae and adults. According to these representatives, mosquitoes are an integral part of a balanced food web or chain. Chemical treatments that could create an imbalance in the food web would be incompatible with the purposes of these agencies and

⁴⁴ Metropolitan Mosquito Control District, Adult Mosquito Control Procedures: 6-7, 9, 10-11.

⁴⁵ Memorandum of Agreement Between Hennepin Parks and the Metropolitan Mosquito Control District Regarding Control of Mosquitoes and Black Flies on Property Owned and/or Managed by Hennepin Parks, effective date Feb. 1995.

Table 3.6: Selected Public Agencies Refusing Access to Metropolitan Mosquito Control District

Public Agency	Estimated Acres	Year Initiated	Refused Treatment for Larval, Adult, Both
U.S. Fish & Wildlife Service:			
Minnesota Valley Wildlife Refuge	10,000	1985	Both
Department of Natural Resources	42,497 ^a	1989	Both
Chanhassen	500	1992	Adult control on city property
Maplewood	500	1993	Adult control on city property
St. Paul Parks:			
Hidden Falls Park	800	1992	Adult control
Crosby Nature Park			Both
Lilydale Park			Both
Minneapolis Parks ^b	5,200	1996	Adult control
Hennepin Parks	larval - 3,800 adult - 25,000	1970s	Varies depending on the park
Town of Grant	14	1993	Both
Columbus Township ^c	30	1993 to 1998	Was both
Nature Centers/Areas:			
Spring Brook, Fridley	127	1978	Both
Innsbrook, Fridley	25	1978	Both
Westwood Hills, St. Louis Park	150	Late 1980s	Both
Woodlake, Richfield	150	1988	Both

NOTE: In addition, the North Oaks Company and North Oaks Homeowners Association requested in 1997 that about 4,000 acres of property not be treated for larval or adult mosquito control.

^aRepresents all Department of Natural Resources-administered land in the Twin Cities metropolitan area.

^bMinneapolis Parks refused treatment policy changed from no larval or adult treatment since 1992 to no adult treatment in 1996.

^cAt a meeting on August 26, 1998 the Columbus Township Board reversed its refused treatment policy effective immediately.

SOURCES: Office of the Legislative Auditor telephone interviews, Summer 1998; memoranda of agreement between Metropolitan Mosquito Control District and Department of Natural Resources, Hennepin Parks, Minneapolis Parks, various dates, on file at the Office of the Legislative Auditor.

organizations. Concern was also expressed about the impact on nontarget species. Community representatives, whose properties would be most affected by treatments for adult mosquitoes, cited public health concerns about insecticides.

We also asked agency representatives to rank their satisfaction with MMCD honoring their request. Most people responded that they were “satisfied” or “very satisfied.” Some people who were dissatisfied told us about situations from the late 1980s and early 1990s when the District publicly blamed agencies refusing treatment for the District’s inability to control mosquitoes. Agency representatives described the relationship with the District as tense and competitive during these years. Some people acknowledged that with the change in director at MMCD in 1994 working relationships had improved and were not so antagonistic, and the District staff had stopped directing citizen complaints to

The District received 600 additional refused treatment requests in 1998.

agencies refusing treatment. According to a DNR representative, agency staff were “very dissatisfied” with MMCD because the District treated refused treatment land in a scientific and natural area in 1997 and again in 1998. In both years, DNR staff contacted MMCD to complain about the treatments. MMCD staff told us that because the boundaries of the area had expanded there was confusion about what land was owned by DNR.

During the spring and summer of 1998, an environmental group encouraged people to contact the District and request refused treatment status for their property. Based on information from MMCD and our analysis of MMCD telephone customer requests, the District received about 600 additional refused treatment requests in 1998.⁴⁶ This compares with about 100 requests received in 1997.⁴⁷ Nearly one-half of the 1998 requests were from Hennepin County, followed by Ramsey County with 17 percent, and Dakota and Washington counties with about 13 percent each. MMCD has not compiled the 1998 requests in a computerized database, which limited our ability to draw conclusions about the nature of or the number of acres involved with these requests.

MMCD has conducted a telephone survey of residents in the Twin Cities area every two years since 1994. The 1998 survey was the first to ask about the general public’s awareness of their right to refuse entry. Of the 422 people surveyed, about one-third (34 percent) responded that they were aware that “citizens have the right to request that their property not be treated by MMCD.”

About 34 percent of citizens surveyed by MMCD were aware that they have a right to refuse mosquito control treatments.

In August 1998, we surveyed a random sample of people who had called MMCD to request service, refuse service, or ask for information in 1997.⁴⁸ Nine percent (or 23) of the respondents to our survey, said they called to request that their property not be treated with mosquito control insecticides. These respondents said they refused mosquito control treatment for a variety of reasons.⁴⁹ When asked to rank their satisfaction with MMCD’s response to their request, 14 respondents indicated that they were “satisfied” or “very satisfied,” while 5 people responded that they were “dissatisfied” for different reasons.

As discussed above, the District’s current procedures allow both private property owners and public property managers, including the Commissioner of Natural Resources, to refuse treatment for larval and/or adult mosquito control activities, even though state law specifically allows the District to enter DNR property for mosquito control purposes. Based on our review of state law, we concluded that:

⁴⁶ During Summer 1998, MMCD staff responded to new refused treatment requests in writing. The content of those letters and the District’s relationship with the public is discussed further in Chapter 5.

⁴⁷ Telephone conversation with Jim Stark, Public Affairs Representative, October 27, 1998.

⁴⁸ Approximately 2,600 people called the District in 1997 for various reasons. In August 1998, we mailed a questionnaire to a random sample of 368 citizens who had called the District in 1997. Of these, 248 responded for a response rate of 67 percent.

⁴⁹ The survey instrument asked people to indicate the reason they refused treatment and included: concern about effects of insecticides on people, frogs, birds, bees and other insects, wildlife, cattle, horses, or other animals; support a natural approach; do not want chemicals in their property; a chemically sensitive person lives on the property; or the property contained gardens or orchards.

Property access language in state law treats the Department of Natural Resources differently than other state agencies.

- **Language contained in state law related to the Metropolitan Mosquito Control District’s access to public property is unclear and contradictory.**

Minn. Stat. §473.704, subd. 17 says the District may “enter upon any property” to clean up stagnant pools of water and other mosquito breeding sites, “subject to the paramount control of the county and state authorities.”⁵⁰ It is not clear whether this limitation also applies to the application of insecticides used to kill mosquito larvae and adults or other activities of the District. 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.⁵¹ 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 Department of Natural Resources. Based on the current language in state law, most of the public agencies (cities and towns) currently refusing access to MMCD do not legally have the right to do so (see Table 3.6). We suggest that:

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

Over 40 percent of the refused access or “no treatment” acres in 1995 were requests from federal or state agencies, or local governments, including the Minnesota Department of Natural Resources, the cities of Maplewood and Chanhassen, and Minneapolis and Hennepin parks. 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 the Department of Natural Resources and local units of government should be allowed to determine whether mosquito control activities are conducted on public property. In some situations, the goals of public agencies and MMCD may be in conflict. Specifically, we believe that entities managing public land for ecological and natural resource reasons should have the right to refuse mosquito control treatments. This argument would apply to federal, state,

⁵⁰ *Minn. Stat.* §473.704, subd. 17 reads: “Entry to property. Members of the commission, its officers, and employees while on the business of the commission, may enter upon any property within or outside the district at reasonable times to determine the need for control programs. They may take all necessary and proper steps for the control programs on property within the district as the director of the commission may designate. Subject to the paramount control of the county and state authorities, commission members, officers and employees of the commission may enter upon any property and clean up any stagnant pool of water, the shores of lakes and streams, and other breeding places for mosquitoes within the district. The commissioner of natural resources shall allow the commission to enter upon state property for the purposes described in this subdivision. The commission may apply insecticides approved by the director to any area within or outside the district that is found to be a breeding place for mosquitoes. The commission shall give reasonable notification to the governing body of the local unit of government prior to applying insecticides outside the district on land located within the jurisdiction of the local unit of government. The commission shall not enter upon private property if the owner objects except for control of disease bearing mosquito encephalitis outbreaks.”

⁵¹ 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.)

or local entities with a mission to manage land to protect and preserve natural areas and to provide recreation and educational opportunities in natural settings consistent with conservation and ecological concerns. Agencies, such as MMCD, that want an exception from the paramount control of these public land managers should have to prove to the Legislature why such an exception is warranted.

The Legislature may also want to consider formally extending the ability to refuse access to MMCD to cities and townships, whose officials are concerned about the use of insecticides on public property. In this manner, cities and townships would have the same right to refuse access to MMCD that is currently available to county and state authorities and to private property owners.

We also recommend that:

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

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 well articulated, 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 may require an annual renewal of refused treatment requests in 1999. Given the sensitive nature of this issue, we believe that an annual renewal requirement belongs in a refused treatment policy that has been reviewed and approved by the Commission.

Finally, as noted above, contrary to what is stated in its refused entry procedures, MMCD has not maintained computerized refused entry data files since 1995. We recommend that:

- **The Metropolitan Mosquito Control District should maintain a separate computerized database for refused entry requests involving private and public land.**

The District should develop a comprehensive, up-to-date refused entry database, containing names, addresses, property locations, and status. This will allow MMCD to more effectively monitor the status of these properties and contact property owners or managers if needed to verify changes in ownership or the refused treatment status of a property.

State law and MMCD's current refused treatment procedures with generous buffer zones create the potential for conflict between a person who does not want treatment and neighbors who do. To balance the interests of people who want treatment with those who do not, MMCD could reduce the size of its buffer zone

**The District
may require an
annual renewal
of refused
treatment
requests
beginning in
1999.**

or adopt other methods of addressing refused treatment situations. Aside from that approach, balancing these interests becomes a policy issue that the Legislature may want to address.

BLACK FLY CONTROL ACTIVITIES

The Minnesota Department of Natural Resources regulates activities on the state's public waters. Because MMCD controls the black fly population by pouring liquid *Bti* into rivers and small streams, it must obtain a DNR permit annually. MMCD's permit application reviews the activity and efficacy of the black fly program for the previous year. The permit issued by DNR specifies the insecticides that can be used for black fly treatments, treatment thresholds, and possible treatment sites. For river treatments, the permit also requires efficacy sampling and specifies the maximum dose of *Bti* allowed.

The black fly program began in 1983, when MMCD started testing for black fly larvae (*Simulium venustum*) on small streams. MMCD established over 500 test sites on streams throughout the Twin Cities area and began treatments in 1984. Since then, a number of sites have been dropped from MMCD's list of possible treatment sites. As Table 3.7 shows, MMCD treated 65 small stream sites in 1997.

**The District's
black fly
control
program began
in 1983 on small
streams.**

**Table 3.7: Metropolitan Mosquito Control District
Black Fly Program Activity, 1995-97**

Year	River	River Treatments (<i>S. luggeri</i> , <i>S. johansenni</i> , <i>S. meridionale</i>)		Stream Treatments (<i>S. venustum</i>)	
		Treatments	Sites Treated	Treatments	Sites Treated
1997	Crow	3	2		
	Minnesota	30	7		
	Mississippi	13	2		
	Rum	<u>19</u>	<u>2</u>		
	Total	65	13	65	65
1996	Crow	5	2		
	Minnesota	21	7		
	Mississippi	9	2		
	Rum	<u>32</u>	<u>4</u>		
	Total	67	15	74	74
1995	Crow	7	2		
	Minnesota	22	6		
	Mississippi	15	2		
	Rum	<u>14</u>	<u>2</u>		
	Total	58	12	47	47

SOURCE: Metropolitan Mosquito Control District.

Currently, the District treats four large rivers, as well as small streams, to kill black fly larvae.

In the mid-1980s, MMCD realized that a large black fly population was emerging from Minnesota rivers as well as small streams. In 1987, MMCD began experimental treatments for three species of black flies on rivers—*Simulium* (*S.*) *luggeri*, *S. johansenni*, and *S. meridionale*. After a series of studies assured DNR that black fly treatments would not have long-term significant impacts on other species, black fly operational treatments began in 1992. Currently, the MMCD is permitted to treat 21 sites: 3 on the Mississippi, 5 on the Rum, 6 on the Crow, and 7 on the Minnesota River. The DNR requires MMCD to continue monitoring nontarget species on the Mississippi River as a permit condition.

There are two criteria that larval samples must meet before MMCD will treat: (1) the number of larvae must meet or exceed the threshold established by MMCD and DNR and (2) the majority of the larvae must be near the pupal stage. MMCD testing stations on the Minnesota, Crow, Rum, and Mississippi rivers consist of three buoys, each with two mylar strips attached. When checking for threshold, MMCD collects five of the six strips at a site. The average per strip must reach 100 *S. luggeri*, or 40 *S. johansenni* or *S. meridionale* (or a combination of the two) before MMCD will treat. In small streams, sites are tested by a field worker grabbing a handful of submerged vegetation. The threshold for *S. venustum* is 90 larvae per “grab.”⁵² MMCD tries to target its treatments when the majority of the black fly larvae are near pupation, but before they stop feeding. MMCD does this to leave live black fly larvae in the streams and rivers as long as possible. According to MMCD, if a site meets threshold but the larvae are not far enough along in development, MMCD will not treat.

Table 3.7 shows black fly treatment activity for 1995 through 1997. MMCD treats for *S. venustum* in small streams once each year. The number of treatments have ranged from 47 in 1995 to 74 in 1996. MMCD may treat sites on large rivers for the other three species of black flies more than one time per year when larval samples meet threshold. For example, the District made 19 treatments at 2 sites on the Rum River in 1997.

DATA MANAGEMENT ISSUES

The District uses treatment records to compile year-end summaries and to inform its board, county commissioners, legislators, and the public about its activities. Until 1997 the District contracted with an outside firm for data entry services. To save costs, this function was brought in house starting in 1997. While the 1995 and 1996 computer records appear to be in reasonably good condition, we found that:

⁵² In 1990, the treatment threshold for *Simulium* (*S.*) *venustum* was set at 10 larvae per “grab,” but *S. venustum* was not very prevalent in adult counts conducted by MMCD. Both DNR and MMCD began to question whether *S. venustum* was a problem. The two organizations agreed to increase the threshold for *S. venustum* by 10 each year. If the number of adult *S. venustum* increased or complaints from the public increased, then the threshold could be revisited.

- **There were too many errors in the District's computerized treatment records for 1997 to be used to reliably describe mosquito control activities.**

When we compared the 1997 treatment records to MMCD's 1997 audited inventory records, we found differences greater than 5 percent for some insecticides. We also found that some inaccuracies were concentrated in individual regional offices. Therefore, we could not use the data to analyze where the District applied larval and adult insecticides in 1997. 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.**

We have discussed this issue with MMCD staff who had already established procedures during the summer of 1998 to compare internal inventory records with treatment data. The comparison aided in the identification and correction of some problems with the 1998 treatment data. We urge the District to continue these efforts and to refine them as necessary. As a result of the quality control checks that the District instituted for 1998, we were more comfortable using its 1998 treatment data. MMCD's 1998 treatment data reported district-wide material use very close to that recorded in its inventory records. However, we identified some problems with the quality of the District's 1998 data. For example, the amount of resmethrin used by one facility according to its treatment records was over 15 percent higher than the use indicated by the inventory.

Given the time devoted to collecting and recording the information, we recommend that:

- **The District should identify and focus its data collection efforts on items that are necessary to meet regulatory requirements, document effectiveness, and inform policy makers and the public about its activities.**

Only data which are needed and are most likely to be used to meet some purpose should be collected. MMCD might also consider whether all of the data that are collected need to be recorded in the computer records.

COMPLIANCE WITH PESTICIDE REGULATIONS

The primary regulators of MMCD activities are the Minnesota Department of Agriculture and the Minnesota Occupational Safety and Health Administration (OSHA), a division of the Department of Labor and Industry. The Department of Agriculture regulates the registration, labeling, storage, application, and use of

The District initiated measures to improve its treatment data in 1998.

insecticides and the licensing of applicators pursuant to federal and state laws and rules. It also investigates citizen complaints and incidents involving MMCD's use of insecticides. We talked with Department of Agriculture staff and reviewed their enforcement files and found that:

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

The District reported 15 incidents of pesticide spills between 1979 and 1997.

According to the Department of Agriculture staff, MMCD has a good record of complying with pesticide rules and regulations. Department of Agriculture pesticide enforcement records show that between 1979 and 1997 MMCD reported 15 incidents or spills of control materials. The most recent incident occurred in 1996. About one-half of the spills involved *Bti* granules, a dry larval insecticide, and about one-third involved liquid adult insecticides.

The Department of Agriculture conducted three routine inspections of MMCD regional offices in recent years—two in 1994, and one in 1995. The inspection at one facility resulted in several noncompliance notations, including: a release response plan was not on file at the facility, an incident notification sign was not posted, incident training was not provided, and insecticides were stored with an incomplete label.

Between 1986 and 1997, the Department of Agriculture investigated seven complaints filed by citizens against MMCD. Most of the complaints were not substantiated. Two complaints resulted in enforcement actions. A 1991 complaint involving an exposure violation resulted in a civil enforcement action (Notice of Intent) and MMCD paid a settlement penalty of \$1,000. A 1997 complaint involving the use of an insecticide (resmethrin) inconsistent with label instructions resulted in a Notice of Violation because the applicator was not properly licensed. According to Department of Agriculture records, the employee had completed the required training, but the District had not submitted the application and licensing fee to the department in a timely manner. It is possible that other employees who were not properly licensed had applied resmethrin during the summer of 1997 before being licensed in August. A review of the Department of Agriculture applicator records revealed that over 30 other MMCD employees were licensed in August 1997, at the same time as the employee cited in the above violation.

Between 1986 and 1997, the Department of Agriculture investigated seven complaints against MMCD.

The dose of insecticide used affects its toxicity. Therefore, calibration of the equipment used to apply insecticides is of critical importance. MMCD has documented procedures and maintained calibration records for the backpacks, sprayers, and foggers used to apply resmethrin and permethrin in 1998. Generally, backpacks have been calibrated after 30 minutes of use or about two times a summer. Since dosage regulators for the backpacks and sprayers are internal to the unit, staff applying the insecticides can not adjust the application rate in the field. The hoppers used to dispense *Bti* granules and methoprene pellets from helicopters have been calibrated using field tests every spring.

Insecticide regulations require that people applying restricted use pesticides be licensed applicators. MMCD applies resmethrin, a restricted use pesticide, most often in the evening using a cold fogger. MMCD licenses more employees than

are required for its operations. In 1997, about 60 percent of control operations staff were licensed as noncommercial insecticide applicators. MMCD also provides insecticide applicator training for its own employees and for employees of other jurisdictions.

The Department of Labor and Industry is responsible for ensuring safe and healthy working conditions for Minnesota workers. OSHA does not have any record of complaints, inquiries into complaints, inspections, or investigations at any MMCD facility in the past 10 years.

CONCLUSIONS

The Metropolitan Mosquito Control District reduced the number of acres treated with insecticides by 15 percent in 1998—from 231,200 acres in 1997 to 197,500 acres in 1998. Our review of the District's treatment and inventory data reveals that mosquito breeding sites represented nearly two-thirds of the acres treated in 1998. The insecticides used to kill mosquito larvae accounted for over 91 percent of insecticide costs in 1997.

We also examined the District's use of pretreatment thresholds to justify applying insecticides and found that in nearly all cases the sites treated for both larval and adult mosquito control met the thresholds. Epidemiology staff at the Department of Health think that the District plays a valuable role in the prevention of mosquito-borne diseases, but think that spraying for adult mosquitoes should be secondary to eliminating mosquito breeding sites. Based on conversations with staff at the Department of Agriculture and a review of enforcement files, it appears that the District usually has applied insecticides according to label directions and has complied with state regulations for the application of insecticides.

The District's current adult mosquito treatment policy gives more emphasis to responding to citizen requests than did earlier policies. It appears that MMCD does not follow its 1998 adult mosquito treatment policy. Contrary to its policy, the District provided adult mosquito treatments to some for-profit enterprises and private functions in 1998. We recommend that the Commission review the District's existing policies and procedures and adopt a comprehensive adult mosquito treatment policy. We also recommend that the District reexamine its adult mosquito treatment practices to ensure that they conform with its adult treatment policy.

After reviewing state law related to District access to public property, we concluded that the language contained in state law is unclear and contradictory. We suggest that the Legislature consider clarifying language in statute and decide whether state law should allow the Department of Natural Resources and local units of government the right to refuse the District access to public property, except for monitoring and treatment of mosquitoes that can carry diseases. We also recommend that the Commission develop a comprehensive refused treatment policy for both larval and adult mosquito control.

Our analysis of adult mosquito treatments and refused treatment requests was limited because of problems with MMCD's data. We recommend that the District focus its data collection efforts, develop rigorous quality control standards for its treatment data, develop clear criteria and instructions for collecting data, and maintain a separate database for refused entry requests.

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 pesticide applications and licensing 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 computerized 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.