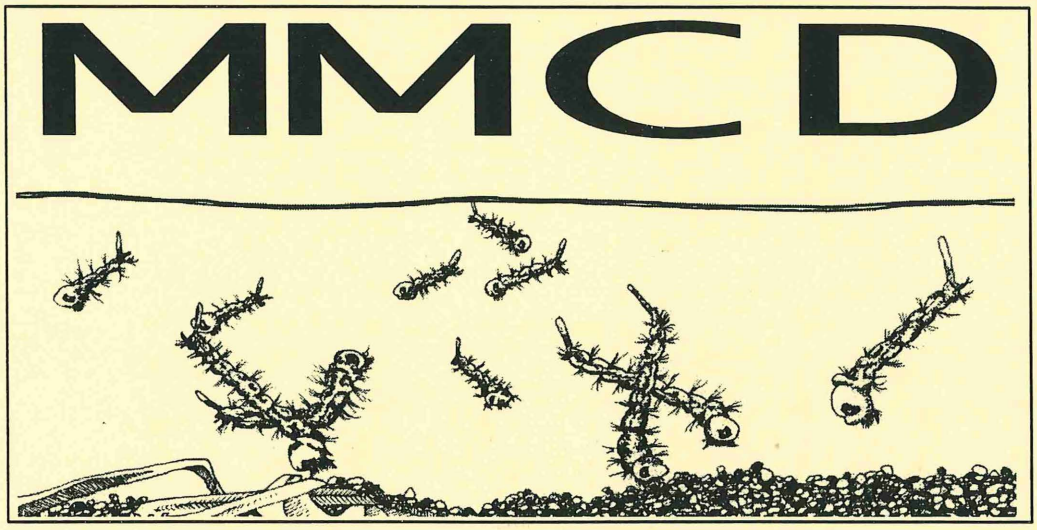
Metropolitan Mosquito Control District



1999 Operational Review and Plans for 2000

Metropolitan Mosquito Control District
2099 University Avenue West
St. Paul, MN 55104-3431

METROPOLITAN MOSQUITO CONTROL DISTRICT

MISSION

The Metropolitan Mosquito Control 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.

GOVERNANCE

The Metropolitan Mosquito Control District, established in 1958, controls mosquitoes and black flies and monitors ticks in the metropolitan counties of Anoka, eastern Carver, Dakota, Hennepin, Ramsey, Scott, and Washington. The District operates under the seventeen member Metropolitan Mosquito Control Commission (MMCC), composed of county commissioners from the participating counties. A director is responsible for the operation of the program and reports to the MMCC.

METROPOLITAN MOSQUITO CONTROL COMMISSION 2000

Randy Johnson, Chair	Hennepin County
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Tony Bennett	Ramsey County
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Barbara Marschall	Scott County
Dennis Hegberg	Washington Co.
Myra Peterson	Washington Co.

TECHNICAL ADVISORY BOARD

The TAB was formed in 1981 by the MMCC to provide annual independent review of the field control programs, to enhance inter-agency cooperation, and to facilitate compliance with Minnesota State Statute 473.716.

TAB MEMBERS 1999-2000

Richard Anderson	US EPA
Greg Busacker, Chair	MDOT
Laurence Gillette	Hennepin Parks
Steve Hennes	MPCA
Art Mason	MDA
Gary Montz	MDNR
Roger Moon	U of MN
David Neitzel	MDH
Susan Palchick	Hennepin Co. Community Health
Robert Sherman	Independent Statistician
Terry Schreiner	USFWS

METROPOLITAN MOSQUITO CONTROL DISTRICT CONTRIBUTING STAFF

Joe Sanzone	Director
Stephen Manweiler	Technical Services Coordinator
Sandy Brogren	Entomologist
Diann Crane	Asst. Entomologist
Cara Hansmann	Technical Services
Janet Jarnefeld	Tick Ecologist
Kirk Johnson	Vector Ecologist
Mike McLean	Public Affairs
Nancy Read	Supporting Research
Mark Smith	Control Materials
Jim Stark	Public Affairs Coordinator
John Walz	Black Fly

METROPOLITAN MOSQUITO CONTROL DISTRICT

METRO COUNTIES GOVERNMENT CENTER
2099 UNIVERSITY AVENUE WEST ■ ST. PAUL, MINNESOTA 55104-3431
651-645-9149 ■ FAX 651-645-3246 TTY use Minnesota Relay Service

JOSEPH F. SANZONE, BCE
Director

W.J. CAESAR
Business Admin.

Dear Reader:

The following report is the Metropolitan Mosquito Control District's (MMCD) 1999 Operational Review and Plans for 2000. It outlines program operations based on the policies set forth by the Metropolitan Mosquito Control Commission, MMCD's governing board of elected county commissioners.

This report has been reviewed by the Commission's Technical Advisory Board (TAB). TAB's charge is to comment on and make recommendations for improvements in the District's operations, on an annual basis. The minutes and recommendations from their fall and winter meetings are included in this report.

The TAB's recommendations and report were accepted by the Commission at their June 28, 2000 meeting. The Commission approved the MMCD 1999 Operational Review and Plans for 2000, and thanked the TAB and District staff for their work.

Please contact us if you would like additional information about the District.

Sincerely,

Joseph F. Sanzone
Director

Minnesota Department of Transportation

Office of Environmental Services
395 John Ireland Boulevard
St. Paul, MN 55155-1899

Fax: 651/ 284-3754
Phone: 651/ 284-3750

May 4, 2000

Commissioner Randy Johnson, Chair
Metropolitan Mosquito Control Commission
2099 University Avenue West
St. Paul, MN 55104

Dear Commissioner Johnson,

The Technical Advisory Board (TAB) met on January 28, 2000 to discuss MMCD operations in 1999 and plans for 2000. Minutes of the meeting are attached. After an excellent interchange of questions and information between the TAB and MMCD staff, the TAB approved the following motion:

> The TAB finds the procedures of District employees more than adequate and that the District does a laudable job in scientific procedures and appears to be moving the District forward in an acceptable manner.

If you have any questions, or if you need additional information, please call me.

Sincerely,

Greg P. Busacker, Ph. D.
Chair, Technical Advisory Board
(651) 284-3759

Cc: J. Sanzone
S. Manweiler

Encl. Meeting minutes

EXECUTIVE SUMMARY

MMCD'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 provides a number of services to accomplish this mission including: tire pickups, tick identification, routine surveillance of black flies and mosquitoes, and nontarget monitoring, and testing current and alternative control materials to name a few. Following is an overview of some of the major highlights of 1999.

Three cases of LaCrosse encephalitis occurred in the metropolitan area during 1999. MMCD staff performed extensive inspections of each case area and all other probable exposure sites within the District.

A new infestation of the Asian tiger mosquito (*Aedes albopictus)* was detected at the Greenman Technologies tire recycling facility, prompting increased surveillance and treatments in and around this Scott County business.

The University of Minnesota/MMCD cooperative study which examined *Ehrlichia* in the metropolitan area observed low *Ehrlichia* infection rates in small mammals. MMCD began exploring additional tick-borne disease risk studies in collaboration with Camp Ripley, the Department of Health, and the University of Minnesota.

Because of abundant frequent rainfall, overall adult mosquito levels were high beginning the end of May and continuing through August. Summer *Aedes* prevailed most of the season except for late July when *Coquillettidia perturbans* were predominant. About 10,000 more acres were treated with larvicides in 1999 than in 1998. In contrast, acres treated with adulticides in 1999 decreased by around 15,000 acres from 1998 levels.

The KLD Model DC-III Droplet Analyzer enabled very rapid adjustment of ULV sprayers to produce optimal droplet size distributions. This new analyzer reduced adjustment time significantly (2-4 hours per sprayer).

Lagenidium is a fungal parasite which can be used to control mosquitoes and is marketed under the trade name Laginex®. The third year of Laginex® tests was as successful as previous tests. In 2000, this material will be compared directly to Altosid® to determine how Laginex® best fits into the cattail mosquito control program.

A newly available sumithrin product (Anvil®) was tested against Scourge® (both pyrethroid adulticides). Anvil® is a non-restricted control material which could be a better alternative to Scourge®. Both materials performed equally well in three tests in campgrounds in northern Anoka County. Additional tests will continue in 2000.

Black fly treatments continued to result in significant reduction in black fly annoyance for

metropolitan area residents in 1999. Material usage in 1999 was similar to 1998 although more was used in the spring and less in the summer because of early high flow rates. MMCD's black fly program continues under a permit from the Minnesota Department of Natural Resources.

As of March 1999 staff completed digitizing the breeding site layer for Priority I using digital orthophotography from the Metropolitan Council as a base. This now allows field staff to use MapInfo® software to create photo-based section maps. Staff can mark and label breeding sites, update maps more quickly, make specialized maps of different sizes and content, compute the size of breeding sites automatically, and eventually much more. Portions of the breeding site digital files have been shared with local government units such as Soil and Water Conservation Districts on request. This cooperation will continue to benefit everyone.

CONTENTS

CHAPTER 1 VECTOR-BORNE DISEASE HIGHLIGHTS

1999 RESULTS

Mosquito Vectors

- Three cases of LaCrosse encephalitis occurred in the District.
- 19,020 tires were collected and processed.
- *Culex tarsalis* remained at low levels.
- Sentinel chicken flocks detected no evidence of western equine encephalitis (WEE).
- A new *Aedes albopictus* infestation was detected in July in Savage at Greenman Technologies, Inc.

Tick Vectors

- Continued the *Ixodes scapularis* distribution study—the methodology has been the same since 1993— results are in progress.
- A collaborative study with the University of Minnesota (U of MN) detected low *Ehrlichia* infection rates in the small mammal populations.

PLANS FOR 2000

Mosquito Vectors

- A new Vector Ecologist will be hired.
- Continue surveillance at and around Greenman Technologies and other sites (all pre-1999) where *Ae. albopictus* has been detected.
- Develop a West Nile virus surveillance program in collaboration with the Minnesota Department of Health (MDH).
- Be vigilant for *Aedes japonicus*, a container-breeding mosquito introduced into the eastern US in 1998, as well as other exotic mosquitoes that may be implicated as disease vectors.

Tick Vectors

- MMCD and Camp Ripley (Brainerd area) will begin a multi-year study to assess tick-borne disease risk at Camp Ripley and elsewhere, including the District. The U of MN and the MDH will also most likely be involved.
- The *Ixodes scapularis* distribution study within the District will continue as in 1999.

• CHAPTER 1 • VECTOR-BORNE DISEASE

BACKGROUND

District staff provide a variety of disease surveillance and control services, including public education, to help reduce the risk of contracting LaCrosse encephalitis, western equine encephalitis (WEE), Lyme disease, and ehrlichiosis in the metropolitan area. Past District efforts have also included determining metro-area risk for Jamestown Canyon virus, babesiosis, Rocky Mountain spotted fever, and Sin Nombre Virus (a form of hantavirus).

LaCrosse encephalitis prevention services were initiated in 1987 to identify areas within the District where significant risk of acquiring this disease exists. High risk areas are defined as having high populations of the primary vector *Aedes triseriatus* (eastern tree-hole mosquito) and a history of LaCrosse encephalitis cases. These areas are targeted for intensive control efforts including public education, mosquito breeding site removal, and limited adult mosquito treatments. Additionally, routine surveillance and control activities are conducted at past LaCrosse encephalitis case sites. *Aedes albopictus* (Asian tiger mosquito) surveillance has also been initiated to detect infestations of this potential disease vector before it becomes established within the District.

In 1989, the District was mandated by the state legislature "to consult and cooperate with the MDH in developing management techniques to control disease vectoring ticks." The District responded by beginning tick surveillance and forming the Lyme Disease Tick Advisory Board (LDTAB) in 1990. The LDTAB includes MMCD and MDH staff, local scientists, and agency representatives who offer their expertise to the tick-borne disease effort.

MMCD initiated tick surveillance to determine the range and abundance of the black-legged tick (*Ixodes scapularis*- also known as the deer tick) and the Lyme disease spirochete, *Borrelia burgdorferi*, within the District. To date, MMCD has mapped the current distribution of black-legged ticks (545 total sites sampled) and continues to monitor their populations in the metropolitan area, as well as undertaking cooperative spirochete and ehrlichiosis studies with the U of MN. All data collected are summarized and given to the MDH for risk analysis. Because no ecologically or economically wide-scale tick control measures exist to date, tick control is limited to public education activities which emphasize tick-borne disease awareness and prevention. District staff continue to provide tick identifications upon request and are used as a tick referral resource by agencies such as the MDH and the Minnesota Department of Natural Resources (MNDNR).

1999 PROGRAM

Mosquito Vectors

—*Aedes triseriatus* Surveillance and Control In 1999, intensive surveillance for adult *Ae. triseriatus* populations continued in several hundred wooded areas in the Lake Minnetonka region of Hennepin and Carver counties, the area where the majority of past LaCrosse encephalitis cases have occurred. Adult *Ae. triseriatus* populations have been monitored in

wooded neighborhoods in this region since 1987. Additional surveillance activities occurred in wooded areas of Dakota County where LaCrosse encephalitis cases have also occurred, and elsewhere as necessary. Staff collected 1,556 samples using a vacuum aspirator. Adult *Ae. triseriatus* were captured in 397 wooded areas of the 895 that were checked. These areas will be targeted for additional control efforts early in the 2000 field season. Similar surveillance was conducted at all past LaCrosse encephalitis case locations to prevent further cases in those areas.

Surveillance for *Ae. triseriatus* adults began the week of May 30. Sampling detected unusually high levels of *Ae. triseriatus* in June (Fig.1.1). Typically, *Ae. triseriatus* populations are relatively low through June, with the highest populations occurring in July and August. The consistent, District-wide rains in the spring resulted in many samples containing high numbers of *Ae. triseriatus*. Populations were more typical later in the summer.

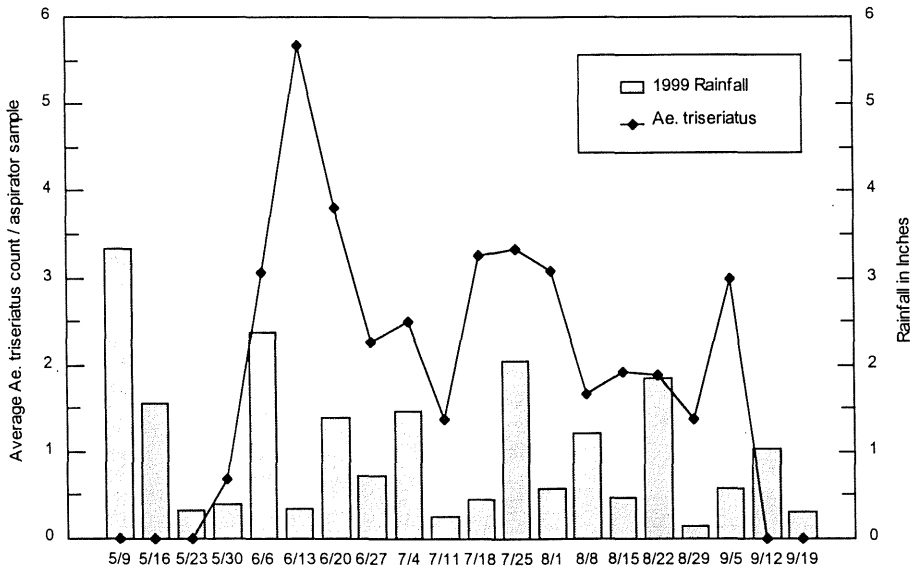


Figure 1.1 Average weekly counts of *Ae. triseriatus* in vacuum aspirator samples and average weekly rainfall.

As in past years, staff distributed LaCrosse encephalitis prevention brochures to citizens living in identified risk areas. MMCD staff also distributed brochures at county and state fairs, and other public functions. In addition, interpretive posters and other information were presented at each county fair and the State Fair. These brochures and presentations described LaCrosse encephalitis, and stressed water-holding container removal to prevent the disease.

In 1999, staff removed 19,020 waste tires from high risk areas of the District. Since 1988 the District has removed 339,121 tires. Cooperative waste tire removal efforts continued with several county environmental management departments resulting in the disposal of many waste tires, especially in Carver and Dakota counties. Field staff completed 2,390 site inspections, removed

1,447 artificial containers, and filled 1,277 tree holes in several areas including the Lake Minnetonka area, both in response to new cases and as part of routine surveillance. Three hundred seventy-six treatments were made against adult *Ae. triseriatus* populations at or above threshold numbers to lower the immediate disease risk until larval breeding habitats in these areas could be found and removed.

— **Ovitrapping** Staff processed 438 ovitrap samples to detect the presence of *Ae. triseriatus* at past LaCrosse encephalitis case sites. If egg numbers exceed 400, an adulticide treatment can be made. Ovitraps were also placed at sites where *Ae. albopictus* has previously been found. Eggs from those samples were reared to adults and sent to MDH for LaCrosse virus isolation.

— **LaCrosse Encephalitis Cases** In 1999 three cases of LaCrosse encephalitis occurred in the District: a 5-year-old boy from Shorewood (onset in late July, reported to MDH in August), a 14-month-old girl from Chaska (onset in early August, reported to MDH in late August), and a 7-year-old girl from Maple Grove (onset in early August, reported to MDH in late September). The Maple Grove child almost surely was exposed at Sand Lake near Webster, WI because an inspection of the area around that child's home revealed very few harborage or breeding sites. All three children have recovered. The case incidence for 1999 is similar to that of recent years (Fig. 1.2).

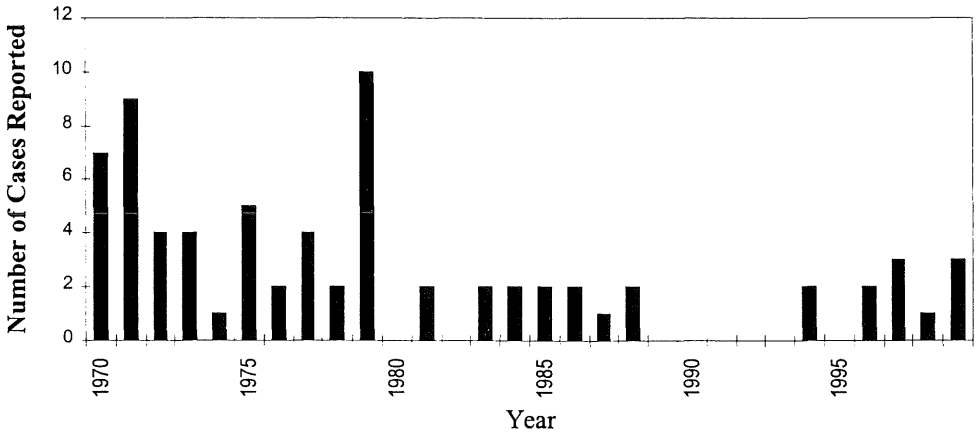


Figure 1.2 Number of LaCrosse encephalitis cases reported from the seven-county metropolitan area 1970-1999

Intensive inspections and sampling were conducted around the homes of all three cases and treatments were made around the homes of the first two cases (Table 1.1). Larvae were collected, reared to adults, and sent to the MDH for virus isolation. Analyses are not yet completed. Boy Scout Island (Wawatosa Island) in Lake Minnetonka was also inspected because the first case might have been exposed there. The third case was reported so late in the season that no mosquitoes could be located when inspections occurred.

Table 1.1 Summary of immediate field response to the first two LaCrosse encephalitis cases in 1999

LaCrosse encephalitis prevention activities	Case location	
	Shorewood	Chaska
Brochures distributed	364	167
Tree-holes removed	132	24
Tree-holes treated[a]	9	0
Containers removed	217	169
Containers treated[a]	7	7
Tires removed	39	291
Tires treated[a]	4	106
Vacuum aspirator samples	65	33
Adulticide Treatments[b]	22	7

[a] *Bti* and methoprene treatments. [b] Permethrin and resmethrin treatments.

— ***Aedes albopictus*** *Aedes albopictus* is an aggressive nuisance and disease vector mosquito capable of transmitting the LaCrosse encephalitis virus. It breeds in tree holes and in containers (e.g., tires, cans, bird baths, and other water-holding containers) typically associated with human activity. This mosquito is native to Korea and Japan but has spread throughout many parts of the world, including the United States, mainly with the trade and subsequent movement of used tires. Its northern range limit in the US is believed to be Chicago, IL.

Aedes albopictus has been found in or near the District in four of the past nine field seasons. Infestations of this mosquito were detected at waste tire recycling businesses in Scott County in 1991, 1996 and 1999. In 1997, field staff found *Ae. albopictus* adults and larvae while inspecting grounds in response to a reported LaCrosse encephalitis case in Delano. The infestation presumably resulted from infested containers that accompanied a citizen who moved to the area from Florida in July 1997.

In July 1999, field staff found *Ae. albopictus* adults and larvae during routine surveillance of Greenman Technologies of Minnesota, Inc., a tire recycling facility. The infestation was traced to tires shipped to Greenman from a waste tire abatement site in Cassville, Missouri. All tires initially shown to be harboring *Ae. albopictus* were shredded within three days of the initial discovery. Additional adults were found immediately thereafter. More tires were destroyed and both permethrin and resmethrin treatments were made to eliminate the infestation. No additional *Ae. albopictus* were detected at locations where it was found previously or elsewhere in the

District. We intend to continue surveillance to ensure that *Ae. albopictus* is no longer present.

— ***Culex tarsalis* and WEE** Based on CO_2 trap results, adult *Cx. tarsalis* numbers remained low throughout the 1999 season. Routine blood samples drawn from three sentinel chicken flocks located along the District's western border detected no WEE virus activity.

Tick Vectors

— ***Ixodes scapularis* Distribution** The District continued to sample the network of 100 sites set up in 1991-1992 to monitor potential changes in tick distribution over time. As in previous years, the primary sampling method involved capturing small mammals from each site and removing any attached ticks from them. Past collections from the northeastern metropolitan area in Washington and Anoka counties have consistently detected *I. scapularis* populations and in 1998, *I. scapularis* was detected for the first time in Hennepin and Scott counties. Study results from 1999 are not yet available.

***Ehrlichia* & *Borrelia burgdorferi* Cooperative Studies** Two changes in the study scope and methodology for the cooperative research studies with Dr. Russ Johnson of the U of MN were made in 1999.

1. Based on the low overall *Ehrlichia* exposure results found in the past several years in tandem with finding comparable *B. burgdorferi* results, the sampling period was reduced to a six-week window (July 14 - August 19), generally corresponding to the peak infection rate period in the small mammal population.
2. Literature published in spring of 1999 suggested that *Peromyscus leucopus* (white-footed mouse) may not be as effective an amplifying-reservoir for human granulocytic ehrlichiosis (HGE) as they are for *Borrelia burgdorferi*. As *Tamias striatus* (eastern chipmunk) is the next most logical potential reservoir, larger sized Sherman traps (3x3x10inch) were used in an attempt to maximize their collections.

Overall, 45 small mammals were collected using the larger sized traps. Thirty-eight *P. leucopus*, one *Clethrionomys gapperi* (southern red-backed vole), and six *T. striatus* (vs. 4/ 181 total mammals in 1998) were trapped. Preliminary 1999 results indicated a low *Ehrlichia* infection rate in the small mammal population. This study will be expanded in 2000.

—Tick Identification Services/Outreach The District's tick identification service was displayed in a small paragraph on the front page of a spring Star Tribune Variety section, resulting in larger numbers of customer tick identification requests in 1999 (estimated 60 requests versus 10 for prior years). The overall scope of tick-borne disease education activities was maintained utilizing previously described methods and tools.

PLANS FOR 2000

LaCrosse Encephalitis Prevention Services will continue to emphasize *Ae. triseriatus*

surveillance and control. Historically, surveillance was concentrated within the Lake Minnetonka region of Hennepin and Carver counties, and in northern Dakota County. Due to recent viral activity in other areas of the District, we will continue to increase surveillance and control efforts. Waste tire removal will also continue to be a priority across the entire District. MMCD will continue to work with county environmental management departments in cleaning up and disposing of larger waste-tire collections.

Disease and Exotic Mosquito Surveillance A West Nile virus surveillance and response plan is being developed in collaboration with plans already being employed by the MDH. This plan, in part, is being adapted from plans already developed for New York State and adjacent areas. Our current surveillance for WEE and its vector, *Cx. tarsalis,* will continue as in previous years. We will continue surveillance at and around Greenman Technologies and other sites (all pre-1999) for *Ae. albopictus*. We will also be vigilant for *Aedes japonicus*, a container-breeding species newly introduced into the eastern United States (i.e., New York west to Ohio) in 1998, and other exotic container species.

New Tick Research In spring 2000, a new cooperative study in Crow Wing County (Brainerd area) with staff from Camp Ripley will begin. The purpose of the study is to gain more understanding about the epidemiology of tick-borne diseases in a higher risk area. The intent is to begin to measure the tick density at Camp Ripley in 2000 and perhaps compare results with locally collected data. The District's ultimate goal would be to create a risk model that could then be used in the metropolitan area as well as at Camp Ripley. Dr. Russ Johnson (U of MN) and Dave Neitzel of the MDH will also be involved in studies in this area.

CHAPTER 2 SURVEILLANCE HIGHLIGHTS

1999 RESULTS

- Average District rainfall was the highest in the last five years.
- The first peak of summer *Aedes* occurred in June with several smaller peaks in July and August.
- Adult collections of the cattail mosquito (*Coquillettidia perturbans*) peaked the third week of July, two weeks later than usual.

PLANS FOR 2000

- Obtain keys for the newly introduced *Aedes japonicus*.
- Review New Jersey light trap procedures to improve collections.
- Compare newly-purchased CO_2 traps with current traps.

• CHAPTER 2• SURVEILLANCE

BACKGROUND

MMCD conducts a variety of surveillance activities to identify the need for control and to monitor the District's progress toward reducing mosquito levels. Rainfall information is collected from 76 gauges to help identify where mosquito production is likely. This rainfall information is also forwarded to the MDNR State Climatology Office to supplement their network. Larval samples taken from breeding sites before treatment are identified to detect the presence and amount of human-biting mosquito species. MMCD uses New Jersey light traps, sweep nets and CO_2 traps to monitor adult mosquitoes.

New Jersey light traps are the standard adult mosquito collection devices for many mosquito control districts. MMCD has used New Jersey light traps since 1960 to collect historical data on mosquito populations. Light from a 25-watt light bulb acts as an attractant and a timer turns traps on and off. Personnel empty traps daily from May to September.

Sweep net collections are used to detect mosquitoes annoying to people, and both species composition and abundance are evaluated. Sampling occurs during the peak mosquito activity period, five minutes after the end of twilight, which is about 35-40 minutes after sunset. Employees take two-minute collections in the evening in their yards once per week for 17 weeks.

CO_2 traps baited with dry ice are also used to monitor mosquito population levels during the peak mosquito activity period, and to monitor the presence of disease vector mosquito species. Employees set traps in their yards on the same nights as the sweep net collections, once per week for 17 weeks.

1999 SURVEILLANCE RESULTS

Rainfall Average rainfall per gauge in the District from May 1 through September 30, 1999 was 22.41 inches (Table 2.1), two inches above the 41-year District average. Rainfall was fairly evenly distributed throughout the District for the season, with lower rainfall in Carver and Washington counties. The District average in 1999 was the highest in the past five years.

Table 2.1. Average amount of rainfall received in each county from May through September 1995-1999 and the 41-year average

Year	Anoka	Carver	Dakota	Hennepin	Ramsey	Scott	Wash.	District
1995	22.75	18.85	17.42	20.18	21.99	19.39	23.59	21.00
1996	13.23	11.91	15.64	13.04	12.66	13.50	14.31	14.06
1997	19.21	24.01	26.27	19.52	23.21	23.49	22.34	21.33
1998	18.95	18.70	23.53	18.30	19.26	22.06	19.89	19.43
1999	22.12	20.12	22.66	22.55	22.95	22.43	21.60	22.41
41-Year	18.89	NA	19.70	19.52	19.77	19.38	20.08	19.40

The winter of 1998-'99 was mild with low snowfall amounts. There was not much ground frost and the spring rains soaked in quickly. Our first big brood of mosquitoes resulted from an accumulation of rain from May 5-12, with amounts totaling more than 3 inches (Fig. 2.1). Other broods occurred as a result of 2-inch rains the first week of June, the end of July and the third week of August. Some smaller broods occurred during June and July, for a total of 8 broods.

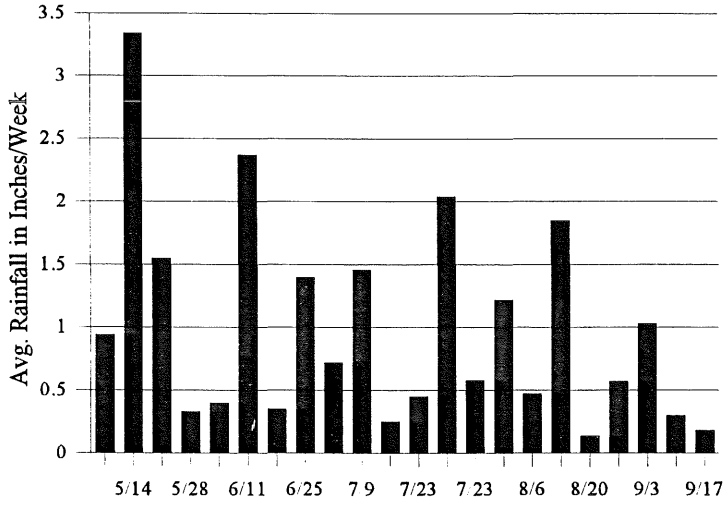
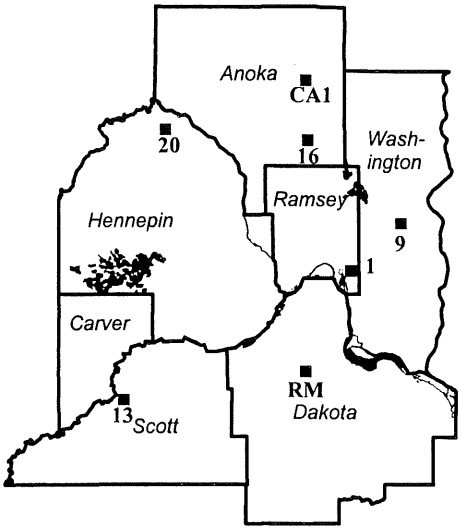


Figure 2.1 Average rainfall in inches per gauge per week, May-September, 1999

Larval Collections In 1999, staff identified 14,168 larval collections. Frequencies of occurrence for the most abundant larval species District-wide were *Ae. vexans* (32.6%), *Ae. cinereus* (12%), *Ae. stimulans* (10%), *Ae. excrucians* (4.5%), and *Culex restuans* and *Cx. territans* (both 5%). Each county had a different profile of abundant mosquitoes, but *Ae. vexans* was, by far, the most abundant in all locations (Appendix A).

Adult Collections — New Jersey light traps



The District operated seven traps in 1999. Trap 1 was located in St. Paul, trap 9 in Lake Elmo, trap 13 in Jordan, trap16 in Lino Lakes, trap 20 in Elm Creek Park Reserve, trap CA in Carlos Avery Wildlife Refuge and trap RM at Lebanon Hills Regional Park in Eagan (Fig. 2.2). Traps 1, 9 and 16 have operated each year since 1960. Table 2.2 shows the total number of each species of mosquito captured in New Jersey light traps in 1999. The number of mosquitoes collected per night from 1960 to 1999 is displayed in Appendix B. We plan review New Jersey light trap collection procedures to improve the data collected.

Fig. 2.2 New Jersey light trap locations - 1999

Table 2.2 New Jersey light trap collection totals May 8-Sept. 24, 1999

Trap No.	1	9	13	16	20	CA1	RM	Season	% of female	Average
Location	St. Paul	Lk. Elmo	Jordan	Lino Lks.	N. Henn.	Carlos	Rosemount	total	total	per night
No. of coll.	139	140	137	137	135	133	129	950		
1. *Ae. abs.*	0	0	0	0	0	83	0	83	0.06%	0.09
6. *can.*	0	0	0	0	0	14	0	14	0.01%	0.01
7. *cin.*	7	26	1	121	70	1,074	28	1,327	0.93%	1.40
10. *dor.*	2	0	1	1	0	0	0	4	0.00%	0.00
11. *exc.*	0	0	1	0	0	0	0	1	0.00%	0.00
12. *fit.*	0	0	0	0	0	0	0	0	0.00%	0.00
13. *flav.*	0	0	0	0	0	0	0	0	0.00%	0.00
14. *imp.*	0	0	0	0	0	1	0	1	0.00%	0.00
16. *nig.*	0	0	0	0	0	4	0	4	0.00%	0.00
18. *punc.*	0	0	0	0	0	103	0	103	0.07%	0.11
19. *rip.*	0	0	0	0	1	0	0	1	0.00%	0.00
20. *spen.*	0	0	0	0	0	0	0	0	0.00%	0.00
21. *stic.*	1	4	45	1	362	14	15	442	0.31%	0.47
22. *stim.*	0	0	0	0	36	8	0	44	0.03%	0.05
23. *prov.*	0	0	0	0	0	8	0	8	0.01%	0.01
24. *tris.*	0	9	0	0	1	0	5	15	0.01%	0.02
25. *triv.*	1	28	31	2	242	21	203	528	0.37%	0.56
26. *vex.*	568	4,445	1,432	9,172	19,985	37,295	14,078	86,975	60.73%	91.55
261. *Ae.* sp.	20	65	15	154	294	990	990	2,528	1.77%	2.66
118. *abs/punc*	2	0	2	3	10	2,141	9	2,167	1.51%	2.28
28. *An. earl.*	0	0	0	0	1	5	2	8	0.01%	0.01
29. *punc.*	0	20	4	4	69	47	70	214	0.15%	0.23
31. *walk.*	1	10	25	48	602	1,416	14	2,116	1.48%	2.23
311. *An.* sp.	0	2	4	5	121	75	15	222	0.16%	0.23
33. *Cx. pip.*	0	0	0	0	0	0	0	0	0.00%	0.00
34. *rest.*	8	72	4	45	127	57	88	401	0.28%	0.42
35. *sal.*	0	0	0	0	2	0	0	2	0.00%	0.00
36. *tars.*	4	5	4	21	18	5	0	57	0.04%	0.06
37. *terr.*	0	13	1	9	45	20	56	144	0.10%	0.15
371. *Cx.* sp.	24	138	13	85	301	142	216	919	0.64%	0.97
38. *Cs. inor.*	0	13	2	24	44	21	19	123	0.09%	0.13
39. *melan.*	0	1	0	0	52	0	0	53	0.04%	0.06
40. *minn.*	4	18	2	200	255	121	102	702	0.49%	0.74
41. *mors.*	0	4	0	7	4	30	4	49	0.03%	0.05
411. *Cs.* sp.	2	1	0	29	15	11	2	60	0.04%	0.06
42. *Cq. pert.*	61	89	72	741	2,716	35,917	1,515	41,111	28.71%	43.27
471. *Ps.* sp.	0	0	0	0	0	0	1	1	0.00%	0.00
48. *Ur. sapp.*	5	134	5	8	1,153	19	377	1,701	1.19%	1.79
501. Unident.	11	24	3	74	86	651	231	1,080	0.75%	1.14
Female Total	721	5,121	1,667	10,754	26,612	80,293	18,040	143,208	82.64%	150.75
Male Total	397	2,301	910	3,338	6,685	11,533	4,925	30,089	17.36%	31.67
Grand Total	1,118	7,422	2,577	14,092	33,297	91,826	22,965	173,297		182.42

Mosquito Abundance

— Evening sweep net collections Summer *Aedes* and *Cq. perturbans* were the usual predominant species in the sweep collections (Table 2.3). In years of low rainfall, such as in 1996, *Cq. perturbans* can predominate because of low populations of floodwater mosquitoes. Spring *Aedes* were consistently low in the last five years. Weather conditions the past 5 years have not been conducive for high levels of *Cx. tarsalis.* The number of sweep net collections varied from 54-129 per night due to different numbers of staff available to take samples.

Table 2.3 Avg. number of mosquitoes collected per evening sweep net collection, 1995-99

Species	1995	1996	1997	1998	1999
Summer *Aedes*	6.1	1.5	4.0	4.2	5.6
Cq. perturbans	1.7	2.2	0.7	1.4	1.9
Spring *Aedes*	0.1	0.1	0.1	0.1	0.1
Cx. tarsalis	0.04	0.01	0.01	0.04	0.01

— Evening CO_2 trap collections The trends in species abundance in the CO_2 traps are the same as the sweep net collections (Table 2.4). The high levels of summer *Aedes* are due to above average rainfall which produced abnormally high populations of *Ae. trivittatus* in addition to *Ae. vexans*. Beginning in 1997, CO_2 traps were operated all night instead of the 2-hour period used in previous years. Therefore, yearly comparisons with trapping previous to 1997 cannot be made. We operated 64 traps in 1999.

Table 2.4 Average number of mosquitoes per CO_2 trap collection 1997-99

Species	1997	1998	1999
Summer *Aedes*	182.7	138.2	309.4
Cq. perturbans	30.9	31.9	39.4
Spring *Aedes*	2.4	0.9	1.9
Cx. tarsalis	0.7	0.4	0.5

Seasonal distribution Evening sweep net collection results show populations of summer *Aedes* peaked early in the summer following a week-long rain event in May (Fig 2.3). Rain storms were spaced throughout the season, causing five other smaller peaks of mosquitoes. *Coquillettidia perturbans* peaked the third week of July, later than the usual first week of July.

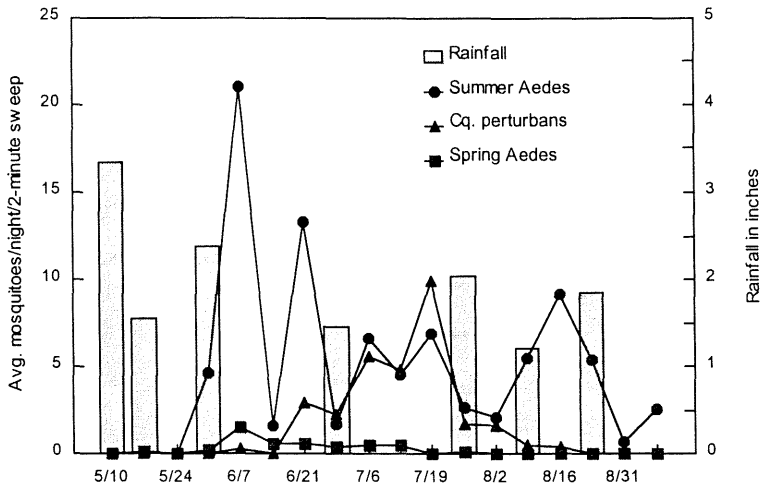


Figure 2.3 Average number of summer *Aedes*, *Cq. perturbans* and spring *Aedes* per evening sweep-net collection in 1999. Major rainfall events are indicated by bars.

Evening CO_2 trap collection results mirrored the sweep net collections (Fig. 2.4). The *Cq. perturbans* peak occurred a week earlier in the CO_2 traps than in the sweep nets. The summer *Aedes* peaks are dwarfed by the first peak of the season.

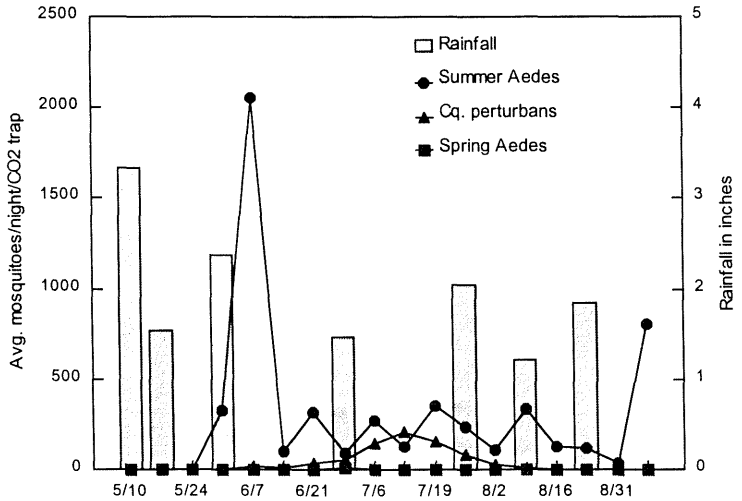


Figure 2.4 Average number of summer *Aedes*, *Cq. perturbans* and spring *Aedes* per CO_2 trap collection in 1999. Major rainfall events are indicated by bars.

PLANS FOR 2000

Exotic Species Surveillance *Aedes japonicus* is a container-breeding mosquito from Asia that was recently detected in the eastern United States, most likely imported in a used tire shipment. Its disease importance is not fully known, but laboratory tests have proven its ability to transmit West Nile virus. Like *Ae. albopictus*, it is a very invasive species and could impact populations of *Ae. triseriatus*. Staff will incorporate this species into the mosquito identification keys to ensure that its presence does not go undetected.

New Jersey Light Traps Collections have been inconsistent and untimely in the past few years. The plan is to review the collection methods to determine why these problems occur and take steps to improve the process.

Trap Comparison Studies The current style of CO_2 trap used by the District has some inconsistencies and flaws. In 1998, we purchased a few American Biophysics Company (ABC) traps and conducted a small-scale comparison of their catch results with our current model. There was no significant difference between trap catches, so we purchased 130 more ABC traps for use in 2000. A larger-scale comparison study will be conducted this season to determine if there is a significant difference between the old trap and the ABC trap.

CHAPTER 3 MOSQUITO CONTROL HIGHLIGHTS

1999 RESULTS

Control Activities

- MMCD treated about 10,000 more acres with larvicides in 1999 than in 1998.
- MMCD treated about 15,000 fewer acres with adulticides in 1999 than in 1998.

Mapping

- Completed digitizing wetland mosquito breeding sites in Priority 1 and parts of Priority 2; have shared digital files with other local government units on request
- Improving computer-generated field maps with addition of landmarks, water features, and harborage locations in some areas
- Working on restricted access boundaries and associated databases, and process for mapping buffer areas for treatment

PLANS FOR 2000

- There will be no major changes to control program for 2000.
- Staff will continue to add landmarks, water features and harborage locations to maps.
- Staff will complete entering restricted access boundaries into GIS data bases.

• CHAPTER 3• MOSQUITO CONTROL

BACKGROUND

The mosquito control program targets the principal summer pest mosquito, *Ae. vexans*, several species of spring *Aedes*, and the cattail mosquito *Cq. perturbans*. Larval control is the main focus of the program but is supplemented by adult mosquito control when necessary. *Aedes* larvae hatch in response to snow-melt or rain with adults emerging at various times during the spring and summer. Cattail mosquito larvae develop in cattail marshes over twelve months and emerge as adult mosquitoes in June and July. See Appendix C for a more in-depth description of biologies of the various mosquito species found in the District.

Mosquitoes are adept at using the natural resources of the metropolitan area. These same natural resources contribute to the recreation and enjoyment of the citizens living here. The rolling topography provides many highly productive breeding sites for mosquito larvae. Lush, wooded areas serve as protection from daily heat and low humidity for the resting adult mosquitoes.

CONTROL STRATEGY OVERVIEW

Due to the large size of the metropolitan region (2,600 square miles), larval control was considered the most cost effective control strategy in 1958 and remains so to date. Mosquito control services target the most prolific mosquito breeding locations for all human biting mosquitoes. An insect growth regulator, methoprene, and a soil bacterium, *Bacillus thuringiensis israelensis* or *Bti*, are the primary larval control materials. A description of the control materials is found in Appendix D and pesticide labels are found in Appendix E.

Adult mosquito control supplements the larval control program. Adulticide applications are performed only after sampling detects mosquito populations meeting or exceeding threshold levels, primarily in high use park and recreation areas; for public events; and in response to citizen mosquito annoyance reports. Two synthetic pyrethroids, resmethrin and permethrin, are used for adult mosquito control.

Appendix F summarizes the number of acres treated with each control material from 1992-1999. The number of acres treated includes sites that were treated multiple times. Appendix G summarizes the amount of active ingredient (AI) for each control material the District uses.

1999 MOSQUITO CONTROL

Larval Mosquito Control District-wide larvicidal treatments began in mid-April and continued though August. Additional treatments were made in the west and east in September. In 1999 MMCD treated about 10,000 more acres with larvicides than in 1998 (Table 3.1). Larvicidal treatments last reached these levels in 1991 and 1995, both wet years (Appendix F).

In 1999 significantly fewer acres were treated with briquets than in 1998 (Table 3.1) although more acres were treated with the standard 150-day briquet in 1999 than in 1998. Much of the

difference was due to a 90-day briquet available to MMCD at reduced cost only in 1998. The District increased *Bti* and Altosid® pellet treatments in 1999 compared to 1998 (Table 3.1).

The thresholds for treatment with *Bti* were 0.1 larvae per dip for spring *Aedes* and 2 larvae per dip for floodwater *Aedes* in Priority Zone I, and 0.5 larvae/dip for spring *Aedes* and 5 larvae/dip for floodwater *Aedes* in Priority Zones II and III. The higher thresholds in Priority Zones II and III help target limited control materials to sites with the most intense breeding and the potential to provide benefit to the most citizens (i.e., proximity to human population).

Table 3.1 Comparison of control material usage in 1998 and 1999

	1998		1999	
Material used	**Amount of material used**	**No. of acres treated**	**Amount of material used**	**No. of acres treated**
Larvicides				
Altosid® briquets 150-day	555 cases	371	700 cases	533
Altosid® briquets 90-day	1,013 cases	961	0 cases	
Altosid® pellets	31,297.70 lbs	10,432	42,386.00 lbs	13,775
Altosid® SR-20 liquid	528.11 fl oz	529	354.78 fl oz	355
Altosand	5,979.00 lbs	1,868	19,840.80 lbs	3,968
Bti corncob	855,737.55 lbs	113,539	950,636.45 lbs	118,733
Larvicide totals		127,698		137,364
Adulticides				
Permethrin	1,210.53 gal	6,164	950.21 gal	4,865
Resmethrin	740.60 gal	65,356	616.28 gal	51,582
Adulticide totals		71,520		56,447

Adult Mosquito Control Adult mosquito control operations were prompted when mosquito levels were above threshold — two mosquitoes in a 2-minute sweep or 2-minute slap test or 130 mosquitoes in an overnight CO_2 trap — with most treatments occurring in July and early August. Staff also conducted treatments in areas identified by District surveillance and customer mosquito annoyance reports.

In 1999, MMCD treated about 15,000 fewer acres with adulticides than in 1998 (Table 3.1), primarily because staff spent more time larviciding and inclement weather prevented adulticiding. The number of acres treated with permethrin in 1999 (4,865 acres) was lower than 1998. Fewer acres were treated with resmethrin in 1999 (51,582 acres) compared to 1998 as well. These acres treated includes sites that have been treated more than once.

Mapping The District has continued its commitment to computerizing field maps and coordinating maps with other electronic databases. During 1999 staff became more familiar with

the MapInfo GIS program. As of March 1999, staff completed digitizing the breeding site layer for the Priority I area, using digital orthophotography from the Metropolitan Council as a base. This now allows field staff to use MapInfo to create photo-based section maps with marked and labeled breeding sites, update maps quicker, make specialized maps of different sizes and content, compute the size of breeding sites automatically, and eventually much more. Portions of the breeding site digital files have been shared with local government units such as Soil and Water Conservation Districts upon request.

For some parts of the District, harborage sites and Priority II breeding sites have also been entered or may be entered this winter. Kyle Beadle and Nancy Read presented a poster at the state GIS conference in October of how data on LaCrosse inspections and adulticide treatments can be linked to harborage maps.

PLANS FOR 2000 - MOSQUITO CONTROL SERVICES

Larval Control: Cattail Mosquito *Coquillettidia perturbans* has a limited flight range of five miles. Consequently, MMCD will focus control activities on the most productive cattail marshes near human population centers. Briquet applications will start in early March to frozen sites (floating bogs, deep water cattail sites, remotely located sites). Beginning in late May, staff will apply pellets by helicopter at a rate of 4 lbs/acre. MMCD plans to treat 500-1,100 acres with Laginex® at a rate of 40 oz/acre in late May to control the 2000 emergence. The precise number of acres will be determined by sampling in March and April.

Larval Control: Floodwater Mosquitoes The larval treatment strategy for 2000 will be similar to 1999. Staff will treat ground sites (i.e., sites less than 3 acres) with methoprene products and *Bti* corn cob granules. MMCD also plans to continue using six helicopters for the treatment of air sites. Based on sites meeting larval thresholds, breeding sites in highly populated areas will receive treatments first during a wide-scale mosquito brood. The District will then expand treatments into less populated areas where treatment thresholds are higher.

The primary control material will again be *Bti* corn cob granules. Forecasted material needs for *Bti* and similar experimental materials in 2000 are similar to 1999. To minimize shortfalls, control material use may be more strictly rationed during the second half of the season. Regardless of annoyance levels, MMCD will maintain sufficient resources to protect the public from potential disease risk.

Adult Mosquito Control Forecasted permethrin and resmethrin requirements in 2000 are similar to the last three years. MMCD will direct adult mosquito control treatments to provide the greatest customer benefit— generally high risk disease areas and areas that have high levels of mosquitoes. Also, MMCD will provide service in high use park and recreation areas and for public functions.

The adult mosquito control information line (Bite Line: 651-643-8383) will again enable citizens

to hear a daily recording on where adult mosquito control operations are taking place (e.g., parks, neighborhoods, and public events). MMCD will also have this information on its Internet web site at www.mmcd.org. MMCD will continue notification in 2000 at the level similar to 1999.

Vector Mosquito Control Field staff routinely monitor and control populations of the vector of LaCrosse encephalitis, *Ae. triseriatus*, the western encephalitis vector, *Cx. tarsalis*, and *Ae. albopictus*. See the Vector-Borne Disease Management chapter of this report for details.

Adulticide Non-target Research In 2000, we intend to evaluate effects of ULV-applied adulticides upon nocturnal insects (including many types of moths) as part of continued ULV adulticide efficacy tests similar to those conducted in 1999 (see the Product and Equipment Testing chapter for results of 1999 tests).

Mapping Restricted Access Areas In the winter of 1999-2000 staff will collect parcel boundary information from the counties (through the MetroGIS data sharing agreements) and create a map layer of restricted access areas. This layer is being linked to updated database files with details of customer requests for each area. A custom tool is being designed to use the map layer and linked database to draw treatment buffers appropriate for each treatment.

Additional Mapping Staff are entering landmarks and/or using landmarks provided with the TLG street layer (from MetroGIS) to make maps more usable in the field. The replacement of any old field maps in Priority I will be with MapInfo-generated maps. The District is also working with the Metropolitan Council to support a new photography acquisition in 2000. In the fall of 2000, we will assess additional mapping priorities such as completion of breeding site mapping beyond Priority I and improving harborage and adult treatment mapping.

CHAPTER 4 BLACK FLY PROGRAM HIGHLIGHTS

1999 Results

Small Streams

- Slightly more small stream sites were treated in 1999 than in 1998.
- Higher water flow in 1999 required the use of about twice as much liquid *Bti* in 1999 as in 1998.

Large Rivers

- There were fewer large river treatments in 1999 than in 1998.
- Higher river discharge levels resulted in slightly more liquid *Bti* being used in 1999 than in 1998.

Non-target Monitoring

- Multiplate samples were collected in summer 1999. Processing and identifications will be completed by December 2000. A final report will be produced by February, 2001.

Plans for 2000

- No major changes will be made to the larval monitoring and control program.
- We will begin assessing the feasibility of a human tolerance threshold for adult black flies.

• CHAPTER 4• BLACK FLY PROGRAM

BACKGROUND

The goal of the black fly program is to reduce pest populations of adult black flies within the MMCD to tolerable levels. Black fly larval populations are monitored at 144 small stream and 21 large river sites using standardized sampling techniques during the spring and summer. Liquid *Bti* is applied to sites when the target species reach the treatment threshold.

The small stream program began in 1984. The large river program began with experimental treatments and non-target impact studies in 1987. A full-scale large river treatment program did not go into effect until 1996.

1999 PROGRAM

Small Stream Program – *Simulium venustum* Control The only human biting species that breeds in small streams is *Simulium venustum*. It has one early spring generation. Larvae are found in small streams throughout the District, although the largest populations generally are found in Anoka County.

A total of 144 potential *S. venustum* breeding sites were sampled in mid-April in order to determine larval abundance using the standard grab sampling technique developed by the MMCD in 1990. The treatment threshold was 100 *S. venustum* per sample. A total of 62 sites on 15 streams met the threshold and were treated once with *Bti*. A total of 44.1 gallons of *Bti* was used (Table 4.1).

Large River Program There are 3 large river-breeding black fly species that MMCD targets for control. *Simulium luggeri* breeds mainly in the Rum and Mississippi rivers, although it also breeds in smaller numbers in the Minnesota and Crow rivers. *Simulium luggeri* is abundant from mid-May through August. *Simulium meridionale* and *S. johannseni* breed primarily in the Crow and Minnesota rivers. These species are most abundant in May and June, although *S. meridionale* populations will remain high throughout the summer if stream flow is also high.

Table 4.1 Summary of *Bti* treatments for black fly control by the MMCD in 1999

Water body	Number of application sites	Total number of treatments	Gallons of *Bti* used
Small streams	62	62	44.1
Mississippi River	2	17	2518.5
Crow River	3	7	171.7
Minnesota River	7	12	1500.0
Rum River	2	14	108.9
Total	76	112	4343.2

The black fly population size at each treatment location was measured every seven days in 1999 using artificial substrates at 21 sites permitted by the Minnesota Department of Natural Resources on the Rum, Mississippi, Crow and Minnesota rivers. The treatment thresholds were the same as those used since 1990. Table 4.1 shows the number of treatments per river in 1999.

A total of 4299 gallons of *Bti* were used for control of large river breeding black fly larvae in 1999 (Table 4.2). In 1998, a total of 4209.2 gallons of *Bti* was used in 77 treatments. In 1997, 5419.3 gallons of *Bti* were used in 65 treatments. More *Bti* was used in 1999 than in 1998 despite 27 fewer treatments because river discharge was higher than average during most of the 1999 treatment season.

Table 4.2 Historical treatment records for small streams and large rivers from 1995-1999

	1995	1996	1997	1998	1999
Small stream					
No. sites treated	48	74	66	57	62
Gallons of *Bti* used	8.95	28.64	26.20	23.74	44.10
Large river					
No. sites treated	58	67	65	77	50
Gallons of *Bti* used	3584	2996	5419	4209	4299
Discharge[a]	7420	6353	9446	5076	6857

[a] Average daily discharge measured in cubic ft/sec. for Mississippi, Minnesota, Rum, and Crow rivers combined (April-September).

Adult Population Sampling Adult black fly populations were monitored in 1999 at 48 standard locations throughout the MMCD using the District's standard black fly over-head net sweep monitoring technique that was established in 1984. Samples were taken twice weekly from May through September, generally between 8 and 10 AM. Yearly results are shown in Table 4.3.

The average number of all species of adult black flies captured in 1999 was 1.63 (Table 4.3). This is within the range of the average net sweep counts observed since the District-wide larval control program was started in 1991 and is well below the counts observed in 1984 through 1986 before any *Bti* treatments were done on the large rivers (Table 4.3). Only limited experimental *Bti* treatments were done on the large rivers in 1987, 1989 and 1990. No treatments were done in 1988, which was a year of extreme drought and very low black fly populations. In 1997 and 1998, the overall average number of adults captured was 2.91 and 2.85, respectively (Table 4.3).

Table 4.3 Annual mean number of black fly adults captured in over-head net sweeps

Year	All species[a]	*S. luggeri*	*S. johannseni*	*S. meridionale*
1984	17.95	16.12	0.01	1.43
1985	14.56	13.88	0.02	0.63
1986	11.88	9.35	0.69	1.69
1987	6.53	6.33	0.02	0.13
1988[b]	1.60	1.54	0.05	0.00
1989	6.16	5.52	0.29	0.18
1990	6.02	5.70	0.01	0.24
1991[c]	2.59	1.85	0.09	0.60
1992	2.63	2.19	0.12	0.21
1993	3.00	1.63	0.04	1.24
1994	2.41	2.31	0.00	0.03
1995	1.77	1.34	0.32	0.01
1996	0.64	0.51	0.01	0.07
1997	2.91	2.49	0.00	0.25
1998	2.85	2.64	0.04	0.04
1999	1.63	1.34	0.04	0.06

[a] All species includes *S. luggeri*, *S. meridionale*, *S. johannseni*, *S. vittatum*, and *S. venustum*.

[b] No treatments done due to drought conditions.

[c] Operational treatments began.

The average number of adult *S. venustum* captured in 1999 was 0.09, which is higher than the index counts from past years. However, as in previous years, S. *venustum* made up a low percentage of the total black flies collected. The number of *S. venustum* captured in the net-sweep samples always is low and is not representative of the actual population density. This is due to the fact that samples are averaged for the entire field season and *S. venustum* adults are rare after late May because there is only a single generation in the spring.

The most abundant black fly collected in the over head net-sweep samples in 1999 was *S. luggeri,* comprising 85% of the black flies collected in 1999. The overall average number of *S. luggeri* captured in the net-sweep samples in 1999 was 1.34, which was one of the lowest net-sweep counts observed for this species since the start of the black fly program. *Simulium luggeri* was most abundant in Anoka County in 1999, as it has been in prior years. The average number of *S. luggeri* captured in Anoka County was 5.32 in 1999. In 1998, 16 *S. luggeri* were captured per sample in Anoka County. The high number *of S. luggeri* captured in Anoka County is most likely due to its close proximity to the Rum and Mississippi rivers which have abundant *S. luggeri* larval habitat.

Adult black fly populations were also monitored twice weekly in May through early June by CO_2-baited light traps at 4 sites in Scott/Carver counties, at 4 sites in northern Anoka County and at 3 sites outside the MMCD treatment area in Monticello, MN. The sampling sites in Anoka and

Scott/Carver counties were located near *S. venustum* breeding sites on small streams and the Rum River. The three sampling sites in Monticello were located near the Mississippi River and were selected to serve as a reference site outside the MMCD black fly treatment area.

The average number of *S. venustum* captured per CO_2 trap in 1999 was 3.7 (exclusive of the Monticello traps, which were not collected in 1997 and 1998). In 1997 and 1998, the average number of *S. venustum* captured per trap was 14.7 and 10.5, respectively. The average number of *S. luggeri* captured per trap at the three reference sites in Monticello in 1999 was 34.3 versus 0.5 per trap at the 8 sites within the MMCD.

Non-target Monitoring The District conducts semi-annual monitoring of the non-target invertebrate population in the Mississippi River as a requirement of its permit from the Minnesota Department of Natural Resources. These data will provide a long-term assessment of the invertebrate community in *Bti*-treated reaches of the Mississippi River. Sampling was conducted in 1999 and the samples are still being analyzed. A report will be submitted to the Minnesota Department of Natural Resources in February, 2001.

PLANS FOR 2000 - BLACK FLY CONTROL SERVICES

Our goal is to continue to effectively control black flies in the large rivers and small streams. The thresholds for treatment will remain the same as they were in 1999. We will continue to monitor adult black fly populations with the over-head net sweep method and CO_2 traps. We also will begin preliminary studies on human response to adult black flies. These studies are part of our long-term goal to determine the human tolerance threshold for black flies in the MMCD.

CHAPTER 5 PRODUCT & EQUIPMENT TESTING HIGHLIGHTS

1999 RESULTS

- Laginex® successfully controlled *Cq. perturbans* in 1999. Tests were as successful as trials in 1997 and 1998.
- Two ULV-applied adulticides, Scourge® (resmethrin) and Anvil® (sumithrin), equally effectively suppressed adult mosquitoes at local campgrounds.
- CDC traps fitted with UV lights were successfully tested as a way to evaluate adulticide impacts upon non-target organisms.
- The DC-III droplet analyzer was used to much more quickly and accurately calibrate all ULV insecticide generators in 1999.

PLANS FOR 2000

- Laginex® will be compared directly with Altosid® to help decide how to integrate Laginex® into the cattail mosquito control program.
- Additional adulticide tests including non-target impact evaluations will be performed.
- The DC-III droplet analyzer will be used to calibrate all insecticide sprayers.
- Additional testing of electric cold foggers will be conducted
- Ways to further reduce waste will be studied.

• CHAPTER 5 • PRODUCT AND EQUIPMENT TESTS

BACKGROUND

Quality assurance is an integral part of MMCD services. The quality assurance process focuses on control material evaluations, label compliance, application analysis, calibration, and exploration of new technologies to improve District operations. The Technical Services Team provides project management and technical support. Staff from the regional facilities provide coordination of field testing and data collection.

1999 PROJECTS

Quality assurance processes focused on standardization of control material inventory processes and new product evaluations. The District tested three operational and seven new control materials in 1999. These ongoing material evaluations may lead to products being certified, and therefore eligible for bidding for the 2000 control material contracts, and provide the process teams important information on which to base purchasing, budgeting, and operational decisions.

Helicopter Swath Analysis and Calibration Procedures In 1993, MMCD purchased the WRK, Inc. system for sampling and analyzing granule deposition patterns for the purpose of improving helicopter calibration methods. MMCD has worked closely with the helicopter contractor, Scott's Helicopter Service, to continue to improve aerial applications and distribution patterns. Through the use of this technology, we have been able to modify the helicopter's Isolair application systems to greatly improve swath patterns and application results.

Technical Services and staff conducted three helicopter calibrations during the 1999 season: two sessions were held at the municipal airport in LeSueur, MN and one in Lino Lakes, MN. Staff completed calibrations for six different operational and experimental control materials. In total, seven helicopters were calibrated and each helicopter was configured to apply an average of three different control materials.

Inventory Process Improvements Inventory monitoring continued to improve. In 1999, each regional facility inventory manager worked with their field staff to monitor the field application databases to reduce discrepancies between physical inventory and field form recorded usage. During the treatment season, MMCD inventory staff conducted three internal physical audits to compare control material quantities. This interaction allowed for timely minor corrections and reduced the time to reconcile each facility's inventory and usage figures at the end of the season.

MMCD will continue to improve physical inventory measuring tools and refine methods of tracking of liquid materials. MMCD is reviewing a checkout system for adulticide materials and smaller container size to assist in the physical inventory reporting. For liquid larvicides, MMCD is considering a change in SR-20 treatment rates from 29.57 ml to 20 ml to help field staff measure accurate quantities and assist in treating smaller sites according to label requirements. Due to the viscous nature of SR-20, staff will continue to develop methods to improve dispensing the material and increase accuracy of material tracking.

Vendor Introductions to MMCD Field Operations During the 1999 treatment season, control material and equipment vendors were invited to participate in field operations to better understand how their products were being utilized by MMCD. Three vendors participated and each vendor stated these introductions were valuable to their general understandings of the District. They believe this will lead to their ability to provide better service and improved products. MMCD will continue to build relationships with vendors by having open communications and working together to develop mutually advantageous products.

Acceptance Testing of Altosid® (methoprene) Briquets, Pellets, XR-G and Altosand During 1999, warehouse staff collected random Altosid® product samples from shipments received from Wellmark International for methoprene content analysis. MMCD contracted an independent testing laboratory, Interpoll Laboratories, to complete the analysis. The testing methodologies were furnished by Zoecon Corporation, Dallas, Texas. The laboratory protocols used were CAP No. 311, "Procedures for the Analysis of S-Methoprene in Briquets and Premix" and CAP No. 313, "Determination of Methoprene in Altosid Sand Granules". Table 5.1 shows that all samples were within acceptable values of the label claim of percent methoprene.

Table 5.1 Methoprene analysis for Altosid® briquets and pellets

Methoprene product	Samples analyzed	Methoprene content: label claim	Methoprene content: analysis average	SD
150-day XR briquets	25	2.10%	2.01%	0.11
30-day pellets	40	4.25%	4.26%	0.17

Additional laboratory testing was conducted on other methoprene products. MMCD evaluated the effect of carrying over XR-G sand from one treatment season to the next. The methoprene content of the 20-day XR-G sand dropped slightly but proved to be a relatively stable product that MMCD could carryover from year to year if the need arises. MMCD also evaluated Altosand, 10-day methoprene product that MMCD manufactured from the SR-20 (Altosid® Liquid Larvicide) concentrate. Since MMCD did not have methoprene content data for stored product, samples were taken and aged for approximately thirty days. Methoprene content was analyzed and was found to be maintaining stability while stored (Table 5.2).

Table 5.2 Methoprene analysis for sand products

Methoprene product	Samples analyzed	Methoprene content: label claim	Methoprene content: analysis average	SD
20-day XR-G sand	20	1.50%	1.28%	0.08
10-day Altosand	20	0.07%	0.10%	0.01

Efficacy of Control Materials

— Altosid® Briquet, XR-G Sand and Altosand Applications In previous years, low sample sizes and highly variable bioassay results, sometimes including lower than desirable mean efficacy results, have rendered evaluation of efficacy difficult. The number of successful bioassays collected for some products such as Altosid® briquets has been very low, in part because relatively few sites are treated with briquets for *Ae. vexans* control. The time and effort required to collect adequate numbers of bioassays is significant. In 1999 studies focused on three products for which the most efficacy questions remained unanswered (i.e., Altosid® briquets, Altosid® XR-G sand, and Altosand). A minimum target of 40 bioassays for each product was chosen and responsibility for collecting those bioassays was distributed among field staff as uniformly as possible.

Untreated control emergence averaged 88.13%, essentially the same as 86.64% measured in 1998. This translates to an average natural mortality of 11.87% (Table 5.3).

Table 5.3 Bioassay results for untreated control sites

	Count	Mean % emergence	Median % emergence	SD	Min % emergence	Max % emergence
Untreated control	38	88.13	94.45	16.72	26.0	100

Table 5.4 shows the bioassay results for the Altosid® products used for larval mosquito control in 1999. Mean Altosid® briquet efficacy was fairly low and not directly related to the number of days between treatment and bioassay collection (Pearson correlation = 0.074); variability was high as in previous years. Median Altosid® briquet efficacy was higher indicating that half of the treatments that were bioassayed achieved reasonable to excellent control.

Table 5.4 Bioassay results for Altosid® briquets, XR-G sand, and Altosand. Emergence inhibition (EI) is corrected for untreated control mortality.

Material	Sample taken days post-treatment	Count	Mean % EI	Median % EI	S.D.	Min % EI	Max % EI
Briquet (150-day)	9 to 143	41	58.92	71.63	38.10	0.00	100.00
XR-G Sand (20-day)	2 to 16	44	64.57	71.80	32.05	0.00	100.00
Altosand (10-day)	.5 to 10	42	49.97	47.24	40.90	0.00	100.00
	11 to 14	27	31.61	27.06	34.81	0.00	97.73
Total Altosand		69	42.79	37.53	39.41	0.00	100.00

Mean efficacy of Altosid® XR-G sand in 1999 was slightly higher than in 1998 (mean emergence inhibition = 54.71%). Different methods of applying Altosid® XR-G sand yielded different efficacy levels with hand applications achieving higher efficacy than aerial applications (Table 5.5). These differences may have been influenced by the time (number of days) between treatment and collection of bioassays (Pearson correlation = - 0.519). Bioassays of aerial applications were collected later after treatment than bioassays for hand applications (Table 5.5).

Hand and seeder-applied Altosand also achieved a higher mean emergence inhibition than aerial treatments (Table 5.5). These differences also may have been influenced by the number of days between treatment and collection of bioassays. Bioassays of aerial applications were collected later after treatment than bioassays for hand or seeder applications (Table 5.5).

Table 5.5 Bioassay results by application method for Altosid® XR-G Sand and Altosand Emergence Inhibition (EI) corrected for untreated control mortality

Material	Application equipment	Count	Mean EI	Median EI	SD	Min % EI	Max % EI	Mean days	SD
XR-G sand	By hand	10	90.27	97.73	22.45	27.61	100.00	4.8	1.13
(20-day)	Helicopter	34	57.01	62.09	30.69	0.00	100.00	10.7	3.48
Altosand	By Hand	12	59.27	74.19	40.55	0.00	100.00	5.7	3.60
(10-day)	By Seeder	4	84.40	89.79	17.14	60.29	97.73	3.5	1.00
	Helicopter	53	35.91	27.06	37.72	0.00	100.00	9.3	3.57

— *Bti* Corncob Applications Vectobac® brand *Bti* (5/8 inch mesh size corncob granules) from Abbott Laboratories was the main *Bti* product applied by helicopter in 1999. Typically the District begins the season using an 8 lbs/acre rate when water temperatures are cold and the material is less effective. By mid-summer, water temperatures rise to levels that allow the dosage to be reduced to 5 lbs/acre. By late summer, however, the amount of vegetation and organic matter in sites make it necessary to increase the dosage to 8 lbs/acre again. This year, the application rate of 8 lbs/acre was maintained throughout the season because of extensive, frequent rains and high mosquito production during the middle of the season.

Field staff measured efficacy in 8% of the 5,310 helicopter *Bti*-treated sites during 1999 (Table 5.4). Efficacy was calculated in terms of pre-treatment and post-treatment larval counts. This method consisted of taking a series of dips in a breeding site soon after a rain event and estimating the average number of mosquito larvae per dip (pre-treatment count). The process was repeated in a randomly selected sample of sites 24-48 hours after treatment (post-treatment count). Percent control was calculated as a percent reduction based on the differences between the two counts. Samples were partitioned into spring, mid-summer and late summer to facilitate comparison with 1998 values.

Table 5.6 Efficacy of aerial *Bti* applications in 1998 and 1999

Treatment period	Duration (start-end date)	Number of checkbacks (1999)	Average % mortality (1999)	Average % mortality (1998)
Spring	4/20 - 7/16	268	88.1	88.3
Mid-summer	7/16 - 8/16	109	96.8	85.9 [a]
Late summer	8/16 - 8/28	48	95.2	88.8
Overall		425	91.1	88.4

[a] Based on the 5 lb/acre rate, all other treatments were made at the 8 lb/acre rate.

New Control Material Evaluations The District, as part of its Continuous Quality Improvement philosophy, desires to continually improve its control methods. It is the District's practice to attempt to use the most environmentally friendly products possible while achieving acceptable control rates. As part of this process, MMCD certifies materials acceptable with District-run evaluations before using the products operationally.

— **LarvX SG Biological Soluble Granules (Meridian Vector Management)** In 1999, LarvX granules were used operationally in aerial and ground applications. Staff found the three pound per acre treatment rate worked adequately when applied by seeder or hand, but had variable results when applied by helicopter (Table 5.7). MMCD will evaluate aerial applications of LarvX granules using a 5 lb/acre rate in 2000. It is hoped that the increased treatment rate will bring efficacy to acceptable levels. Our goal is to complete this product certification process in the 2000 season.

Table 5.7 LarvX efficacy by application method

LarvX application method	24-h % mortality	48-h % mortality	Count
Helicopter (aerial)	42.21%	48.35%	16
Seeder (ground)	68.61%	81.47%	17
Hand (ground)	53.33%	74.67%	1
Overall average	55.74%	65.21%	34

— **SBG Single-Brood Methoprene Sand (5-day)** Wellmark International provided 40 pounds of the new SBG granules for product evaluation in 1999. MMCD conducted some preliminary testing to identify potential application methodology using the District's application equipment. The material's flowability and physical makeup proved suitable for proper dispersal through our equipment. MMCD did not evaluate the efficacy of the product in the laboratory or mosquito breeding sites. MMCD plans a small scale evaluation in 2000.

— Laginex® AS (AgraQuest, Inc.) *Lagenidium giganteum* is a fungal parasite specific to mosquitoes and is marketed under the trade name, Laginex®. Laginex® AS applications to Minnesota wetlands have effectively controlled *Cq. perturbans* for three seasons (1997-99). Both ground (hand applied) and aerial applications have achieved between 70-99% suppression of adult mosquito emergence (Table 5.8). In all four tests *Cq. perturbans* emerged in significantly fewer cages in the Laginex® -treated sites than in the untreated controls (Table 5.9) A new Laginex® AS formulation with a 1 to 3-month shelf life was applied in June 1999 and proved to be as effective as the earlier formulation. Testing in 2000 will explore how the District can integrate this cost effective product into our *Cq. perturbans* control program most effectively.

Table 5.8 Mean cumulative *Cq. perturbans* emergence per cage in four Laginex® AS tests

Test	Date applied	Sampling dates	No. sample days	Mean emergence Control	Mean emergence Laginex® AS	Percent suppre s-sion	Mann-Whitney p-value
1	6/11/97	6/16 - 7/14/97	33	14.89	2.38	84	p=0.026
2	9/07/97	6/12 - 7/12/98	38	12.10	2.18	82	p=0.003
3	6/03/99	6/16 - 7/29/99	43	13.02	3.85	70	p=0.002
4	6/04/99	6/16 - 7/29/99	43	5.00	0.05	99	p<0.0001

Table 5.9 Number of cages from which *Cq. perturbans* emerged

Test	Date applied	Sampling dates	Control	Laginex® AS	Fisher Exact p-value
1	6/11/97	6/16 - 7/14/97	8 of 9	3 of 8	p=0.050
2	9/07/97	6/12 - 7/12/98	10 of 10	28 of 40	p=0.046
3	6/03/99	6/16 - 7/29/99	9 of 9	6 of 19	p=0.001
4	6/04/99	6/16 - 7/29/99	8 of 10	1 of 19	p<0.0001

— Vectolex Vectolex contains *Bacillus sphaericus*, a bacterium that is specific to mosquitoes and can recycle in mosquito larvae, sometimes resulting in longer field suppression than *Bti*. In early June, 1999 we applied Vectolex (20 lb/acre) to a small cattail site to test its ability to control *Cq. perturbans*. We were unable to evaluate the results because no mosquitoes emerged from the untreated control site. More tests are planned for 2000.

— Anvil 2+2 (Clarke Mosquito Control Products, Inc) Anvil 2 +2 is a newly available non-restricted use adulticide containing sumithrin/PBO. Efficacy was measured by placing three CO_2 traps in wooded harborage areas adjacent to trails in each of three campgrounds on three consecutive nights. To obtain pre- and post-treat counts, traps were set up between 4:00-5:00 PM.

On the night of the treatment, traps were set up around 10:00 PM (30 minutes after ULV treatments). Traps were retrieved at about 8:00 AM on each day. Captured mosquitoes were identified and tallied. ULV treatments using ATV-mounted sprayers were applied at two campgrounds, one being treated with Scourge (1.5 oz/acre) and one with Anvil (3.0 oz/acre). The third campground was not treated. Scourge and Anvil dosages were chosen to equalize the amount of active ingredient (0.0035 lb/acre) applied.

Both Scourge® and Anvil® were equally effective in all three treatments (Table 5.10). Both materials significantly suppressed mosquito catches the night of treatment (second night of sampling). Mosquito collections in the control site in the first and third tests did not change the same way as mosquito collections in the Scourge and Anvil-treated sites (Table 5.10). In the first test, the number of mosquitoes captured in the control increased each night. In the third test, more mosquitoes were caught in the control site on the second night than on the first; the lowest number of mosquitoes was captured on the third night. Similar tests are planned for 2000.

Table 5.10 Mean CO_2 trap catches in three field tests of Scourge® and Anvil® 2+2: 1999 (First, second and third sampling nights are designated pre, trt, and post.)

Material	Test 1 23-25 June		Test 2[a] 13-15 July		Test 3 17-19 August	
	Total mosquitoes	Percent decrease	Total mosquitoes	Percent decrease	Total mosquitoes	Percent decrease
Scourge (pre)	1,814	N/A	1,767	N/A	1,579	N/A
Scourge (trt)	87	95.2	53	97.0	143	90.9
Scourge (post)	974	46.3	741	58.1	98	93.8
Anvil (pre)	552	N/A	1,160	N/A	510	N/A
Anvil (trt)	9	98.4	14	98.8	26	94.85
Anvil (post)	151	72.6	377	67.5	129	74.6
Control (pre)	613	N/A	N/A	N/A	309	N/A
Control (trt)	837	-36.7	N/A	N/A	391	-26.8
Control (post)	1,357	-121.5	N/A	N/A	187	39.4

[a] No control in test number two because traps were knocked down by a thunderstorm.

— **Aqua Reslin (AgrEvo Environmental Health)** This water-based permethrin/PBO product was used as a ULV adulticide and was applied using a truck-mounted cold fogger. One field test of Aqua Reslin using the same protocol as the comparison of Anvil and Scourge yielded good results for Aqua Reslin. Ninety-three percent fewer mosquitoes were caught immediately after a

ULV treatment (the second night) than the first night. Suppression the third night remained at 89.5% below mosquitoes caught the first night. More tests will be needed to verify these results.

— **Mosquito Beater 4+4 (Bonide Products Inc.)** A special formulation of this permethrin/ PBO adulticide was produced for evaluation by MMCD, but was not tested in 1999. This versatile control material could be applied as a barrier or ULV treatment.

Equipment Evaluations

— **Seedvac Pneumatic Helicopter Loading System** Since 1997, MMCD's helicopter contractor, Scott's Helicopter Service, has provided a bulk control material loading vehicle for evaluation. Some of the advantages of the bulk loading system was better utilization of field staff, improved employee safety, and the reduction of waste in control material packaging.

Prior to the 1999 season, an extensive problem solving evaluation was completed and staff corrected some procedures to solve specific problems. During the summer, the Seedvac was utilized seven times. Staff continue to focus on the negative aspects of the one-person loading system stating that loading is not fast enough, it clogs easily, and leads to inventory tracking problems. The physical limitations of the current system cannot be changed and staff are not satisfied with its current performance. Therefore, it is suggested that MMCD discontinue the evaluation of the current bulk loading system. In 1999, MMCD used twenty bulk bags reducing packaging waste by 600 pounds.

— **KLD Model DC-III Droplet Analyzer** In 1999, MMCD purchased the KLD Labs DC-III adulticide droplet measuring instrument. The unit is used to estimate the size of sprayed droplets by measuring the temperature change caused by the deposition of a droplet on a very fine, hot wire. By connecting the DC-III to a laptop computer, equipment calibrations can be done quickly while in the field. This technology has greatly improved the efficiency and accuracy of MMCD's calibration procedures.

MMCD staff optimized all fifty Ultra Low Volume (ULV) insecticide generators to produce an ideal droplet range of 8-20 microns. By adjusting our ULV sprayers to produce a tighter, more uniform droplet spectrum, control materials are being used more effectively. This in-field analysis creates more droplets of the correct size to impinge upon flying mosquitoes. In addition, more uniform swaths allow staff to better predict ULV application patterns and respective insecticide swath coverage.

A subsample of the spray mists of different brands of backpacks was also completed. District backpacks produce a larger droplet size for barrier applications and the ideal droplet spectrum for these treatments is 50-100 microns. Stihl, Maruyama and Hudson backpacks were tested and most backpacks were in compliance with this droplet range. Stihl and Maruyama packs produced droplets around the 50-70 micron range, while the Hudson packs produced a smaller range of 35-60 microns.

In the 2000 season, Technical Services staff will continue to help calibrate and optimize spray patterns of all ULV cold fog units. MMCD will continue to evaluate the back-pack spray patterns and develop optimization recommendations for each type of backpack.

— **Beecomist Truck-Mounted Electric ULV Cold Fogger** Clarke Mosquito Control Products provided a Beecomist Pro-Mist HD sprayer for evaluation. This electric cold fog unit is measurably quieter than equivalent gas-powered models and provides an extremely consistent droplet spectrum for more efficient use of adult mosquito control materials. Benefits of this unit were: 1) reduced noise levels of unit allowed drivers of the cold fog trucks to have more awareness in safely operating their vehicle, and 2) a more comfortable work environment. Also noted, the quieter operations had a less alarming effect on the public during spray operations. Staff highly recommended the electric cold foggers for District use.

— **ElectraMist Truck-Mounted Electric ULV Cold Fogger** MMCD attempted to evaluate a new EM 3000 Variable Flow fogger in 1999. The newly formed company was unable to provide a unit for testing during our treatment season. MMCD will continue to work with the vendor to evaluate their product in 2000.

— **Twister ULV Backpack** A Curtis DynaFog Twister ULV Cold Fog backpack was purchased for evaluation. This backpack has perceived advantages over other District owned hand-held ULV generators. The unit's style centers the equipment weight on a backpack frame, allowing all staff to more easily carry a ULV generator for longer periods in a wooded environment. Staff worked extensively with manufacturer to overcome calibration flow rate problems and this resulted in a limited 1999 evaluation. MMCD will continue to evaluate this equipment in 2000.

— **Modification of MAG ATV-mounted ULV Cold Fog Unit** MMCD staff modified an older London Fog MAG fogger to improve its droplet producing performance. Staff experimented with increasing the pulley sizes on the belt system connecting the engine with the compressor unit. The modification increased the blower pressure and improved droplet spectra. The modification has possible negative implications on equipment life due to higher engine RPMs and related increases in operating temperatures of the engine and compressor. MMCD will continue to monitor this equipment for operational use and maintenance patterns.

— **FFAST System for Water-based Adulticides** London Fog & ADAPCO introduced MMCD staff to a new mixing station for water-based insecticides called FFAST, or Film Forming Aqueous Spray Technology. This facility-based equipment would accurately dilute the insecticide concentrate to produce a ready-to-use ULV spray. For MMCD, some of the advantages of this system are precision fluid measurements (accuracy of inventory) and freshly mixed insecticide (eliminate stratification of unagitated products). MMCD will continue to explore this system in conjunction with water-based insecticide testing.

— **Cougar ATV-mounted ULV cold fogger** Clarke Mosquito Control Products provided an ATV-mounted cold fog unit for a week-long evaluation. Staff found the unit was easy to use, ran

smoothly and provided an even ULV spray. Staff directly compared the Cougar unit with other District-owned equipment (London Fog's MAG and Beecomist's ATV electric) and stated some of the Cougar's features were better than the currently used equipment. Staff would recommend the piece of equipment for use in the District.

— **Monitor II Variable Flow Monitoring System for Truck-Mounted Cold Fog Units** In 1998, MMCD purchased this variable flow monitoring system to upgrade an existing MMCD cold fog unit. This system provided a data storage capability of applications that could be downloaded directly into MMCD computerized treatment files. Staff appreciated the advantages of accurate spray data and the elimination of completing paper records while applying control materials. Staff concerns included possible data loss; the unit is more difficult to operate while driving and more training is required to properly run this system than other variable flow units. Also, downloaded data is not seamless with existing MMCD databases so staff need to complete additional data entry to identify treatment sites. Overall, MMCD staff felt the data storage capabilities were an advantage to current systems and recommended further evaluation of these types of data storage monitoring units.

— **ELF Variable Flow Control System for Truck-Mounted Cold Fog Units** In 1997, MMCD's sixteen cold fog units started to experience computer motherboard failures of their 10-year old Pro-Flow variable flow control systems. The Pro-Flow system was no longer being supported by the manufacturer and a replacement variable flow system was sought to continue operations with the mechanically sound cold fog units. Clarke's ELF variable flow units easily replaced the Pro-Flow units. By 1999, MMCD has replaced six units with ELF systems. Staff appreciate the basic, easy-to-use format of the ELF. Not only is the ELF system compact and portable, but it also has a "plug-in" mounting system that allows the unit to be removed from the cab when the cold fogger is not in use. Staff had concerns over the consistent push button responses of control panel but most felt that it was a dependable replacement system.

— **Adulticide Mixing Drum** It is known that oil-based insecticides will stratify and precipitation can occur over time. Regular blending of MMCD's 5.7% permethrin mixture can improve the consistency of applied product and theoretically can improve its treatment effectiveness. MMCD purchased a special fifty-five gallon drum from Midway Container to address product mixing and improve various other issues (i.e., inventory monitoring, material spillage, mounting of devices). This drum contains an internally mounted mixing bar and MMCD additionally modified it to satisfy the other needs. Staff found the drum properly addressed most operational issues but found an additional conflict between the inventory monitoring device (Liquid Measuring Device or LMD) and the mixing process — the LMD can break if not removed prior to mixing. MMCD will continue to attempt to improve and evaluate this system for further use in the District.

— **Waste Reduction of Control Material Packaging** MMCD continues to strive to reduce waste production of control materials packaging. MMCD worked directly with Abbott Laboratories to modify our pallet shipments of *Bti* granules to reduce the amount of protective

cardboard found on each pallet. MMCD reduced cardboard waste by 540 sheets (500 lbs) during 1999. MMCD will continue to work with vendors to find new ways to save money and reduce waste packaging.

PLANS FOR 2000

Quality assurance processes will continue to be incorporated into the everyday operations of the regional process teams. A primary goal is to assure the collection of adequate information for all evaluations. The District will continue to improve and make quality decisions based upon data.

We plan to continue our review of the various methoprene formulations used against floodwater mosquitoes (primarily *Ae. vexans*). The causes of less-than-desired Altosid® briquet efficacy are still undetermined. We plan to study further the apparent differences in efficacy of aerially and hand-applied methoprene sand products (Altosid® XR-G and Altosand) as these differences could be due more to varying intervals between treatment and bioassay sample collections. The ultimate goal is to use each product where it will most effectively achieve District goals, and to determine how best to measure efficacy using bioassay data.

We also plan to compare the efficacy of Altosid® pellets and Laginex® against the cattail mosquito, *Cq. perturbans*, in a final evaluation of where each product fits best into the District cattail mosquito control program. We plan to include Vectolex in this test to evaluate its potential as another material for controlling the cattail mosquito.

Continued field evaluation featuring up to four adulticides (Aqua Reslin, Anvil, Mosquito Beater and Scourge) is planned to simultaneously test these adulticides under similar field conditions.

We will continue to improve our calibration techniques to optimize our adult mosquito control equipment.

MMCD will evaluate two truck-mounted electric ULV cold foggers in 2000. These foggers provide an extremely consistent droplet size spectrum which allows the District to optimize adulticide spray. The electric engine is significantly quieter than its gas powered equivalent.

CHAPTER 6 SUPPORTING WORK SEASON HIGHLIGHTS

1999 RESULTS

Wright County Long-Term Nontarget Study

- Invertebrate sampling results from 1997-1998 showed no effect of treatment on most invertebrate groups, in contrast to 1993 results.
- The only significant treatment effect was a reduction in density and biomass of some Chironominae, but other subgroups were abundant enough that there was no significant decrease in chironomids overall.
- Additional reviews were received, results presented at ESA, and production of a journal publication is still in progress.

Frog Census

- Frog research (not funded by MMCD) was completed at these sites.
- Preliminary results show that some malformations were found, but were as common in untreated sites as in methoprene-treated sites.

PLANS FOR 2000

- Coordinate with members of the review panel and provide Dr. Balcer appropriate support to facilitate publication of results from 1997-'98 non-target sampling.

NON-TARGET RESEARCH

Long-Term Study of Non-target Effects of Mosquito Larvicides (Wright County Study) The Wright County non-target study sites were a set of 27 wetlands that were originally selected for study by the Natural Resources Research Institute (Duluth, MN) in 1988, assigned to treatment groups (*Bti*, methoprene sand, or untreated control), and were treated every year starting in 1991. They are a unique resource for study of long-term effects of treatment.

Results from the original study conducted between 1988-1993 showed there was no difference between treated and untreated sites for measures of zooplankton, breeding red-winged blackbirds, or the bird community inhabiting the wetlands (Niemi et al.1997; Hanowski et al.1997). For macroinvertebrates in samples of core sediments, Hershey et al. (1998) reported significant decreases in insects, mostly non-biting chironomid midges in the later sampling dates from 1992 and especially 1993, but not in 1991. The lack of measurable effects of these insect results on other parts of the food web is discussed in Niemi et al. (1999).

Continuation Study The sampling approach used by Hershey was repeated by Drs. Mary Balcer and Kurt Schmude of Lake Superior Research Institute (LSRI), Superior, WI, in 1997 and 1998. They found generally high numbers of insects and other invertebrates in all the sites. The only difference between treated and untreated sites was lower populations of some groups within the Chironominae in treated sites, but other chironomid groups were higher, resulting in no difference in chironomid numbers or biomass as a whole (LSRI reports to MMCD, Dec. 1997 and Feb. 1999). Statistical analysis for LSRI was done by Ann Lima, who also did the analysis for the previous NRRI study.

Most of the members of the Scientific Peer Review Panel (SPRP) that oversaw the original 1988-1993 studies have continued to direct and review the 1997-1998 work. This Continuation Panel includes original SPRP members R. Anderson, S. Hurlbert, R. Moon, W. Schmid, M. Zicus, K. Simmons, and J. Helgen (as available), and former TAB member D. Belluck. Gary Montz of the MDNR has received updates on Panel activities. Nancy Read from MMCD served as administrative staff, and Stephen Manweiler was the liaison with the MMCD Management Team.

Progress in 1999 No additional invertebrate sampling was done in 1999. Additional reviews of the results were solicited from other wetland invertebrate specialists including M. Berg (Loyola Univ.), R. W. Merrit (Mich. State), L. Ferrington Jr. (Kansas State), W. Walton (UC-Riverside), R. Newman (Univ. of Minn.), and J. P. Gathman (Mich. State), as well as from A. Hershey (now at Univ. of North Carolina). These reviews were distributed to the Panel and to Dr. Mary Balcer who has begun work on a journal publication covering the 1997-1998 results. Other limitations on Dr. Balcer's time in 1999 have resulted in delay of production of a final publication. A brief talk on the 1997-1998 results was presented by Nancy Read (MMCD) at the national meeting of the Entomological Society of America in December, 1999.

Frog Census A survey of frog populations at 18 of the Wright County study sites started in 1998 was continued in 1999 under the direction of Dr. Lucinda Johnson of NRRI and Dr. Val Beaseley of Univ. of Illinois - Champaign/Urbana, with funding provided directly by Wellmark International, not by MMCD. Site treatments were continued (also arranged and funded by Wellmark) as in previous years and treatment verifications were compiled by Dr. Lyle Shannon, NRRI. As in 1998, preliminary results show that some malformations were found, but were as common in untreated sites as in methoprene-treated sites. A final report is being prepared for Wellmark and will be available from NRRI.

Publication on Chironomids and *Bti* Effects Another study originally conducted under the direction of the SPRP has now been published. Liber et al. (1998), using replicate mesocosms in wetlands in central Minnesota, showed that the *Bti* dosage rates the District uses provide for a reasonable margin of safety for chironomids (midges). Certain chironomid taxa were susceptible to *Bti* rates at 5 times and 10 times the label rate but recovery was generally observed within 14 to 32 days post-application. Predatory chironomids (Tanypodinae) were unaffected by *Bti*.

Strategic Planning Focus Groups In 1999, the District conducted a focus group study as part of its strategic planning process. The following summary is based on results submitted by Corinna Roy of the Wilder Research Center, the company contracted to perform the research. MMCD management chose to use focus groups rather than non-structured public input sessions because focus groups gather information from a random sample of the community, rather than just from those concerned with particular issues.

Nine focus groups were held in August of 1999. Three groups targeted citizens from the inner area of the District where full larval and adult mosquito control is provided. Three additional groups targeted citizens from the outer area that receives disease and black fly control but limited annoyance mosquito control. The final three groups included a sample of representatives of local government (city managers or park directors), who are also customers of District services. The major questions to be addressed by the study were:

1. What combination of services or level of service would the public and local governments like to have in their area?
2. How do they view the costs, benefits, and risks of control?
3. Do people who live within the Metropolitan Mosquito Control District's priority service area have different views from those who live in the secondary service area?

Summary of Findings

Current Experience:

- People who live outside of the Metropolitan Mosquito Control District priority service area reported having more severe problems with mosquitoes than persons residing within the priority service area.
- Participant's perceptions of the black fly problem were largely influenced by their biological response to being bitten, and the amount of time they engage in outdoor activities.

Value of Services:

- All of the participants had negative experiences with mosquitoes and valued the services provided by the Metropolitan Mosquito Control District.
- Some participants were concerned about the environmental impact of the District services, but most felt that the value of having some relief outweighed these concerns.

Importance of Public Outreach:

- The participants responded well to educational materials that provided information about the generally benign nature of the District's treatment services, and felt that it would be important to disseminate this information to quell public fears about the toxicity of the treatment.
- City officials felt that the dissemination of information about District services would be good publicity, particularly in efforts to raise additional funding to increase services outside of the priority service area.

Increase in Taxes and Service:

- Householder participants were willing to spend about as much in additional taxes on District services as they spend on repellent products, and this amount was substantially higher outside of the priority service area.

Other Issues:

- Most participants felt that notification should remain the same or that District services should be increased and notification reduced.
- A majority of participants were in favor of allowing the District to treat Department of Natural Resources land.

PLANS FOR 2000

Continuation Study Publication of the 1997-1998 results is important not only to MMCD but to mosquito control districts around the country as they deal with continued questions about the 1992-1993 results presented in Hershey et al., 1998. Staff will coordinate with members of the review panel and provide Dr. Balcer whatever support is appropriate to facilitate publication. MMCD has no plans to continue research or treatments at the Wright County sites in 2000.

REFERENCES CITED

Balcer, M.D., K.L. Schmude, and J. Snitgen. 1999. Long-term effects of the mosquito control agents *Bti* (*Bacillus thuringiensis israelensis*) and methoprene on non-target macro-invertebrates in wetlands in Wright County, Minnesota (1997-1998). Report submitted to Metropolitan Mosquito Control District February 4, 1999.

Hanowski, J., G. Niemi, A. Lima, and R. Regal. 1997. Response of breeding birds to mosquito control treatments of wetlands. Wetlands 17(4):485-492.

Hershey, A., A. Lima, G. Niemi, and R. Regal. 1998. Effects of *Bacillus thuringiensis israelensis* (BTI) and methoprene on nontarget macroinvertebrates in Minnesota wetlands. Ecol. Applic. 8(1):41-60.

Liber, K., K. Schmude, and D. Rau. (1998). Toxicity of *Bacillus thuringiensis* var. *israelensis* to chironomids in pond mesocosms. Ecotoxicology 7, 343-354.

Niemi, G., A. Hershey, L. Shannon, J. Hanowski, A. Lima, R. Axler, and R. Regal. 1999. Ecological effects of mosquito control on zooplankton, insects, and birds. Environ. Toxicol and Chem. 18(3):549-559.

Niemi, G., R. Axler, J. Hanowski, A. Hershey, and L. Shannon, 1995. Evaluation of the effects of methoprene and *Bti* on wetland birds and invertebrates in Wright County, MN 1988 to 1993. Metropolitan Mosquito Control District Final Report, St. Paul, Minnesota, USA.

Schmude, K.L. and M.D. Balcer. 1997. Effects of the mosquito control agents *Bti* (*Bacillus thuringiensis israelensis*) and methoprene on non-target macroinvertebrates in wetlands in Wright County, Minnesota (1997). Report submitted to the Metropolitan Mosquito Control District, December 31, 1997.

APPENDIXES

APPENDIX A FREQUENCY OF OCCURRENCE (%) OF LARVAL SPECIES IN STANDARD DIPPER COLLECTIONS, 1999.[a]

	Anoka	Carver	Scott	Dakota	Hennepin	Ramsey	Wash.	District
No. of Collections	2157	520	1247	1677	5690	1549	1332	14164
1. Aedes abserratus	1.2	0.2	0.4	0.2	0.5	0.3	0.3	0.5
6. canadensis	0.2	2.5	1.2	1.6	0.7	0.4	0.6	0.8
7. cinereus	13.0	13.5	14.7	13.6	10.9	10.9	12.4	12.1
8. communis	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0
10. dorsalis	0.0	0.0	0.0	0.1	0.2	0.3	0.2	0.1
11. excrucians	3.0	1.5	1.6	3.0	6.2	4.5	10.9	5.0
12. fitchii	0.6	0.6	0.2	0.8	0.6	0.5	2.6	0.8
13. flavescens	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
14. implicatus	0.2	0.6	0.2	0.1	0.9	1.1	0.3	0.6
15. intrudens	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.0
16. nigromaculis	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
18. punctor	0.3	0.4	0.5	0.1	0.3	0.3	0.2	0.3
19. riparius	0.9	1.2	0.5	0.3	2.4	0.8	0.5	1.4
20. spencerii	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0
21. sticticus	0.1	0.0	0.0	1.0	0.3	0.1	0.8	0.3
22. stimulans	2.1	11.0	6.2	7.1	13.7	7.9	16.1	10.0
23. provocans	0.3	0.0	0.1	0.8	0.5	1.2	3.0	0.8
25. trivittatus	0.7	0.6	3.4	14.1	2.8	3.7	2.1	3.8
26. vexans	25.0	22.1	33.2	49.7	32.7	33.3	25.5	32.6
261. Aedes species[b]	68.5	55.8	47.7	42.3	49.3	46.4	58.7	52.1
28. Anopheles earlei	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
29. punctipennis	0.0	0.2	0.3	0.5	0.1	0.0	0.1	0.1
31. walkeri	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
311. An. species[b]	0.7	0.6	0.6	0.9	0.4	0.2	0.7	0.5
33. Culex pipiens	0.1	0.4	1.0	0.4	0.8	1.3	0.2	0.6
34. restuans	3.0	1.9	3.4	3.9	5.4	7.0	2.8	4.5
35. salinarius	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
36. tarsalis	0.5	0.2	0.7	0.6	0.5	1.5	0.5	0.6
37. territans	3.8	1.3	5.9	5.4	4.1	7.3	3.1	4.5
371. Cx. species[b]	8.9	6.0	6.9	2.3	4.3	4.8	5.3	5.2
38. Culiseta inornata	2.2	6.0	2.9	6.1	4.1	4.0	6.4	4.2
40. minnesotae	0.5	0.0	0.1	0.1	0.3	0.2	0.2	0.2
41. morsitans	0.2	0.2	0.1	0.0	0.0	0.1	0.0	0.1
411. Cs. species[b]	3.2	4.4	1.7	1.5	1.7	1.7	3.5	2.2
46. Psorophora ferox	0.0	0.0	0.1	0.1	0.0	0.1	0.1	0.0
47. horrida	0.0	0.0	0.1	0.4	0.0	0.0	0.0	0.1
471. Ps. species	0.0	0.0	0.0	0.3	0.0	0.1	0.1	0.1
48. Ur. sapphirina	0.5	0.2	1.0	0.2	0.3	0.8	0.5	0.5
501. Unidentifiable	0.9	0.2	0.5	1.6	0.7	1.4	0.6	0.9

[a] Other collection methods are used to sample *Cq. perturbans* and *Ae. triseriatus*.

[b] Genus level identifications only.

APPENDIX B AVERAGE NUMBER OF COMMON MOSQUITO SPECIES COLLECTED PER NIGHT IN NEW JERSEY LIGHT TRAPS 1960-1999

	Aedes abs/punc	*Aedes cinereus*	*Aedes sticticus*	*Aedes trivittatus*	*Aedes vexans*	*Culex tarsalis*	*Coquilletidia perturbans*	All species	Average Rainfall
1960	0.20	0.76	0.00	5.49	84.50	0.69	0.22	98.10	20.11
1961	0.51	0.32	0.34	2.51	41.10	0.49	0.87	51.23	16.56
1962	2.04	0.92	0.34	0.22	125.30	1.13	3.01	143.70	24.65
1963	1.09	0.58	0.89	0.16	72.00	0.25	6.55	89.58	16.03
1964	0.07	0.19	0.07	0.01	32.90	0.70	1.30	39.18	21.07
1965	1.03	0.77	0.19	0.08	89.00	4.70	1.43	111.74	27.97
1966	1.29	0.13	0.00	0.02	33.70	0.69	17.66	61.78	14.41
1967	0.64	0.24	0.65	0.12	75.40	1.61	14.37	101.55	15.60
1968	0.14	1.60	0.04	0.77	119.30	1.25	2.43	136.54	22.62
1969	0.70	0.19	0.02	0.17	19.90	0.65	4.27	30.82	9.75
1970	0.17	0.57	0.06	0.33	73.10	0.76	2.78	83.16	17.55
1971	0.69	0.55	0.15	0.33	52.10	0.28	3.51	62.93	17.82
1972	0.98	2.13	0.41	0.35	124.50	0.39	8.12	142.35	18.06
1973	1.29	0.70	0.11	0.06	62.20	0.41	25.86	95.14	17.95
1974	0.17	0.32	0.14	0.12	30.30	0.15	7.15	40.09	14.32
1975	0.28	0.63	0.44	0.17	40.10	6.94	4.93	60.64	21.47
1976	0.10	0.05	0.04	0.00	2.30	0.23	4.42	9.02	9.48
1977	0.20	0.16	0.01	0.02	17.50	2.44	1.16	25.17	20.90
1978	0.17	0.74	0.33	0.24	51.40	1.35	1.04	62.63	24.93
1979	0.07	0.24	0.10	0.21	18.30	0.13	4.39	25.59	19.98
1980	0.02	0.26	0.33	0.77	47.40	0.25	13.87	65.28	19.92
1981	0.01	0.10	0.25	1.03	57.00	0.44	3.98	65.30	19.08
1982	0.01	0.21	0.08	0.03	23.10	0.15	8.63	34.60	15.59
1983	0.03	0.24	0.08	0.14	55.60	0.58	8.72	69.71	20.31
1984	0.08	0.16	0.14	0.35	65.40	1.82	1.60	92.42	21.45
1985	0.05	0.17	0.05	0.02	21.20	0.21	5.07	28.51	20.73
1986	0.40	0.23	0.12	0.03	25.80	0.92	2.61	34.30	23.39
1987	0.00	0.11	0.01	0.15	29.10	0.96	3.37	37.77	19.48
1988	0.01	0.51	0.00	0.00	21.00	0.72	1.40	27.28	12.31
1989	0.66	1.60	0.01	0.12	14.40	1.01	0.12	26.35	16.64
1990	0.83	11.37	1.22	0.34	125.80	2.65	0.99	159.45	23.95
1991	1.17	2.67	1.55	0.51	90.80	1.37	6.03	14.44	26.88
1992	0.09	0.09	0.02	0.24	36.00	0.49	38.31	79.81	19.10
1993	0.54	0.50	1.01	1.50	71.20	1.20	34.10	120.45	27.84
1994	0.70	0.47	0.46	0.33	29.70	0.15	68.45	104.52	17.72
1995	2.13	1.62	0.25	0.40	129.01	0.37	48.28	193.26	21.00
1996	0.82	0.62	0.58	0.47	25.82	0.09	40.65	72.05	13.27
1997	1.53	1.91	0.19	4.46	72.66	0.10	48.47	132.48	21.33
1998	1.86	0.66	0.08	0.54	53.93	0.05	36.16	89.89	19.43
1999	2.48	0.93	0.31	0.37	60.73	0.04	28.71	82.64	22.41

APPENDIX C MOSQUITO BIOLOGIES

There are 50 species of mosquitoes in Minnesota. Thirty-nine species are found within the MMCD. Species can be grouped according to their habits and habitat preferences which include: disease vectors, spring *Aedes*, summer *Aedes*, permanent water species, and the cattail mosquito.

Disease vectors *Aedes triseriatus*, also known as the eastern tree hole mosquito, is the vector of LaCrosse encephalitis. It breeds in tree holes and artificial containers, especially discarded tires.. The adults are found in wooded or shaded areas and stay within ¼ to ½ miles from where they emerged. They are not aggressive biters and are not attracted to light. Vacuum aspirators are best for collecting this species. *Culex tarsalis* is the vector of western equine encephalitis. In late summer, egg laying spreads to temporary pools and artificial containers, and feeding shifts from birds to horses or humans. MMCD monitors this species using New Jersey light traps and CO_2 traps. Viral activity is monitored by testing blood from sentinel chicken flocks.

Spring *Aedes* Spring *Aedes* are the earliest mosquitoes to hatch in the spring. They breed in woodland pools, bogs, and marshes that are flooded with snow melt water. There is only one generation per year and overwintering is in the egg stage. Adult females live throughout the summer and can take up to four blood meals. These mosquitoes do not fly very far from their breeding sites, so localized hot spots of biting can occur both day and night. Our most common spring *Aedes* species are *Ae. abserratus*, *Ae. excrucians* and *Ae. stimulans*. Spring *Aedes* adults are not attracted to light, so human or CO_2-baited trapping is recommended.

Summer *Aedes* Summer *Aedes* eggs hatch in late April and early May. Eggs are laid at the margins of grassy depressions, marshes, and along river flood plains. There are multiple generations per year resulting from rainfalls greater than one inch. Overwintering is in the egg stage. Adult females live about three weeks. Most species can fly great distances and are highly attracted to light. Peak biting activity is as at dusk. *Aedes vexans*, the floodwater mosquito, is our most numerous pest. Other summer *Aedes* are *Ae. cinereus*, *Ae. sticticus* and *Ae. trivittatus*. New Jersey light traps, CO_2-baited traps, and human-baited sweep net collections are effective methods for adult surveillance of these species.

Coquillettidia perturbans This summer species breeds in cattail marshes and is called the cattail mosquito. A unique characteristic of this mosquito is that it can obtain oxygen by attaching its specialized siphon to the roots of cattails and other aquatic plants. They overwinter in this manner. Adults begin to emerge in late June, with peak emergence around the first week of July. They are very aggressive biters, even indoors, and will fly up to five miles from the breeding site. Peak biting activity is at dusk and dawn. Surveillance of adults is best achieved with CO_2 traps.

Permanent water species There are three genera of mosquitoes that breed in permanent and semipermanent sites: *Anopheles*, *Culex,* and *Culiseta.* These mosquitoes are multi-brooded and lay their eggs in rafts on the surface of the water. The adults prefer to feed on birds or livestock but will bite humans. The adults overwinter in places like caves, hollow logs, stumps or buildings. We do not usually target these species for surveillance or control.

APPENDIX D DESCRIPTION OF CONTROL MATERIALS

The following is an explanation of the control materials currently in use by MMCD. The specific names of products used in 1999 are given. The generic products will not change in 2000, although the specific formulator may change.

ALTOSID® (METHOPRENE) 150-DAY BRIQUETS

(Wellmark International/Zoecon - Altosid® XR Extended Residual Briquet)

Altosid® briquets are typically applied to mosquito breeding sites which are three acres or less. Briquets are applied to the lowest part of the site on a grid pattern of 14-16 ft apart at 220 briquets per acre. Sites which may flood and then dry up (Types 1 & 2) are treated completely. Sites which are somewhat permanent (Types 3, 4, 5) are treated with briquets to the perimeter of the site in the grassy areas. Pockety ground sites (i.e., sites without a dish type bottom) may not be treated with briquets due to spotty control achieved in the uneven drawdown of the site.

Cattail mosquito (*Cq. perturbans*) breeding sites are treated at 330 briquets per acre in rooted sites or 440 briquets per acre in floating cattail stands. Applications are made in the winter and early spring.

ALTOSID® (METHOPRENE) LIQUID

(Wellmark International/Zoecon-Altosid® Liquid Larvicide Concentrate-A.L.L. Liquid)

Altosid® liquid is mixed with water and applied in the spring to mosquito breeding sites containing spring *Aedes* mosquito larvae. Typical applications are to woodland pools. Sites which are greater than three acres in size are treated by the helicopter at a rate of one ounce of concentrate per acre. The dilution is adjusted to achieve the best coverage of the site. Altosid® liquid treatments are ideally completed by June 1st of each season.

ALTOSID® (METHOPRENE) PELLETS

(Wellmark International/Zoecon-Altosid® Pellets)

Altosid® pellets consist of methoprene formulated in a pellet shape. Altosid® pellets are designed to provide up to 30 days control but trials have indicated control up to 40 days. Applications will be made to ground sites (less than 3 acres in size) at a rate of 2.5 lbs per acre for *Aedes* control and 4-5 lbs per acre for *Cq. perturbans* control. Applications are also done by helicopter in sites which are greater than three acres in size at the same rate as ground sites, primarily for *Cq. perturbans* control.

***BACILLUS THURINGIENSIS ISRAELENSIS* (*BTI*) CORN COB**

(Valent Biosciences-Vectobac® G; Becker Microbial Aquabac G)

Bti corn cob may be applied in all types of mosquito breeding sites which have targeted mosquito larvae in the water. *Bti* can be effectively applied during the first three instars of the mosquito breeding cycle. Typical applications are by helicopter in sites which are greater than three acres in size at a rate of 5-10 lbs per acre. In sites less than three acres, *Bti* may be applied to pockety sites by ground crews with cyclone seeders or power back packs.

BACILLUS THURINGIENSIS ISRAELENSIS (*BTI*) LIQUID

(Valent Biosciences-Vectobac® 12AS; Becker Microbial-Aquabac XT)

Bti liquid is applied directly to small streams and large rivers to control black fly larvae. Treatments are done when standard mylar sampling devices collect threshold levels of black fly larvae. Maximum dosage rates are not to exceed 25 ppm of product as stipulated by the MDNR. *Bti* is applied at pre-determined sites, usually at bridge crossings (applied from the bridge) or by boat.

PERMETHRIN

(Clarke Mosquito Control Products-Permethrin 57% OS)

Permethrin is used by the District to treat adult mosquitoes in known daytime resting or harborage areas. Harborage areas are defined as wooded areas with good ground cover to provide a shaded, moist area for mosquitoes to rest during the daylight hours.

Adult control is initiated when MMCD surveillance (sweep net and light trap collections) indicates nuisance populations of mosquitoes, when employee conducted landing rate collections document high numbers of mosquitoes, or when a large number of citizen complaints of mosquito annoyance are received from an area. In the case of citizen complaints, MMCD staff evaluate mosquito levels to determine if treatment is warranted. MMCD also 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.

The District mixes permethrin with soybean and food grade mineral oil and applies it to wooded areas with a power backpack mister at a rate of 25 ounces of mixed material per acre (0.1 lb active ingredient per acre)

RESEMETHRIN

(Aventis-Scourge® 4+12)

Resmethrin is used by the District to treat adult mosquitoes in known areas of concentration or nuisance. Resmethrin is applied from truck or an all-terrain-vehicle mounted ULV machines that produce a fog that contacts mosquitoes when they are flying. Fogging may also be done with hand held cold fog machines that enables the applications in smaller areas than can be reached by truck. Cold fogging is done either in the early morning or at dusk when mosquitoes become more active. Resmethrin is applied at a rate of 1.5 ounces of mixed material per acre. Resmethrin is a restricted used compound and is applied only by Minnesota Department of Agriculture licensed applicators.

APPENDIX E CONTROL MATERIAL LABELS

Altosid® XR
EXTENDED RESIDUAL BRIQUETS

A sustained release product to prevent adult mosquito emergence

SPECIMEN LABEL

ACTIVE INGREDIENT:

(S)-Methoprene [Isopropyl (2E,4E,7S)-11-methoxy-3,7,11-trimethyl-2,4- dodecadienoate] (Dry Weight Basis)	2.1%
OTHER INGREDIENTS:	97.9%
Total:	100.0

This product contains water; therefore the weight of the briquet and percent by weight of active ingredient will vary with hydration. The ingredient statement is expressed on a dry weight basis.

EPA Reg No. 2724-421
EPA Est. No. 39578-TX-1

KEEP OUT OF REACH OF CHILDREN

CAUTION

INTRODUCTION

ALTOSID® XR BRIQUETS are designed to release effective levels of methoprene insect growth regulator over a period up to 150 days in mosquito breeding sites. Release of methoprene insect growth regulator occurs by dissolution of the briquet. Soft mud and loose sediment can cover the briquets and inhibit normal dispersion of the active ingredient. The product may not be effective in those situations where the briquet can be removed from the site by flushing action.

ALTOSID XR BRIQUETS prevent the emergence of adult mosquitoes including: *Anopheles, Culex, Culiseta, Coquillettidia*, and *Mansonia* spp., as well as those of the floodwater mosquito complex (*Aedes* and *Psorophora* spp.) from treated water. Treated larvae continue to develop normally to the pupal stage where they die.

NOTE: Methoprene insect growth regulator has no effect on mosquitoes which have reached the pupal or adult stage prior to treatment.

PRECAUTIONARY STATEMENTS
HAZARDS TO HUMANS
AND DOMESTIC ANIMALS
CAUTION
ENVIRONMENTAL HAZARDS

This product is toxic to aquatic dipteran. Using it in a manner other than that described by the

label could result in harm to aquatic dipteran. Do not contaminate water when disposing of rinsate or equipment washwaters.

DIRECTIONS FOR USE

It is a violation of Federal Law to use this product in a manner inconsistent with its labeling.

APPLICATION TIME

Placement of **ALTOSID XR BRIQUETS** should be at or before the beginning of the mosquito season. **ALTOSID XR BRIQUETS** can be applied prior to flooding when sites are dry, or on snow and ice in breeding sites prior to spring thaw. Under normal conditions, one application should last the entire mosquito season, or up to 150 days, whichever is shorter. Alternate wetting and drying will not reduce their effectiveness.

APPLICATION RATES

Aedes and *Psorophora* spp.: For control in non-(or low-) flow shallow depressions ($\leq$2 feet in depth), treat on the basis of surface area, placing 1 briquet per 200 ft^2. Briquets should be placed in the lowest areas of mosquito breeding sites to maintain continuous control as the site alternately floods and dries up.

Culex, Culiseta, and *Anopheles* spp.: Place one ALTOSID XR BRIQUET per 100 ft^2.

Coquillettidia and *Mansonia* spp.: For application to cattail marshes and water hyacintbeds. For control of these mosquitoes, place one briquet per 100 ft^2.

APPLICATION SITES

ALTOSID XR BRIQUETS are designed to control mosquitoes in treated areas. Examples of application sites are: storm drains, catch basins, roadside ditches, fish ponds, ornamental ponds and fountains, other artificial water-holding containers, cesspools and septic tanks, waste treatment and settling ponds, flooded crypts, transformer vaults, abandoned swimming pools, tires, construction and other manmade depressions, cattail marshes, water hyacinth beds, vegetation-choked phospate pits, pastures, meadows, rice fields, freshwater swamps and marshes, salt and tidal marshes, treeholes, woodland pools, floodplains, and dredging spoil sites. For application sites connected by a water system, i.e., storm drains or catch basins, all of the water-holding sites in the system should be treated to maximize the efficiency of the treatment program.

STORAGE AND DISPOSAL

STORAGE

Store in a cool place. Do not contaminate water, food, or feed by storage or disposal. Do not reuse empty container.

DISPOSAL

Dispose of empty bag in a sanitary landfill or by incineration, or if allowed by state and local authorities, by burning. If burned, stay out of smoke.

WARRANTY AND CONDITIONS OF SALE

Seller makes no warranty, express or implied, concerning the use and handling of this product other than indicated on the label. Buyer assumes all risks of use and handling of this material when such use and handling are contrary to label instructions.

Always read the label before using the product.

For information call 1-800-248-7763 or visit our Web site at: www.altosid.com.

ZOËCON Wellmark

Wellmark International
Bensenville, Illinois U.S.A

April 1998

98-24-053

Altosid® Pellets
MOSQUITO GROWTH REGULATOR

A GRANULAR PRODUCT TO PREVENT ADULT MOSQUITO EMERGENCE

SPECIMEN LABEL

ACTIVE INGREDIENT:

(S)-Methoprene (CAS #65733-16-6)	4.25%
OTHER INGREDIENTS:	95.75%
Total:	100.0%

EPA Reg No. 2724-448
EPA EST. NO. 39578-TX-1

KEEP OUT OF REACH OF CHILDREN

CAUTION

PRECAUTIONARY STATEMENTS
HAZARDS TO HUMANS
AND DOMESTIC ANIMALS
CAUTION
ENVIRONMENTAL HAZARDS

This product is toxic to aquatic dipteran (mosquitoes) and chronomid (midge) larvae. Using it in a manner other than that described by the label could result in harm to aquatic dipteran. Do not contaminate water when disposing of rinsate or equipment washwaters.

DIRECTIONS FOR USE

It is a violation of Federal Law to use this product in a manner inconsistent with its labeling.

INTRODUCTION

ALTOSID® Pellets release ALTOSID® Insect Growth Regulator as they erode. The pellets prevent the emergence of adult standing water mosquitoes, including *Anopheles, Culex, Culiseta, Coquillettidia*, and *Mansonia* spp., as well as adults of the floodwater mosquitoes, such as *Aedes* and *Psorophora* spp. from treated sites.

GENERAL DIRECTIONS

ALTOSID Pellets release effective levels of ALTOSID Insect Growth Regulator for up to 30 days under typical environmental conditions. Treatment should be continued through the last brood of the season. Treated larvae continue to develop normally to the pupal stage where they die. **NOTE:** This insect growth regulator has no effect on mosquitoes which have reached the pupal or adult stage prior to treatment.

APPLICATION SITES AND RATES

MOSQUITO HABITAT	RATES (Lb/Acre)
Floodwater sites Pastures, meadows, ricefields, freshwater swamps and marshes, salt and tidal marshes, cattail marshes, woodland pools, flood-plains, tires, other artificial water-holding containers	2.5-5.0
Dredging spoil sites, waste treatment and settling ponds, ditches and other manmade depressions	5.0-10.0
Permanent water sites Ornamental ponds and fountains, fish ponds, cattail marshes, water hyacinth beds, flooded crypts, transformer vaults, abandoned swimming pools, construction and other manmade depressions, treeholes, other artificial water-holding containers	2.5-5.0
Storm drains, catch basins, roadside ditches, cesspools, septic tanks, waste settling ponds, vegetation-choked phosphate pits	5.0-10.0

Use lower rates when water is shallow, vegetation and/or pollution are minimal, and mosquito populations are low. Use higher rates when water is deep (>2 ft), vegetation and/or pollution are high, and mosquito populations are high.

APPLICATION METHODS

Apply ALTOSID Pellets up to 15 days prior to flooding, or at any stage of larval development after flooding, or in permanent water sites. Fixed wing aircraft or helicopters equipped with granular spreaders capable of applying rates from 2.5 to 10.0 lb/acre may be used to apply ALTOSID Pellets. The pellets may also be applied using ground equipment which will achieve good, even coverage at the above rates. ALTOSID Pellets may be applied to artificial containers such as tires and catch basins, etc.

STORAGE AND DISPOSAL

Do not contaminate water, food, or feed by storage or disposal.

STORAGE

Store closed containers of ALTOSID Pellets in a cool, dry place.

PESTICIDE DISPOSAL

Wastes resulting from the use of this product may be disposed of on site or at an approved waste disposal facility.

CONTAINER DISPOSAL

Triple rinse (or equivalent). Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or if allowed by state and local authorities, by burning. If burned, stay out of smoke.

WARRANTY AND CONDITIONS OF SALE

Seller makes no warranty, express or implied, concerning the use and handling of this product other than indicated on the label. Buyer assumes all risks of use and handling of this material when such use and handling are contrary to label instructions.

Always read the label before using this product.

For information call 1-800-248-7763 or visit our Web site at: www.altosid.com.

ZOECON Wellmark

Wellmark International
Bensenville, Illinois U.S.A

Zoëcon Professional Products is a Wellmark International Brand.
ALTOSID® Briquets, ALTOSID® Insect Growth Regulator, and Zoëcon® are registered trademarks of Wellmark International.

November 1999

20-24-001

Altosid® Liquid Larvicide Concentrate

PREVENTS EMERGENCE OF ADULT FLOODWATER MOSQUITOES

SPECIMEN LABEL

ACTIVE INGREDIENT:

(S)-Methoprene [Isopropyl (2E,4E,7S)- 11-methoxy-3,7,11-trimethyl-2,4-dodecadienoate]	20.0%
OTHER INGREDIENTS:	80.0%
Total:	100.0

Formulation contains 1.72 lb/gal (205.2 g/l) active ingredient.

EPA Reg No. 2724-446
EPA Est. No. 39578-TX-1

KEEP OUT OF REACH OF CHILDREN

CAUTION

SEE ADDITIONAL PRECAUTIONARY STATEMENTS

Because of the unique mode of action of A.L.L.™, successful use requires familiarity with special techniques recommended for application timing and treatment evaluation. **See Guide to Product Application** or consult local Mosquito Abatement Agency.

PRECAUTIONARY STATEMENTS

HAZARDS TO HUMANS

CAUTION

Causes moderate eye irritation. Avoid contact with eyes or clothing. Wash thoroughly with soap and water after handling. Prolonged or frequently repeated skin contact may cause allergic reactions in some individuals.

ENVIRONMENTAL HAZARDS

This product is toxic to aquatic dipteran. Using it in a manner other than that described by the label could result in harm to aquatic dipteran. Do not contaminate water when disposing of rinsate or equipment washwaters.

DIRECTIONS FOR USE

It is a violation of Federal Law to use this product in a manner inconsistent with its labeling.

CHEMIGATION

Refer to supplemental labeling entitled **"Guide to Product Application"** for use directions for chemigation. Do not apply this product through any irrigation system unless the supplemental labeling on chemigation is followed.

MIXING AND HANDLING INSTRUCTIONS

1. **SHAKE WELL BEFORE USING.** A.L.L. may separate on standing and must be thoroughly agitated prior to dilution.
2. Do not mix with oil; use clean equipment.
3. Partially fill spray tank with water; then add the recommended amount of A.L.L., agitate and complete filling. Mild agitation during application is desirable.
4. Spray solution should be used within 48 hours; always agitate before spraying.

RECOMMENDED APPLICATIONS

INTRODUCTION

A.L.L. must be applied to 2nd, 3rd, or 4th larval instars of floodwater mosquitoes to prevent adult emergence. Treated larvae continue normal development to the pupal stage where they die. This insect growth regulator **has no effect when applied to pupae or adult mosquitoes.** A.L.L. has sufficient field life to be effective at recommended rates when applied to larval stages under varying field conditions. For further information, see **Guide to Product Application**.

METHOD OF APPLICATION

AERIAL

Use the recommended amount of A.L.L. listed below in sufficient water to give complete coverage. One-half to 5 gallons of spray solution per acre is usually satisfactory. Do not apply when weather conditions favor drift from areas treated.

GROUND

Determine the average spray volume used per acre by individual operators and/or specific equipment. Mix A.L.L. in the appropriate volume of water to give the rate per acre recommended below.

APPLICATION RATE

Apply 3/4 to 1 fl oz of A.L.L. per acre (55 to 73 ml/hectare) in water as directed.

APPLICATION SITES

PASTURES

A.L.L. may be applied after each flooding without removal of grazing livestock.

RICE

A.L.L. must be applied to 2nd, 3rd, and/or 4th instar larvae of mosquitoes found in rice, usually within 4 days after flooding. A.L.L. treatment may be repeated with each flooding.

INTERMITTENTLY FLOODED NONCROP AREAS

A.L.L. may be applied as directed above when flooding may result in floodwater mosquito hatch.

Typical sites include: freshwater swamps and marshes, salt marshes, woodland pools and meadows, dredging spoil sites, drainage areas, waste treatment and settling ponds, ditches and other natural and manmade depressions.

CROP AREAS

A.L.L may be applied to irrigated croplands after flooding to control mosquito emergence. Examples of such sites are: vineyards, rice fields (including wild rice), date palm orchards, fruit and nut orchards, and berry fields and bogs. Irrigated pastures may be treated after each flooding **without** the removal of livestock.

DENSE VEGETATION OR CANOPY AREAS

Apply an A.L.L. sand mixture using standard granular dispersal equipment. For detailed preparation instructions, refer to **Guide to Product Application**.

STORAGE AND DISPOSAL

Do not contaminate water, food, or feed by storage or disposal.

STORAGE

Store in cool place away from other pesticides, food, and feed. In case of leakage or spill, soak up with sand or another absorbent material.

PESTICIDE DISPOSAL

Wastes resulting from the use of this product may be disposed of on site or at an approved waste disposal facility.

CONTAINER DISPOSAL

Triple rinse or equivalent. Then offer for recycling or reconditioning or puncture and dispose of in a sanitary landfill, or incineration, or if allowed by state and local authorities, by burning. If burned, stay out of smoke.

Always read the label before using this product.

For information call 1-800-248-7763 or visit our Web site at: www.altosid.com.

ZOËCON Wellmark

Wellmark International
Bensenville, Illinois U.S.A

January 1998
98-14-014

ABBOTT LABORATORIES

VectoBac® G

Biological Larvicide Granules

ACTIVE INGREDIENT:

Bacillus thuringiensis, subsp. *israelensis*, 200 International Toxic Units (ITU) per mg (Equivalent to 0.091 billion ITU per pound)	0.2%
INERT INGREDIENTS	99.8%
TOTAL	100.0%

EPA Reg. No. 275-50
EPA Est. No. 33762-IA-1 List No. 5108

INDEX:

KEEP OUT OF REACH OF CHILDREN
CAUTION

1.0 STATEMENT OF PRACTICAL TREATMENT

If in Eyes: Flush eyes with plenty of water. Get medical attention if irritation persists.

2.0 DIRECTIONS FOR USE

It is a violation of Federal Law to use this product in a manner inconsistent with its labeling. Do not apply directly to treated, finished drinking water reservoirs or drinking water receptacles.

3.0 STORAGE AND DISPOSAL

Do not contaminate potable water, food or feed by storage or disposal.

Storage: Store in a cool, dry place.

Pesticide Disposal: Wastes resulting from the use of this product may be disposed of on site or at an approved waste disposal facility.

Container Disposal: Completely empty bag into application equipment. Then dispose of empty bag in a sanitary landfill or by incineration, or, if allowed by State and local authorities, by burning. If burned, stay out of smoke.

4.0 APPLICATION DIRECTIONS

VectoBac G is an insecticide for use against mosquito larvae.

Mosquito Habitat (Such as the following examples):	Suggested Rate Range*
Irrigation ditches, roadside ditches, flood water, standing ponds, woodland pools, snow melt pools, pastures, catch basins, storm water retention areas, tidal water, salt marshes and rice fields	2.5 - 10 lbs / acre

In addition, standing water containing mosquito larvae, in fields growing alfalfa, almonds, asparagus, corn, cotton, dates, grapes, peaches and walnuts may be treated at the recommended rates.

* Use 10-20 lbs / acre when late 3rd and early 4th instar larvae predominate, mosquito populations are high, water is heavily polluted (sewage lagoons, animal waste lagoons), and/or algae are abundant.

Apply uniformly by aerial or ground conventional equipment.

A 7 to 14 day interval between applications should be employed.

5.0 NOTICE TO USER

SELLER MAKES NO WARRANTY, EXPRESS OR IMPLIED, OF MERCHANTABILITY, FITNESS OR OTHERWISE CONCERNING USE OF THIS PRODUCT OTHER THAN AS INDICATED ON THE LABEL. USER ASSUMES ALL RISKS OF USE, STORAGE OR HANDLING NOT IN STRICT ACCORDANCE WITH ACCOMPANYING DIRECTIONS.

Abbott Laboratories - Quality Health Care World Wide
Agricultural Products, North Chicago, IL 60064 (800) 323-9597 04-2028/R1 9/97

AQUABAC™ xt

Biological Larvicide Aqueous Suspension

SPECIMEN

AQUABAC™ xt is a microbial insecticide effective against mosquitoes and blackflies in a variety of habitats.

ACTIVE INGREDIENT: *Bacillus thuringiensis var. israelensis,* 1200 International Units (ITU) per milligram*	1.2%
INERT INGREDIENTS	98.8%
TOTAL	100.0%

*Equivalent to 4.84 billion ITU/gallon (1.28 billion ITU/liter)

EPA Reg. No. 62637-1

KEEP OUT OF REACH OF CHILDREN
CAUTION!

STATEMENT OF PRACTICAL TREATMENT

IF ON SKIN: Wash with plenty of soap and water. Get medical attention.

See Additional Precautionary Statements on Next Page.

In case of an emergency endangering life or property involving this product, call collect day or night. Area Code 954-474-7590.

PRECAUTIONARY STATEMENTS

CAUTION

HAZARDS TO HUMANS AND DOMESTIC ANIMALS:

Harmful if inhaled or absorbed through the skin. Avoid contact with skin, eyes, or clothing. Avoid breathing spray mist. Wash thoroughly with soap and water after handling. Remove contaminated clothing and wash before reuse.

DIRECTIONS FOR USE

It is a violation of Federal law to apply this product in a manner inconsistent with its labeling.

STORAGE AND DISPOSAL

Do not contaminate water, food, or feed by storage or disposal.

Storage: Store in a cool, dry place.

Pesticide Dispoal: Wastes resulting from use of this product may be disposed of on site or at an approved waste disposal facility.

Container Disposal: Triple rinse (or equivalent), then puncture and dispose of in a sanitary landfill, or by incineration, or if allowed by state and local authorities, by burning. If burned, stay out of smoke. Do not reuse container.

AQUABAC$_{xt}$ may be applied to any water sites except treated, finished drinking water reservoirs or drinking water receptacles.

DISCLAIMER

The label instructions for the use of this product reflect the opinion of experts based on field use and tests. The directions are believed to be reliable and should be followed carefully. However, it is impossible to eliminate all risks inherently associated with use of this product. Crop injury, ineffectiveness or other unintended consequences may result because of such factors as weather conditions, presence of other materials, or the use or application of the product contrary to label instructions, all of which are beyond the control of Becker Microbial Products, Inc. All such risks shall be assumed by the user.

Becker Microbial Products, Inc. warrants only that the material contained herein conforms to the chemical description on the label and is reasonably fit for the use therein described when used in accordance with the directions for use, subject to the risks referred to above.

Any damages arising from a breach of this warranty shall be limited to direct damages and shall not include consequential commercial damages such as loss of profits or values or any other special or indirect damages. Becker Microbial Products, Inc. makes no other express or implied warranty, including any other express or implied warranty of FITNESS or of MERCHANTABILITY.

MOSQUITOES:

Habitat	Rate Required for Control
Flood water, roadside ditches, irrigation ditches, rice fields, pastures, woodland pools, snow melt pools	0.25-1.0 pts./A
Tidal water, salt marshes, catch basins, storm water retention areas	0.50-1.0 pts./A
Polluted water (sewage lagoons, etc.) water with moderate organic matter, and water with a high concentration of suspended solids	1.0-2.0 pts./A

SPECIFIC APPLICATION INSTRUCTIONS

AQUABAC$_{xt}$ may be applied in conventional aerial and ground application equipment with sufficient water to provide thorough coverage of the target area. The amount of water needed will be dependent on weather, type of spray equipment and mosquito habitat.

Ground applications should be made in 5-100 gallons per acre in conventional equipment. As low as one gallon per acre surface area can be used when the target area is open with a light vegetative cover. Aerial applications may be done diluted or undiluted. For undiluted applications, apply 0.20 to 2.0 pts./A of AQUABAC$_{xt}$ through fixed wing aircraft or helicopters equipped with conventional boom and nozzles or rotary mist atomizers. For diluted applications, fill the mix tank or aircraft hopper with the appropriate volume of water and agitate before adding AQUABAC$_{xt}$. Maintain agitation during loading and spraying.

BLACKFLIES:

SUGGESTED CONCENTRATION RANGE	0.5-75 ppm (0.5-75 mg/liter of stream water)

The concentration should be maintained in the stream for 15 minutes.

SPECIFIC APPLICATION INSTRUCTIONS

Apply with conventional ground and aerial application equipment or metered release systems from infested sites to achieve larvicidal concentrations. Insecticidal activity should occur within 24 hours. Reapply as needed AQUABAC$_{xt}$ may be applied undiluted through appropriate ULV application equipment.

Manufactured by: Becker Microbial Products, Inc., 9464 N.W. 11th St., Plantation, FL 33322

PERMETHRIN 57% OS

CLARKE

For Application Only By Public Health Officials and Trained Personnel of Mosquito Abatement Districts and Other Mosquito Control Programs. A SYNTHETIC PYRETHROID FOR EFFECTIVE CONTROL AND REPELLENCY OF ADULT MOSQUITOES. For Use As An Effective ULV and Barrier Spray for Control of Adult Mosquitoes, Gnats, Biting and Non-Biting Midges, Blackflies, Deer Flies and Other Biting Flies.

Precautionary Statements

HAZARDS TO HUMANS AND DOMESTIC ANIMALS

CAUTION

Harmful if swallowed or absorbed through skin. Avoid contact with skin, eyes or clothing. Wash thoroughly after handling.

STATEMENT OF PRACTICAL TREATMENT

If Swallowed, call a physician or Poison Control Center. Do not induce vomiting. This product contains aromatic petroleum solvent. Aspiration may be a hazard.

ENVIRONMENTAL HAZARDS

This product is highly toxic to fish and aquatic invertebrates. Do not apply directly to water, to areas where surface water is present or to intertidal areas below the mean high water mark. Do not apply when weather conditions favor drift from treated areas. Drift and runoff from treated area may be hazardous to aquatic organisms in neighboring areas. Do not allow spray treatment to drift on pastureland, cropland, poultry ranges or water supplies. Do not contaminate water when disposing of equipment washwaters.

PHYSICAL OR CHEMICAL HAZARDS

Do not use or store near heat or open flame.

DIRECTIONS FOR USE

It is a violation of Federal Law to use this product in a manner inconsistent with its' labeling.

CONDITIONS and RATES to USE for MOSQUITO CONTROL

FOR A BARRIER SPRAY

This product is effective for reducing mosquito annoyance and control of mosquitoes that may transmit diseases such as La Crosse encephalitis, dog heartworm, dengue fever and western encephalitis. Apply product with mist blower, power backpack or ULV machine. If ULV machine is used, adjust pressure to deliver particles from 35-200 microns. Do not allow spray treatment to drift on pasture land, crop land, poultry ranges or water supplies. Do not use on crops used for food, forage or pasture.

Normal use pattern of product requires a residual application on plant and other surfaces where mosquitoes may rest. Product commonly provides sustained control in wooded areas lasting up to 14 days in shaded areas. Secondary activity of product is through repellency. Apply product by ground application equipment such as mist blower, ULV equipment, power backpack or pressure sprayer. Not to be used within 100 feet (30 meters) of lakes and streams. To kill or repel mosquitoes, midges, deer flies and other biting flies, mix with enough oil mixture so as to easily apply 0.1 pounds of Permethrin per acre. The oil-mixture is obtained by mixing one part of soybean oil to two parts of mineral oil. Non-phytotoxic oils must be used. The following chart represents some possible dilutions based on a 2 MPH walking speed with a fifty (50) foot swath. If a different dilution ratio or walking speed is used, adjust flow rate accordingly so as to achieve 0.1 pounds of Permethrin per acre.

For A Two (2) Mile Per Hour Walking Speed And A 50 Foot Application Swath—The Following Are Typical Field Dilutions.

Permethrin 57%	Oil	Fl. oz. Finished Spray Per Acre	Fl. oz./Min.
1 Part	9.0 Parts	25.0	5.0
1 Part	5.8 Parts	17.5	3.5
1 Part	4.0 Parts	12.5	2.5

ACTIVE INGREDIENT:	
Permethrin (3-Phenoxyphenyl)methyl (±) cis, trans-3-(2,2-dichlorethenyl)-2,2-dimethyl-cyclopropanecarboxylate	57.00%
INERT INGREDIENTS	43.00%
	100.00%

Contains petroleum distillates.

Cis/trans isomers ratio: min. 35%(+)cis and max. 65%(+)trans.

Contains 5 lb./gal. Permethrin

CAUTION

KEEP OUT OF REACH OF CHILDREN

SAMPLE

MANUFACTURED BY

CLARKE MOSQUITO CONTROL PRODUCTS, INC.
159 N. GARDEN AVENUE
ROSELLE, ILLINOIS 60172

E.P.A. EST. No. 8329IL01
EPA Reg. No. 8329-44

NET CONTENTS_____

LOT NO. _____

NOTICE: Seller makes no warranty, expressed or implied concerning the use of this product other than indicated on the label. Buyer assumes all risk of use and/or handling of this material when use and/or handling is contrary to label instructions.

This is equivalent to 0.1 lb. of Permethrin/Acre. Apply the product with sufficient carrier to allow distribution over the area to be treated using particle sizes from 35-200 microns mmd. To obtain optimum results, cover the immediate surroundings of housing, buildings including plant surfaces where mosquitoes may rest. For large recreational areas such as football fields, stadiums, racetracks, and public parks, spray the insecticide-oil mixture at the above mentioned application rate on the interface of woods surrounding the main area where the event is to take place. Spray may also be applied in any vegetated area where mosquitoes may rest causing infestations in residential areas.

To kill Gypsy Moths and Tentcaterpillars infesting woodland and forest areas: Apply the insecticide-oil mixture (as described above) directly to insect nests and vegetation by backpack applicator using 62 Fl. Oz./acre at a walking speed of 2 MPH over a swath of 50 feet, applying 12.6 Fl. Oz./minute. This is equivalent to 0.25 lb. of Permethrin/acre. Apply thoroughly to all foliage and insect nests.

TRUCK MOUNTED -ULV- EQUIPMENT

PERMETHRIN 57% is recommended for application as an ultra low volume (U.L.V.) nonthermal aerosol (cold fog) to control adult mosquitoes in residential and recreational areas where these insects are a problem, such as but not limited to parks, campsites, woodlands, athletic fields, golf courses, residential areas and municipalities, gardens, playgrounds, recreational areas and overgrown waste areas. Do not apply this product within 100 feet (30 Meters) of lakes and streams. Do not allow spray treatment to drift on pastureland, cropland, poultry ranges, or water supplies. For best results treat when mosquitoes are most active and weather conditions are conducive to keeping the fog close to the ground, e.g. cool temperatures and wind speed not greater than 10 mph. Applications during the cool hours of the night or early morning is usually preferable. Repeat treatment as needed.

U.L.V. Nonthermal Aerosol (Cold Fog) Application: To control Mosquitoes, Midges and Blackflies, apply PERMETHRIN 57% using any standard U.L.V. ground applicator capable of producing a nonthermal aerosol spray with droplets ranging in size from 5 to 30 microns and a mass median diameter (MMD) of 10 to 20 microns. Apply the product undiluted at a flow rate of 0.54 to 3.25 fluid ounces per minute at an average vehicle speed of 10 mph. If a different vehicle speed is used, adjust rate accordingly. These rates are equivalent to 0.0035 to 0.021 pounds of Permethrin per acre. Vary flow rate according to vegetation density and mosquito population. Use higher flow rate in heavy vegetation or when populations are high. An accurate flow meter must be used to ensure the proper flow rate. PERMETHRIN 57% may also be applied by diluting with a suitable solvent such as a non-phytotoxic mineral oil. The following charts represent some suggested dilution and application rates for ground U.L.V. applications. If an alternate dilution rate is used, adjust flow rate accordingly.

FOR A 1:4 PERMETHRIN 57%/SOLVENT DILUTION RATIO
Mix one (1) part PERMETHRIN 57% with four (4) parts solvent and apply at the following rates.

Permethrin pounds/acre	Application Rates Fl. oz./Min. 5MPH	10MPH	15MPH	Fl. oz. finished spray per acre
0.007	2.70	5.40	8.1	0.90
0.0035	1.35	2.70	4.0	0.45
0.00175	.68	1.35	2.0	0.23

FOR A 1:9 PERMETHRIN 57%/SOLVENT DILUTION RATIO
Mix one (1) part PERMETHRIN 57% with nine (9) parts solvent and apply at the following rates.

Permethrin pounds/acre	Application Rates Fl. oz./Min. 5MPH	10MPH	Fl. oz. finished spray per acre
0.007	5.40	10.75	1.80
0.0035	2.70	5.40	0.90
0.00175	1.35	2.70	0.45

FOR A 1:14 PERMETHRIN 57%/SOLVENT DILUTION RATIO
Mix one (1) part PERMETHRIN 57% with fourteen (14) parts solvent and apply at the following rates.

Permethrin pounds/acre	Application Rates Fl. oz./Min. 5MPH	10MPH	15MPH	Fl. oz. finished spray per acre
0.007	8.0	16.0	32.0	2.70
0.0035	4.0	8.0	16.0	1.35
0.00175	2.0	4.0	8.0	0.68

For proper application, mount the fog applicator so that the nozzle is at least 4½ feet above ground level and directed out the back of the vehicle. Failure to follow the above directions may result in reduced effectiveness. Aerial applications should be done by suitable aerial U.L.V. equipment capable of producing droplets with an MMD of 50 microns or less with no more than 2.5% exceeding 100 microns. Flow rate and swath width should be set so as to achieve 0.2 to 0.8 fluid ounces of PERMETHRIN 57% per acre. PERMETHRIN 57% may also be diluted with a suitable diluent such as mineral oil and applied by aerial ULV equipment so long as 0.6 fluid ounces per acre of PERMETHRIN 57% is not exceeded. Both aerial and ground applications should be made when wind is less than 10 MPH.

IN FLORIDA: Do not apply by aircraft except in emergency situations and with the approval of the Florida Department of Agriculture and Consumer Services.

STORAGE & DISPOSAL

Do not contaminate water, food or feed by storage or disposal.

PESTICIDE STORAGE AND SPILL PROCEDURES: Do not store at temperatures below 40°F (4.5°C). If this material has been exposed to temperatures below 40°F (4.5°C), there may be precipitation. Check for crystallization. If evident, warm to 80°F (26.5°C) and thoroughly mix before using. DO NOT USE OPEN FLAME. Store upright at room temperature. Avoid exposure to extreme temperatures. In case of spill or leakage, soak up with an absorbent material such as sand, sawdust, earth, fuller's earth, etc. Dispose of with chemical waste.

PESTICIDE DISPOSAL: Wastes resulting from the use of this product may be disposed of on site or at an approved waste disposal facility.

CONTAINER DISPOSAL: Triple rinse (or equivalent) then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or by other approved state and local procedures.

CONTAINERS ONE GALLON AND SMALLER: Do not reuse container. Wrap containers in several layers of newspaper and discard in trash.

CONTAINERS LARGER THAN ONE GALLON: Metal Containers—Triple rinse or equivalent. Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or by other procedures approved by state and local authorities. Plastic Containers—Triple rinse or equivalent. Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or by incineration, or if allowed by state and local authorities, by burning. If burned, stay out of smoke. Then dispose of in a sanitary landfill or by other approved state and local procedures.

IN CASE OF EMERGENCY, CALL INFO TRAC 1-800-535-5053

FOR MORE INFORMATION CALL:
1-800-323-5727

12/97

AgrEvo

RESTRICTED USE CLASSIFICATION
Due to Acute Fish Toxicity
For retail sale to and use only by Certified Applicators or persons under their direct supervision and only for those uses covered by the Certified Applicators Certification.

SCOURGE®
INSECTICIDE

with SBP-1382*/PIPERONYL BUTOXIDE 4% + 12% MF
FORMULA II

- *A READY TO USE SYNTHETIC PYRETHROID FOR EFFECTIVE ADULT MOSQUITO (INCLUDING ORGANOPHOSPHATE RESISTANT SPECIES), MIDGE (BITING AND NON-BITING), AND BLACK FLY CONTROL*
- *TO BE APPLIED BY MOSQUITO ABATEMENT DISTRICTS, PUBLIC HEALTH OFFICIALS AND OTHER TRAINED PERSONNEL IN MOSQUITO CONTROL PROGRAMS.*
- *CONTAINS 0.3 lb/gal (36 g/L) OF SBP-1382 AND 0.9 lb/gal (108 g/L) OF PIPERONYL BUTOXIDE*
- *FOR AERIAL AND GROUND APPLICATION*

ACTIVE INGREDIENTS:

* Resmethrin	4.14%
**Piperonyl Butoxide Technical	12.42%
INERT INGREDIENTS†:	83.44%
	100.00%

Cis/trans isomers ratio: max. 30% (±) cis and min. 70% (±) trans. AgrEvo Environmental Health, Inc.'s SBP-1382 brand of resmethrin insecticide.
**Equivalent to 9.94% (butylcarbityl) (6-propyl piperonyl) ether and 2.48% related compounds.
†Contains Petroleum Distillates.
*Scourge and SBP-1382 are registered trademarks of AgrEvo Environmental Health, Inc.

PRECAUCION AL USUARIO: Si usted no lee ingles, no use este producto hasta que la etiqueta le haya sido explicada ampliamente.
(TO THE USER: If you cannot read English, do not use this product until the label has been fully explained to you.)

EPA REG. NO. 432-716 **EPA EST. NO.**

KEEP OUT OF REACH OF CHILDREN
CAUTION
STATEMENT OF PRACTICAL TREATMENT

IF SWALLOWED: Call a doctor or get medical attention. Do not induce vomiting. Do not give anything by mouth to an unconscious person. Avoid Alcohol. This product contains aromatic petroleum solvent. Aspiration may be a hazard.
IF ON SKIN: Wash with soap and plenty of water. Get medical attention.

See Side Panel For Additional Precautionary Statements

NET CONTENTS:

PRECAUTIONARY STATEMENTS
Hazards To Humans & Domestic Animals

CAUTION
Harmful if swallowed or absorbed through skin. Avoid contact with skin, eyes, or clothing. Wash thoroughly with soap and water after handling.

Environmental Hazards

This pesticide is highly toxic to fish. For terrestrial uses, do not apply directly to water, to areas where surface water is present or to intertidal areas below the mean high water mark. Drift and runoff from treated sites may be hazardous to fish in adjacent waters. Consult your State's Fish and Wildlife Agency before treating such waters. Do not contaminate water by cleaning of equipment or disposal of equipment wash waters.

DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

STORAGE AND DISPOSAL

Do not contaminate water, food or feed by storage or disposal.
Storage: Store product in original container in a locked storage area.
Pesticide Disposal: Wastes resulting from the use of this product may be disposed of on site or at an approved waste disposal facility.
Container Disposal: Triple rinse (or equivalent). Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or by other procedures approved by State and Local authorities.

READ ENTIRE LABEL FOR DIRECTIONS
For use only by certified applicators or under the supervision of such applicators, for the reduction in annoyance from adult mosquito infestations and as a part of a mosquito abatement program.

IN THE STATE OF CALIFORNIA: For use only by local districts or other public agencies which have entered into and operate under a cooperative agreement with the Department of Public Health pusuant to Section 2426 of the Health and Safety Code.

This product is to be used for control of adult mosquitoes (including organophosphate resistant species), midges (biting and non-biting) and blackflies by specially designed aircraft capable of applying ULTRA LOW VOLUME of finished spray formulation or by ground application with nonthermal or mechanical spray equipment that can deliver spray particles within the aerosol size range and at specified dosage levels.

NOTICE: This concentrate cannot be diluted in water. Mix well before using. Avoid storing excess formulation in spray equipment tank beyond the period needed for application.

ULTRA LOW VOLUME APPLICATIONS
For use in nonthermal ULV portable backpack equipment similar to the Hudson B.P., mix 70 fl oz (2068 ml) of this product with 1 gal (3.79 L) of refined soybean oil, light mineral oil of 54 second vis-

cosity or other suitable solvent or diluent. Adjust equipment to deliver fog particles of 18-50 microns mass median diameter. Apply at the rate of 4.25-8.50 fl oz of finished formulation per acre (311-621 ml/ha) as a 50 ft (15.2 m) swath while walking at a speed of 2 mph (3.2 kph). This is equivalent to 0.0035-0.0070 lb ai SBP-1382/A (3.92- 7.85 gm/ha) plus 0.0105- 0.0210 lb ai piperonyl butoxide tech./A (11.77-23.54 gm/ha). Where dense vegetation is present, the higher rate is recommended.

For truck mounted nonthermal ULV equipment similar to LECO HD or MICRO-GEN or WHISPERMIST-XL, adjust equipment to deliver fog particles of 8-20 microns mass median diameter. Consult the following chart for application rates.

Treatment lb ai/A of Scourge Wanted SBP-1382/PBO	Fl oz/A of Undiluted Spray to be Applied	Application Rate-Fl oz/Min	
		5 MPH	10 MPH
0.007/0.021	3.0(90 ml)	9.0(266.2ml)	18.0(532.3ml)
0.0035/0.0105	1.5(45 ml)	4.5(133.1 ml)	9.0(266.2 ml)
0.00175/0.00525	0.75(22.5 ml)	2.25(66.6 ml)	4.5(133.1 ml)
0.00117/0.00351	0.50(15 ml)	1.50(45 ml)	3.0(90 ml)

Where dense vegetation is present, the use of the higher rates and/or slower speed is recommended.

For best results, fog only when air currents are 2-8 mph (3.2-12.9 kph). It is preferable to fog during early morning and evening when there is less breeze and convection currents are minimal. Arrange to apply the fog in the direction with breeze to obtain maximum swath length and better distribution. Direct spray head of equipment in a manner to insure even distribution of the fog throughout the area to be treated. Avoid prolonged inhalation of fog.

Where practical, guide the direction of the equipment so that the discharge nozzle is generally maintained at a distance of more than 6 feet (1.83 m) from ornamental plants and 5-15 feet (1.5-4.5 m) or more from painted objects. Temperature fluctuations will require periodical adjustment of equipment to deliver the desired flow rate at the specified speed of travel. The flow rate must be maintained to insure the distribution of the proper dosage of finished formulation.

Spray parks, campsites, woodlands, athletic fields, golf courses, swamps, tidal marshes, residential areas and municipalities around the outside of apartment buildings, restaurants, stores and warehouses. Do not spray on cropland, feed or foodstuffs. Avoid direct application over lakes, ponds and streams.

DIRECTIONS FOR STABLE FLY, HORSE FLY, DEER FLY CONTROL:
Treat shrubbery and vegetation where the above flies may rest. Shrubbery and vegetation around stagnant pools, marshy areas, ponds and shore lines may be treated. Application of this product to any body of water is prohibited.

For control of adult flies in residential and recreational areas, apply this product undiluted at a rate of 178 fl oz/hr (5.26 L/hr) by use of a suitable ULV generator travelling at 5 mph (8 kph) or at a rate of 356 fl oz/hr (10.53 L/hr) while travelling at 10 mph (16 kph). When spraying, apply across wind direction approximately 300 ft (91.4 m) apart. Apply when winds range from 1-10 mph (1.6-16.0 kph). Repeat for effective control.

DIRECTIONS FOR AERIAL APPLICATIONS
FOR USE WITH FIXED-WING AND ROTARY AIRCRAFT

This product is used in specially designed aircraft capable of applying ultra low volume of undiluted spray formulation for control of adult mosquitoes (including organophosphate resistant species), midges (biting and non-biting) and blackflies.

Aerial application should be made preferably in the early morning or evening. Application should be made preferably when there is little or no wind.
It is not recommended to make application when wind speeds exceed 10 mph (16 kph). Repeat applications should be made as necessary. Apply preferably when temperatures exceed 50°F (10°C).

May be used as a mosquito adulticide in recreational and residential areas, and in municipalities, around the outside of apartment buildings, golf courses, athletic fields, parks, campsites, woodlands, swamps, tidal marshes, and overgrown waste areas.

Do not spray on cropland, feed or foodstuffs. Avoid direct application over lakes, ponds and streams.

APPLICATION INSTRUCTIONS FOR PRODUCT IN AIRCRAFT USAGE

lb ai/A Wanted SBP-1382/PBO	**Fl oz/A of Undiluted Spray to be Applied**
0.007/0.021	3.0 (90 ml)
0.0035/0.0105	1.5 (45 ml)
0.00175/0.00525	0.75 (22.5 ml)
0.00117/0.00351	0.50 (15 ml)

NOTICE: Buyer assumes all responsibility for safety and use not in accordance with directions.

AgrEvo Environmental Health
95 Chestnut Ridge Road
Montvale, NJ 07645

APPENDIX F ACRES TREATED WITH CONTROL MATERIALS USED BY MMCD FOR MOSQUITO AND BLACK FLY CONTROL FOR 1991-1999

Control Material	1991	1992	1993	1994	1995	1996	1997	1998	1999
Altosid® XR Briquet 150-day	10,862	10,376	10,537	8,557	7,303	422	501	371	533
Altosid® XR Briquet 90-day	0	0	0	0	0	0	0	961	0
Altosid® Sand-Products	0	625	630	678	871	712	1,096	1,868	3,968
Altosid® Pellets 30-day	75	5,689	5,562	5,374	8,212	10,654	8,851	10,432	13,775
Altosid® SR-20 liquid	1	3,279	15	13	668	565	1,645	529*	355
Bti Corn Cob granules	134,011	101,877	126,778	102,860	131,589	68,355	106,755	113,539*	118,733
Bti Liquid Black Fly (gallons used)	3,574	4,418	5,090	4,047	3,606	3,025	5,445	4,233	4,343
Permethrin Adulticide	22,062	12,812	8,261	10,499	6,305	5,914	6,340	6,164	4,865
Resmethrin Adulticide	155,922	48,716	53,345	40,687	61,858	120,472	106,065	65,356	51,582

* These values are updated, therefore some values may differ from similar values in earlier publications. The actual geographic area treated is smaller because some sites are treated more than once.

APPENDIX G 1999 CONTROL MATERIALS: PERCENT ACTIVE INGREDIENT (AI), AI IDENTITY, PER ACRE DOSAGE, AI APPLIED PER ACRE AND FIELD LIFE

Material	AI	Percent AI	Per acre dosage	AI per acre	Field life
Altosid® briquets	Methoprene	2.10	220 briquets[a]	0.4481 lb	150 days
			330 briquets[a]	0.6722 lb	150 days
			440 briquets[a]	0.8963 lb	150 days
Altosid® pellets	Methoprene	4.25	2.5 lb	0.1063 lb	30 days
			4 lb	0.1700 lb	30 days
Altosid® SR-20	Methoprene	20.00	1 fl oz[b]	0.0134 lb	10 days
Altosid® XR-G	Methoprene	1.50	5 lb	0.0750 lb	20 days
Altosand	Methoprene	0.05	5 lb	0.0025 lb	10 days
Vectobac® G	*Bti*	0.20	5 lb	0.0100 lb	1 day
			8 lb	0.0160 lb	1 day
Permethrin 57%OS	Permethrin	5.70	25 fl oz [c]	0.0977 lb	5 days
Scourge	Resmethrin	4.14	1.5 fl oz [d]	0.0035 lb	<1 day

[a] 44 g per briquet total weight (220 briquets=21.34 lb total weight)
[b] 1.72 lb ai per 128 fl oz (1 gal)
[c] 0.50 lb ai per 128 fl oz (1 gal) (product diluted 1:10 before application, undiluted product contains 5.0 lb AI per 128 fl oz)
[d] 0.30 lb AI per 128 fl oz (1 gal)

Technical Advisory Board (TAB)
Meeting Notes
Monday, November 29, 1999

TAB Members present:
Gary Montz, Minnesota Department of Natural Resources
Art Mason, Minnesota Department of Agriculture
Roger Moon, University of Minnesota
Susan Palchick, Hennepin County Community Health
David Neitzel, Minnesota Department of Health
Robert Sherman, Independent Statistical Consultant
Larry Gillette, Hennepin County Parks
Greg Busacker, Minnesota Department of Transportation

Others present:

Joe Sanzone, Director, MMCD
Stephen Manweiler, Technical Services Coordinator, MMCD
Mike McLean, MMCD
Nancy Read, MMCD
Janet Jarnefeld, MMCD
Diann Crane, MMCD
John Walz, MMCD
Sandy Brogren, MMCD
Mark Smith, MMCD

The meeting was called to order at 12:35 PM by Robert Sherman.

This meeting was a continuation of an April 9, 1999 TAB meeting during which changes in the structure of the Technical Advisory Board (TAB) were proposed.

Discussion of changes to the TAB were initiated by comments of the Legislative Auditor that some TAB members seemed to have no idea how members were chosen. Ensuing discussions have tried to give TAB members a sense of history and purpose.

1) A proposal to change the voting status of members who did not represent the core agencies cited in the MMCD enabling legislation (subdivision 2) was discussed. Members were clear that they did not want to exclude members from voting, even if they didn't belong to the core group of members. Core agencies are Dept. of Agriculture, Dept. of Natural Resources, Dept. of Health, University of Minnesota and Dept. of Transportation. Members added to the TAB since its inception represent: MN PCA, US EPA, USF&WS, Hennepin County Parks, Hennepin County Community Health, and former members of these or similar agencies who continue to be interested in mosquito control issues.

2) A proposal to drop representation of a) environmental interests, and b) industry were discussed. Members indicated that they did not want to eliminate representation of so-called environmental interests, but recognized the difficulty of finding a member that truly represented such a diverse group. A suggestion was made to invite the environmental groups themselves to propose a member. TAB members also recognized the importance of representation by agencies with direct regulatory relationship with MMCD (i.e., MN PCA, US EPA). TAB members also reaffirmed that TAB membership beyond the scope of the enabling legislation, is at the discretion of MMCD

3) A proposal to continue the mission, responsibilities and name of the TAB was approved.

4) A discussion of the scope of TAB authority resulted in continued recognition that the TAB is an advisory body that has no direct control over MMCD operations.

5) Designation of the TAB Chair will be done on a rotating basis among the statutory members of the TAB. Looking back on the order in which statutory members served, it was determined that the DNR representative should be the next to serve as Chair. Gary Montz, of the DNR, however, asked that his slot as Chair be skipped this year due to his membership on a DNR/MMCD task force studying issues of mosquito control on DNR property.
Greg Busacker, MN Department of Transportation, agreed to be the next TAB Chair.

6) TAB Chair will still report to the MMCC once per year to answer commissioners' questions about TAB recommendations and processes. The report would include any and all TAB recommendations (usually in the form of motions) to MMCD. There was sentiment expressed that the Chair could not indicate that TAB had approved the operational review and next year's goals report unless there was a formal spring meeting during which that report would be discussed and approved. Otherwise the TAB Chair could only report whether or not the TAB had reviewed the report.

7) TAB meetings will continue to be held in the fall with a possible spring meeting if warranted. TAB members expressed the need to meet in the fall to get a sense of the major issues faced by MMCD the preceding season (recognizing that only a preliminary report of District activities would be complete by the fall meeting). By meeting in the fall, TAB members said that they would be in a better position to give advise on plans for the following year. A spring meeting might be necessary if final discussion could not be handled through email or other less formal correspondence.

8) TAB subcommittees will be formed at the fall meeting as issues arise. Bob Sherman, past TAB chair, indicated that subcommittees, or task groups could recruit diverse expertise, as needed, to provide new perspectives to the TAB. The TAB decided not to create standing subcommittees. Subcommittees will also be formed if MMCD seeks additional input on technical matters not of interest to the entire TAB.

9) Motion made by Roger Moon and passed by the TAB to meet in the fall and form subcommittees as needed .

10) The "fall 1999" meeting of the TAB will be held in January, 2000. This year's fall meeting slot dealt solely with possible TAB changes.

11) The structure of the TAB report was discussed. TAB did not recommend any significant changes to the overall content or structure of the report. TAB members would like to see a more technical orientation to the document and questioned the need for non-technical information (i.e., public affairs recaps). TAB members also realized that the TAB report acts as a kind of annual report for the District (including public affairs recaps). Suggestions for improving the report included clearly labeling the main points in each section and a more comprehensive executive summary which would allow the reader to focus on portions of the report of interest to the reader. Roger Moon noted that the TAB did not want to spend lots of time acting as a kind of editorial board of the TAB report. Roger Moon also recommended that temporal data in the TAB be expressed in a minimum of 5-year increments.

The meeting was adjourned by consensus at 3:40 PM.

Technical Advisory Board Meeting
Meeting Notes
January 28, 2000; Noon-3:30 PM

TAB Members Present

Dick Anderson	US EPA	Greg Busacker, Chair	MDOT
Larry Gillette	Hennepin Parks	Steve Hennes	MPCA
Art Mason	MDA	Gary Montz	MDNR
Dave Neitzel	MDH	Terry Schreiner	USFWS
Bob Sherman	Independent Statistical Consultant	Susan Palchick	Henn. Co. Community Health

MMCD Staff Present Joe Sanzone; Stephen Manweiler; Sandy Brogren; Diann Crane; Cara Hansmann; Janet Jarnefeld; Michael McLean; Nancy Read; and Mark Smith

1. **The meeting was called to order at 12:30 P.M.** TAB members and MMCD staff introduced themselves. Two new TAB members (Terry Schreiner and Steve Hennes) were welcomed. Joe Sanzone told the TAB that there were no anticipated major shifts in MMCD's focus or efforts — service levels will be maintained as they were in 1999.

   Gary Montz inquired about the status of the environmental group representative and suggested MMCD contact the Minnesota Environmental Partnership by calling Char Brooker. Additional efforts should be made toward getting an industry representative too.

   Larry Gillette provided an update of a discussion he had with other park managers. He was surprised at how little they knew of MMCD. He offered to convey any information to them and suggested that they contact the MMCD field foreman in their area to discuss MMCD issues. District staff offered to make a presentation at their March meeting.

   TAB members gave staff feedback on the way the 1999 Operational Review/Overview document was formatted and distributed. They specifically requested some kind of highlights at the beginning of each chapter that denoted significant events of the year. TAB members requested any correspondence they receive over e-mail be in both WordPerfect and Microsoft Word formats.

2. **MMCD staff reviewed various aspects of District activities and plans for 2000.** A summary of that discussion follows.

   Vector-borne Disease Bob Sherman commented that the occurrence of waste tires is a "tiresome" problem. (No pun intended, I'm sure.) In addition to cleaning up newly discarded tires, the District finds and cleans up old tire dumps each year. For instance, *Aedes triseriatus* mosquitoes near the Chaska case site probably came from a 15-20 year old tire dump. Often one dumper goes from ravine to ravine from year to year to dump tires. Stephen noted that the number of tires collected was about 18,000, not 25,000 which was reported in the overview. Dave Neitzel was asked if he felt the number of waste tires to be retrieved had decreased or if MMCD staff had changed its tire retrieval operations. Stephen responded that he believed staff had observed a real tire decrease and

that tire retrieval operations had not changed. He said he will survey staff to verify their impressions regarding trends in waste tire numbers. Stephen also reported that surveillance of *Aedes triseriatus* indicated that there was no major change in their population from the year before.

Dave Neitzel described the case of eastern equine encephalitis (EEE) in a horse from Mower County. *Coquilletidia perturbans* and *Aedes vexans* were suspected vectors. He also described the status of a case of western equine encephalitis (WEE) in Marshall County, the only reported human case in the U.S. in the last five years. Surveillance within the District did not detect high populations of *Culex tarsalis* and efforts to find viral activity were also unsuccessful (no sentinel chickens seroconverted).

The discussion then turned to *Aedes albopictus*. Dave Neitzel suggested that the District not only monitor the tire recycling facility where *Ae. albopictus* was collected from, but also areas adjacent to the site to detect dispersal of this mosquito so MMCD could respond to contain and eradicate the infestation. The District collected tires in which eggs of *Ae. albopictus* may have been laid and those tires will be closely monitored to determine if this mosquito was able to overwinter in Minnesota.

Art Mason brought up the topic of West Nile virus. He warned that there have been crow deaths in Wisconsin and that the District should be prepared for West Nile. Dave Neitzel informed the TAB that the Department of Health will be testing for West Nile virus in their lab. He clarified that the birds were being tested for WNV at a laboratory (National Wildlife Health Center) in Madison Wisconsin and that no WNV-infected crows were found there. All of the dead birds tested from WNV were from New York and surrounding states. Also Carroll Henderson of the DNR will be monitoring for bird die-off and if anything shows up, mosquitoes will then be targeted.

Stephen Manweiler outlined the District's response procedure in the event of a LaCrosse encephalitis case for Terry Schreiner of the US Fish and Wildlife Service. Art Mason concluded the mosquito-borne disease discussion by reminding all of his experiences with the 1983 WEE outbreak. Much was learned from that case, the result of which was to establish statewide procedures and protocols for future WEE cases.

Janet Jarnefeld updated TAB members of the District's black-legged tick distribution and ehrlichiosis studies. She reported that deer are an important host for the black-legged tick even though they are not a reservoir for *B. burgdorferi* (Lyme disease pathogen). White-tailed deer may be a reservoir host for the HGE (human granulocytic ehrlichiosis) agent. Janet also outlined the cooperative Camp Ripley study and explained the need to identify factors that will be ultimately used to develop a risk model for Lyme disease.

Surveillance Gary Montz asked about populations of *Ae. trivittatus*. Staff responded that they were high in June corresponding with *Ae. vexans*. TAB members questioned the reason for the extreme peak in mosquitoes early in June. Was it due to areas not being treated or too many sites to treat? Staff will address this issue in the final report.

Gary Montz requested that graphs include the day and month because the currently-used month-

only designation makes relating different graphs difficult.

Larry Gillette asked about MMCD staff requesting to treat an area that had never been treated before in Carver Park. He was told that the threshold in that area was now two per dip. He lives only five miles away and the threshold there is five per dip. He questioned whether it was useful to treat in areas where there are already lots of mosquitoes.

Susan Palchick asked if the District could support the statement of spring *Aedes* control in the overview. If so, more detailed information supporting this statement should be included in the operational review.

Sandy mentioned that staff are considering discontinuing the use of New Jersey light traps. Processing time is considerable and there are issues with retrieving them. Staff will evaluate the process this winter. Also, MMCD obtained 106 new CO_2 traps and will do comparison studies to determine if there is a difference in collections between old and new traps.

Control Bob Sherman suggested that the active ingredient be identified (e.g., 5% permethrin) in the table that compares control material usage for 1998 and 1999. Ninety-day Altosid briquets were used only in 1998 and not in 1999 because they are not a regular product of Wellmark. We will continue to use 150-day briquets. There was a question about the increase in larvicide use. Essentially, more sites were treated because, as Stephen said, there were more broods of mosquitoes resulting in an increase in acres treated with larvicides. Also, some sites received multiple treatments. Staff will include a summary of how many sites were treated once or more than once in the final report.

Product and Equipment Tests Stephen Manweiler responded to a question about adverse effects of *Lagenidium* in other areas of the country. Fifteen years of field studies show no non-target effects, although high dosages in the laboratory have affected *Daphnia* and a few other crustaceans. Dick Anderson commented about looking to see if *Lagenidium* can recycle in Minnesota — can it withstand freezing? Joe Sanzone noted that although there is only 80-84% control with *Lagenidium*, the District applied the material at 40 oz/acre and the maximum dose is 128 oz/acre.

As stated in the overview, there have been reports of resistance to methoprene in California. Gary Montz requested copies of any of these reports the District has.

During the update of adulticide tests, Bob Sherman asked if the UV lights that were used as an attractant pulsed. He suggested that we may want to use LED lights instead of UV.

Mark Smith described the KLD droplet analyzer. Susan Palchick suggested staff test some ULV cold fog machines during the season to determine if they maintain their calibration and substantiate if the assumptions of hours of use before recalibration are accurate.

Long-term Study Presentation Nancy presented the recent results of the continuation study in the Wright County SPRP study sites. This round of sampling showed no significant impact on major taxonomic groups, although some shifts occurred in the Chironominae. Ann Hershey, one of the

initial investigators, reviewed these results and thought perhaps the length of time from drought recovery may have had an impact on the first round of sampling results. They will check the water levels to see if that variable affected their results. Also, in 1993 the dose of *Bti* may have been higher than it should have been.

Joe thanked TAB members for their support of this study. When the original investigation was completed the Commission questioned continuing the study. The support of the TAB helped in getting this phase of the study completed. The District does not plan to continue monitoring these sites.

Black Fly Surveillance and Control Gary Montz questioned the characterization of a large number of black fly annoyance complaints. Staff explained that indeed only a few citizens call in to our office to complain, but we also receive complaints that are relayed by county commissioners. Customer calls may not be a good way to gauge black fly annoyance. Gary Montz then described the non-target monitoring for Steve Hennes.

Public Affairs In response to Susan Palchick's question, customer calls are separate from the bite-line inquiries. Susan also noted that the increase in calls may have been due to increased media coverage. The high number of calls in June paralleled the high levels of mosquitoes citizens endured. Bob Sherman suggested evaluating the number of calls as it relates to population density. MMCD staff can evaluate by region or facility and will report this analysis in the final annual operations report.

Mike McLean showed the District's three public service announcements (PSAs) about LaCrosse encephalitis. Only channel 23 aired the PSAs, and only during Saturday morning children's programs. Mike said that the District will review why the PSAs were not more widely aired and try to devise methods to increase air time. Art Mason suggested the District examine how the Dept. of Agriculture uses billboards for its PSAs.

- **Status of spring TAB meeting**: After the draft Operational Review and Plans for 2000 report is reviewed by TAB members, circulate any comments you have with all TAB members. After that time, the need for a spring TAB meeting will be assessed. Art Mason noted that late January seemed to be a good time for the TAB meeting. Stephen invited all TAB members to contact him if they would like to see any aspect of MMCD activities.

- **Wrap up and Adjourn**: Larry Gillette brought up the topic of restricted access status. He recommended that the District send a first-class letter to ensure a response is given. Also, when staff leave door hangers it would be helpful if they did so consistently and to make sure more information (including the results of sampling or surveys conducted by MMCD staff) is put on the door hanger.

The following motion was then proposed: The TAB finds the procedures of District employees more than adequate and that the District does a laudable job in scientific procedures and appears to be moving the District forward in an acceptable manner.

Discussion: Gary Montz stated he would vote "no," not because of MMCD's scientific procedures, but because MMCD treated Fort Snelling in July 1999 against the wishes of the DNR and Gary believed that a "yes" vote could be construed as his endorsing the Ft. Snelling treatment.

The motion passed by a vote of 8-1 (Steve Hennes-abstained, Gary Montz-dissenting, Susan Palchick left early and was not present to vote).

The meeting was adjourned at 3:40 PM.

EDITORIAL STAFF

Diann M. Crane, M.S., Assistant Entomologist

ACKNOWLEDGMENTS

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