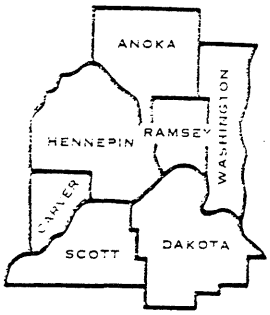
Metropolitan Mosquito Control District

1997 Operational Review and Plans for 1998

Metropolitan Mosquito Control District
MISSION STATEMENT

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.

Metropolitan Counties Government Center
2099 University Avenue West
St. Paul, MN 55104-3431



METROPOLITAN MOSQUITO CONTROL DISTRICT
METRO COUNTIES GOVERNMENT CENTER
2099 UNIVERSITY AVENUE WEST ■ ST. PAUL, MINNESOTA 55104-3431
612-645-9149 ■ FAX 612-645-3246 TDD use Minnesota Relay Service

JOSEPH F. SANZONE
Director

W.J. CAESAR
Business Admin.

Dear Reader:

The following report is the Metropolitan Mosquito Control District's (MMCD) 1997 Operational Review and Plans for 1998. 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 March 20, 1998 meeting are included in this report.

TAB's recommendations and report were accepted by the Commission at their April 22, 1998 meeting. In addition, the Commission approved the MMCD 1997 Operational Review and Plans for 1998.

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

Sincerely,

Joseph Sanzone

Joseph F. Sanzone
Director

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EXECUTIVE SUMMARY

The Metropolitan Mosquito Control District (MMCD), one of the largest mosquito control districts in the United States, is nationally recognized for its expertise and use of the latest mosquito control techniques. MMCD is a leader in testing and using new and environmentally safer products.

MMCD is committed to reducing the risk of vector-borne disease transmission, mitigating the annoyance caused by mosquitoes and black flies, and providing public satisfaction. The District has reorganized its staff into teams to achieve this mission more effectively. MMCD staff have been empowered with more decision making authority, and a free flow of information has been established throughout the organization.

There were three suspected or confirmed cases of LaCrosse (LAC) encephalitis within the District during 1997. These cases occurred in Plymouth, St. Bonifacius and Blaine. The District responded to each incident with appropriate larval and adult control measures, and established surveillance procedures. Other areas at moderate to high risk for LAC were also surveyed for *Aedes triseriatus*, the LAC vector mosquito. In addition, two cases of LAC occurred very close to the District (Hudson, WI and Delano). In response to these cases, MMCD provided support to the Minnesota Department of Health and the Wisconsin Department of Health.

Monitoring for western equine encephalitis using sentinel chicken flocks continued in 1997. Numbers of the vector mosquito (*Culex tarsalis*), however, were generally low and no virus activity was discovered.

The Asian tiger mosquito (*Aedes albopictus*) was discovered in Elko (Scott County) in 1996 and in Delano (Wright County) in 1997. This mosquito is an important vector of several diseases, and would be a likely vector of LAC in Minnesota. *Aedes albopictus* is suspected of being introduced to the U.S. in 1985. Since then, it has become established throughout the south, and as far north as Chicago, IL. It was discovered at a site within the District in 1991, and eradicated. These are the first infestations found since then, however, staff believe these infestations were eradicated as well. An intensive surveillance effort for this mosquito will be made in 1998.

In 1997 monitoring continued for the black-legged tick (*Ixodes scapularis).* This effort has been ongoing since 1990. *Ixodes scapularis* is the known vector of Lyme disease and ehrlichiosis in Minnesota. Results in 1997 show that concentrations of larval ticks on rodents were slightly higher than those in 1996, but in the low range compared to the last five years. Other findings show that tick distribution in the metro area has not changed since 1996. Tick concentrations are heaviest in Washington, Anoka, and northern Ramsey counties.

In 1996 MMCD experienced a budget reduction of 26 percent. This resulted in greatly reduced larval mosquito control that year. The District recovered a small portion of this budget loss in 1997 and increased its larval control operations with the additional funds. Adult control remained level with 1996 (a desirable outcome) despite increased rainfall and higher mosquito levels.

The District's black fly control program on small streams and large rivers continues to be highly effective. Increased rainfall in 1997, however, led to higher rates of water flow in our rivers and streams. As a result black fly levels were considerably higher than in the relatively dry year of 1996. In response to MMCD's agreement with the Minnesota Department of Natural Resources staff continued to collect and process nontarget monitoring samples in the Mississippi River. Results of this effort will reported in early 1999.

MMCD continued to increase its public information and education program. We increased our non-cost placements in the electronic and print media by 25 percent over 1996 levels. In part, this was due to becoming more efficient in delivering our releases using a broadcast fax system. In addition, MMCD provided its message to citizen groups, government agencies, and the public. The District continues to staff information booths at county and state fairs. This continues to be an effective method of getting MMCD's message to the public. Frequently, this message is made by one-to-one contact with fairgoers. During 1997 MMCD had contact with 36,644 people at seven county fairs and the State Fair. MMCD will increase its presence on the World Wide Web in 1998. Citizens can use internet access to get information about daily District activities and weekly bite risk maps through the District's web site.

A large part of MMCD's effort goes toward achieving customer satisfaction. In 1997 staff conducted a 100-phone call survey of the more than 2,000 service requests made to the District. The results showed that more than 90 percent were satisfied or very satisfied with the speed of response to their call and the service they received. To get a more comprehensive picture of public satisfaction, the District will conduct its biennial public opinion survey in 1998.

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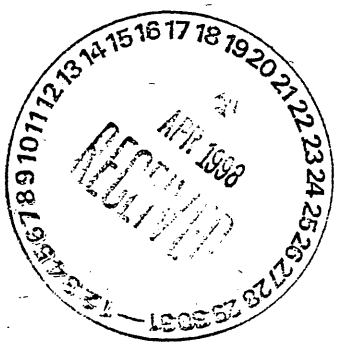
April 14, 1998



Commissioner Margaret Langfeld, Chair
Metropolitan Mosquito District
2099 University Avenue West
St Paul, MN 55104

Dear Commissioner Langfeld:

The Technical Advisory Committee (TAB) met on March 20, 1997 to review the proposed program for MMCD for 1998. A number of issues were discussed, and the exchange between staff and TAB was excellent. It was especially interesting because two past employees of MMCD were on the TAB for this meeting, although one was only a temporary substitute. They provided some interesting history and insights.

Two issues stand out. First, MMCD has conducted a successful public awareness campaign over the past two years. This has resulted in a significant increase in phone calls from the public, some of which are requests for additional service. TAB members inquired about how MMCD responds to increased citizen complaints about mosquitoes or requests for treatment in light of this increased publicity. Do these increased requests reflect an actual need for more mosquito control or are they simply a manifestation of greater awareness of MMCD on the part of the public? Although not included as a motion, TAB cautioned against increasing the use of adulticides as an automatic response to increased requests for control, especially when there is no demonstrated increase in mosquitoes.

Second, TAB continues to urge restraint on the part of MMCD in the use of adulticides for nuisance mosquito control. While it is a necessary part of the overall program, all possible efforts should be expended to keep it a minor part.

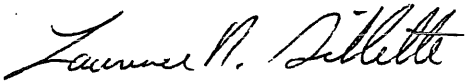
The minutes of the meeting are attached. Our recommendations for the 1998 season and for future meetings are:

Motion 1: The TAB commends the Metropolitan Mosquito Control District for its disease monitoring and control operations, and their cooperative work with the Minnesota Department of Natural Resources, University of Minnesota, Minnesota Department of Health and other organizations.

Motion 2: The TAB commends the MMCD for its continued efforts to locate new products and formulations to control larval and adult mosquitoes, and encourages the District to continue to do so.

Motion 3: The MMCD should develop a description of their adulticide program that includes comparisons of current policies with past practices.

Sincerely,



Laurence N. Gillette
Chair of the Technical Advisory Board

Metropolitan Mosquito Control District (MMCD)

Technical Advisory Board (TAB)
Meeting Notes - March 20, 1998

Members Present

Laurence Gillette, Chair	Hennepin Parks
Richard Anderson	United States Environmental Protection Agency
Dave Neitzel (for Craig Hedberg)	Minnesota Department of Health
Howard Krosch	Formerly of Minnesota Department of Natural Resources
Art Mason	Minnesota Department of Agriculture
Gary Montz	Minnesota Department of Natural Resources
Susan Palchick	Hennepin County Community Health
Robert Sherman	Independent Statistical Consultant
Vicki Sherry	United State Fish & Wildlife Service
Alan Singer	Minneapolis Parks (Environmental Group Representative)

Members absent

Dave Belluck	Minnesota Pollution Control Agency
Jim Cooper	University of Minnesota, Fisheries and Wildlife
Dave Noetzel	University of Minnesota, Entomology
Frederick J. Preiss	McLaughlin Gormly King Company
Robert Wryk	Minnesota Department of Transportation

MMCD Staff

Joseph Sanzone, Director	Stephen Manweiler, Technical Services Coordinator
Sandy Brogren, Technical Services	Nancy Read, Technical Services
Diann Crane, Technical Services	Mark Smith, Technical Services
Janet Jarnefeld, Technical Services	Jim Stark, Public Information
Jeff Luedeman, Vector Ecology	John Walz, Technical Services

Call to order
The meeting was called to order at 12:30 PM and TAB members and MMCD staff introduced themselves.

1998 Chair
Robert Sherman will chair the fall TAB meeting.

Discussion of 1997 Operational Review and plans for 1998
TAB members reviewed the draft 1997 Operational Review report and submitted corrections and editorial comments. Joe Sanzone presented the plans for 1998, which includes a 10.5% budget increase. The increased funds will be used for more seasonal inspectors and larval control in the second priority zone of the District. The District does not plan to increase adult mosquito control in 1998. There was lengthy discussion of the adulticiding issue.

Jim Stark discussed the public relations plans for 1998. The District has an internet web page with information about operations and job opportunities. There was discussion about how MMCD should respond to citizen complaints in light of the increased efforts for public awareness of MMCD.

Jeff Luedeman reported on the vector surveillance and control activities for 1998. *Aedes albopictus*,

the Asian tiger mosquito was found in Delano, just outside the District boundaries. MMCD will work with Minnesota Department of Health to formulate a surveillance plan for this species of mosquito in Delano.

Janet Jarnefeld gave an update on the Lyme tick surveillance.

Nancy Read presented the results of the Long-term Study. TAB members expressed concern about the control material applications and whether they represent normal District operations. The Long-term Study panel will review the report and send a final copy to the TAB.

Joe Sanzone updated the TAB on legislative activities and resulting plans for 1998. The District will notify the public of our activities by placing an ad in the newspaper in May and posting adult treatments made in public areas.

Robert Sherman offered the following motion:
MOTION 1: The TAB commends the Metropolitan Mosquito Control District for its disease monitoring and control operations, and their cooperative work with the Minnesota Department of Natural Resources, University of Minnesota, Minnesota Department of Health and other organizations.
The motion was approved.

Richard Anderson offered the following motion:
MOTION 2: The TAB commends the MMCD for its continuing efforts to locate new products and formulations to control larval and adult mosquitoes, and encourages the District to continue to do so.
The motion was approved.

Allan Singer offered the following motion:
MOTION 3: The MMCD should develop a description of their adulticiding program that includes comparisons of current policies with past policies.
The motion was approved.

Richard Anderson suggested an agenda item for the next TAB meeting should be a discussion of the possibility of an "SPRP" for adulticides. MMCD will provide information on what adulticides are used by other mosquito control agencies.

The meeting adjourned at 3:00 PM.

Metropolitan Mosquito Control District
1997 Operational Review and Plans for 1998

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- Technical Advisory Board Members
- Metropolitan Mosquito Control Commissioners
- MMCD Mission Statement and Staff in Attendance
- Administration

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Metropolitan Mosquito Control District
TECHNICAL ADVISORY BOARD
Fall 1997- Spring 1998

Laurence Gillette, Chair	**Hennepin Parks** 3800 County Road 24 Maple Plain, MN 55359
Richard Anderson	**United States Environmental Protection Agency** Environmental Research Laboratory 6201 Congdon Boulevard Duluth, MN 55804
Dave Belluck	**Minnesota Pollution Control Agency** 520 Lafayette Road St. Paul, MN 55155
Jim Cooper	**University of Minnesota, Fisheries and Wildlife** 200 Hodson Hall St. Paul, MN 55108
Craig Hedberg	**Minnesota Department of Health** 717 SE Delaware Street Minneapolis, MN 55440
Howard Krosch	**Formerly of Minnesota Department of Natural Resources** 1602 Olene Ct. N Stillwater, MN 55082
Art Mason	**Minnesota Department of Agriculture** 90 W. Plato Boulevard St. Paul, MN 55107
Dave Noetzel	**University of Minnesota, Entomology** 226 Hodson Hall St. Paul, MN 55108
Susan Palchick	**Hennepin County Community Health** 1011 First Street South Hopkins, MN 55343
Frederick J. Preiss	**McLaughlin Gormly King Company** 8810 Tenth Avenue North Minneapolis, MN 55427
Robert Sherman	**Independent Statistical Consultant** 2421 Sheridan Avenue So. Minneapolis, MN 55405

Vicki Sherry	**United State Fish & Wildlife Service** 3815 East 80th Street Bloomington, MN 55425
Alan Singer	**Minneapolis Parks** **(Environmental Group Representative)** 3800 Bryant Ave. South Minneapolis, MN 55409
Robert Wryk	**Minnesota Department of Transportation** Water's Edge 1500 West County Rd. B2 Roseville, MN 55113

Metropolitan Mosquito Control District
Board of County Commissioners

The Metropolitan Mosquito Control District, established in 1958, controls mosquitoes and gnats (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, composed of county Commissioners from the participating counties. A Director is responsible for the operation of the program and reports to the Commission.

Metropolitan Mosquito Control Commission-1998

Margaret Langfeld, Chair Dick Lang David McCauley	Anoka County
Ursula Dimler/ John Siegfried (alt)	Carver County
Don Maher James Mueller Willis Branning	Dakota County
Randy Johnson, Vice-Chair Mike Opat Penny Steele	Hennepin County
Tony Bennett Janice Rettman Victoria Reinhardt	Ramsey County
Dallas Bohnsack, Secretary Ralph Malz	Scott County
Mary Hauser Myra Peterson	Washington County

Metropolitan Mosquito Control District
STAFF IN ATTENDANCE

Joseph Sanzone, Director

Technical Services	Stephen Manweiler, Technical Services Coordinator
	Sandy Brogren
	Diann Crane
	Janet Jarnefeld
	Nancy Read
	Mark Smith
	John Walz
Public Information	James Stark, Public Affairs Coordinator
Control Services	Jeff Luedeman, Group Leader -Vector Ecology

Administration

1. Background

The administration of the Metropolitan Mosquito Control District enables operations staff to accomplish their tasks in an effective and efficient manner, while controlling and coordinating resource use. Staff seek to work with the public to identify and define citizen expectations. These service level expectations are communicated to the Commission. Staff design activities and systems to implement Commission policies and goals.

Administrative objectives include:

- Provide leadership and support in the District's operation, particularly focusing on optimizing resource use in meeting the District's mission and goals.
- Meet the operational need for increased numbers of qualified seasonal employees to perform the operations of the District through our recruitment efforts.
- Focus on information management to provide more consistent efficient sources of documentation.

2. 1997 Program

Progress in 1997

The District's resources were stretched in 1997 due to high demand for services amid financial restrictions. Morale remained high as staff responded to the needs of customers as well as the needs of employees in a period of changing processes.

3. 1998 Plans

Service levels will be similar to 1997. We will continue to focus on meeting customer needs. Centralizing procurement of major resources such as control materials will continue.

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Services and Activities

- Public Affairs
- Vector-borne Disease Management
- Mosquito Control Services
- Mosquito Surveillance
- Quality Assurance
- Black Fly Control Services
- Supporting Work

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1. Public Affairs

1.1. Background

The District is committed to openly communicate its activities to citizens, media and organizations who interact with the program. Communication with the public is designed to be clear, concise, and timely. MMCD staff conduct public information/education programs for elected officials, citizen groups, civic organizations, and school within the District. Media releases to newspapers, television and radio also provide information about program activities. In addition, literature is developed, updated and distributed to citizens throughout the District.

1.2. 1997 Program

Media Relations

Print and electronic media coverage of District activities was up 25 percent in 1997. Timely graphics, such as a weekly mosquito risk map, are now distributed with District press releases. Heavy rain in July and increased concerns about LaCrosse encephalitis also focused more media attention on MMCD's activities. MMCD uses up-to-date media contact lists and has begun using a broadcast fax system to distribute press releases.

MMCD Information Booths

MMCD staffs information booths at a variety of venues. On display are samples of mosquito and biting gnat larvae, black-legged ticks, a dog heart infected with heartworm, and control materials. Information on mosquito-borne disease, Lyme disease, heartworm disease, and printed information concerning District services is also available.

In 1997 MMCD staffed information booths at the following events: League of Minnesota Cities Convention, Association of Minnesota Counties Convention, Earth Day in the St. Paul Skyway, and several City Showcases.MMCD also staffs information booths at the state and seven metro county fairs. For state and county fair information see Table 1.1.

Table 1.1. Recorded visits at MMCD information fair booths.

Event	Date (1997)	Estimated Attendance
Anoka	July 29 - August 3	3,058
Carver	August 6 - 10	4,126
Dakota	August 4 - 12	3,020
Hennepin	July 24 - 27	1,100
Ramsey	July 16 - 20	1,604
Scott	July 25 - 27	2,361
Washington	July 29 - August 3	3,055
State Fair	August 21 - Sep. 1	18,320
TOTAL		36,644

Adopt-A-Site

In 1997 MMCD conducted a pilot project in Maple Grove called Adopt-A-Site. Volunteers were solicited to undertake larval control using *Bti* in wetlands on their property. Strict participation criteria were established and, of 40 residents who expressed interest, eight were chosen to participate. These eight citizens received four hours of training in mosquito biology and control including equipment and control material. The District informed DNR and consulted with the city of Maple Grove to develop this pilot project.

Although the sample group was too small to draw conclusions about treatment effectiveness, participants expressed enthusiasm to continue the project. Volunteers also provided suggestions about improvements including more effective training and follow-up contact. Specifically, volunteers requested that more training be held in the field including more practice sampling mosquitoes.

MMCD plans to expand this project into other areas of the District in 1998. New methods to recruit volunteers will be tested to overcome the shortage of volunteers experienced in 1997. Training will be modified to include more field supervision and post treatment checks. A more formal evaluation process will be employed to better document if this program is a feasible supplement to current MMCD mosquito control programs and, if yes, how it can be integrated most effectively.

Customer Response

District outreach efforts continue to increase program awareness and customer response. In 1997 the District received over 2,500 calls from citizens at the main switchboard in St. Paul. Most of the calls were requests for additional service. Citizens wanted more control of mosquitoes and biting gnats, and more services to reduce the risk of mosquito and tick-borne disease. For a list of calls received see Table 1.2.

Table 1.2. Number of telephone calls by category received by MMCD.

Type of Call	1991	1992	1993	1994	1995	1996	1997
Citizen Issues & Concerns	234	292	233	349	164	189	233
Mosquito Breeding Site Location	347	273	359	293	202	451	364
Mosquito/Biting Gnat Annoyance	112	161	173	137	164	388	865
Public Treatment Requests	161	137	171	147	145	186	192
General Information	194	210	387	111	84	360	514
Waste Tire Removal					155	243	398
Total	1048	1073	1323	1037	914	1817	2566

Customer Satisfaction Survey

MMCD personnel conducted a survey of customer satisfaction during August to measure how satisfied citizens were with MMCD's level of response. One hundred nine callers were chosen from more than 2,000 calls made to the District from June through August 1997. These callers were asked the following questions:

- How satisfied were you with how quickly the District responded to your concern?
- How satisfied were you with the service the District provided?
- How satisfied were you with the way District staff conducted themselves?
- How satisfied were you with information given by District staff? Did the information provided answer your questions, and was it easily understood?
- How did you first become aware of services provided by MMCD?

More than 98 percent of those surveyed were either satisfied or very satisfied with the speed of District response to their call. More than 96 percent of those surveyed were either satisfied or very satisfied with the service provided by the District. Those surveyed were unanimous in saying that they were either satisfied or very satisfied with the way District staff conducted themselves. More than 95 percent of those surveyed were either satisfied or very satisfied with information given to them by District staff. And finally, the most common way people became aware of District services was by word of mouth—from neighbors and relatives, followed in order by television, workers in the field, radio, referrals from other government agencies, and newspapers. Miscellaneous avenues included: phone book, helicopter sighting, knowing a current or former MMCD employee, pamphlet, fair booth, and District presentations.

Adult Mosquito Control Information Line - 643-8383.
To inform citizens about the time and location of mosquito adulticiding operations, MMCD offers an adulticiding information line. The information line enables citizens to hear a recorded message updated daily identifying where adulticide activities will occur. While this has significantly reduced the number of telephone calls to selected citizens alerting them to adult control, staff will continue to call those citizens who still desire advanced notice of adult mosquito control treatments. The number of calls received were tallied at the end of the season and are shown in Table 1.3.

Table 1.3 Number of calls to the Adult Control Information Line. Summary by Facility 1993-97

Facility	1994	1995	1996	1997	1997 % by county
Anoka	106	96	66	150	18
Carver	43	68	18	51	6
Dakota	51	92	32	63	7
North Hennepin	85	116	48	118	14
South Hennepin	186	230	130	228	27
Ramsey	95	119	53	111	13
Scott	44	96	22	57	7
Washington	30	74	33	69	8.2
Total	640	891	402	847	100

1.3. 1998 Plans

The District created a new LaCrosse encephalitis brochure, and is working closely with MDH and local health agencies in increasing awareness, and reducing the risk of this potentially serious disease. In 1997 MMCD created a Lyme tick identification card, and worked with MDH in the development of a Lyme disease brochure and slide presentation. In 1998 MMCD will use these information pieces throughout the District, with specific emphasis on Anoka, Washington and Ramsey counties.

MMCD will increase its presence on the World Wide Web during 1998. Citizens can use internet access to get information about daily activities through MMCD's web site. Information will include daily adulticide treatment location information, and weekly mosquito bite risk maps of the metro area. MMCD's web site address is: www.visi.com/~mmcdmosq . Links to MMCD's web site will be established with service providers such as Channel 4000, Pioneer Planet, and Vector Internet.

The District will conduct its biennial public opinion survey in 1998. This survey is a very useful tool in monitoring citizen need and expectation, and evaluating the effectiveness of our public information efforts.

2. Vector-borne Disease Management

2.1. Background

In 1997, District field staff provided a variety of disease surveillance and control services to help prevent LaCrosse encephalitis, western equine encephalitis, Lyme disease and ehrlichiosis. The District has changed to a team structure and eliminated specialized "focus" programs. This was the second year that field staff provided all surveillance and control services.

LaCrosse encephalitis prevention services were initiated in 1987 to identify areas where there is significant risk of LaCrosse encephalitis cases occurring within the District. Areas with high populations of the primary vector *Aedes triseriatus* (tree hole mosquito) and a history of LaCrosse encephalitis cases are defined as high risk areas. These high risk areas are targeted for intensive control efforts including public education, mosquito breeding site removal, and limited adult mosquito treatments. In addition, monitoring and control procedures are conducted at confirmed LaCrosse encephalitis case sites. An *Aedes albopictus* (Asian tiger mosquito) surveillance program has also been initiated to detect this potential LaCrosse encephalitis vector before it becomes established within the District.

In 1990, MMCD initiated Lyme disease tick surveillance to determine the range and abundance of the black-legged tick (*Ixodes scapularis*) and the Lyme disease spirochete (*Borrelia burgdorferi*) within the District. To date, MMCD has mapped the current distribution of black-legged ticks and have initiated cooperative spirochete and ehrlichiosis studies with the University of Minnesota. MMCD has also worked in cooperation with the Minnesota Department of Health (MDH) in response to a case of Rocky Mountain spotted fever (RMSF) in the metropolitan area. All data collected are summarized and given to the MDH for their risk analysis. This has been a surveillance and public education effort only, as no large-scale black-legged tick treatment options are available.

2.2. 1997 Program

Aedes triseriatus Surveillance

In 1997 intensive surveillance for adult *Ae. triseriatus* continued in the Lake Minnetonka region of Hennepin and Carver counties. Additional surveillance occurred in northern Dakota County and elsewhere as determined necessary. Most of the past LaCrosse encephalitis cases have occurred in these areas. Vacuum aspirator samples have been collected every year since 1987 to monitor populations of *Ae. triseriatus* within this region. These collections help to identify high risk neighborhoods in which to target control efforts. Adult *Ae. triseriatus* collected in overnight CO_2 traps were also used to direct sampling and control efforts.

The weekly average number of *Ae. triseriatus* collected per sampling location in 1997 remained low through July. In early August levels rose dramatically and remained steadily high until the last week of August. *Aedes triseriatus* levels were lower thereafter (Fig. 2.1). Over 950 vacuum aspirator samples were taken District-wide through September 13, 1997. The increased sampling effort was in response to reports of LaCrosse encephalitis cases and elevated numbers of *Ae. triseriatus*.

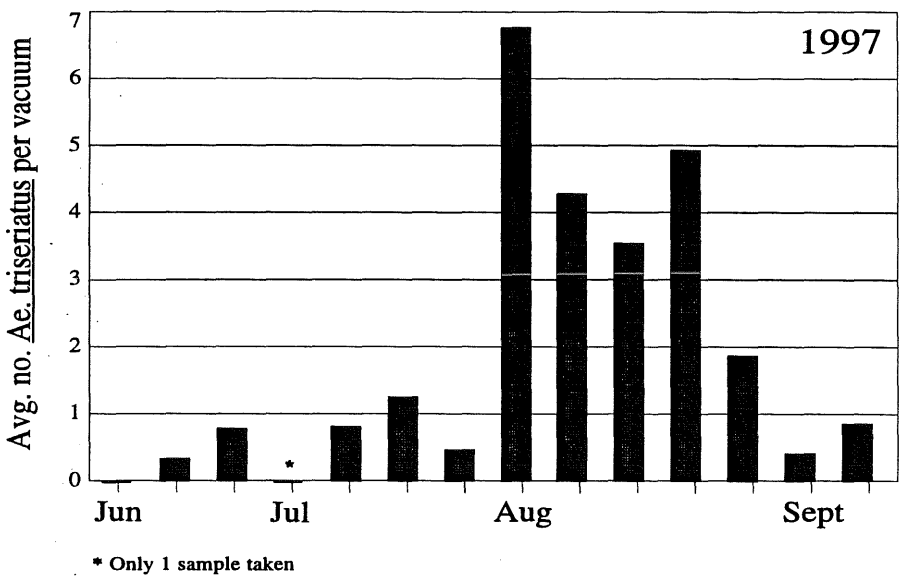

Figure 2.1 Weekly mean number of *Ae. triseriatus* captured in vacuum aspirator samples in 1997.

***Aedes triseriatus* Control.**

As in past years, staff continued to distribute the LaCrosse encephalitis prevention brochures to citizens living in identified risk areas. MMCD also supplied brochures to 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 1997, staff removed 36,280 waste tires from high risk areas of the District (283,821 tires picked up since 1988). Cooperative efforts to clean up tire dumps continued with several county environmental management departments, resulting in the elimination of many waste tire sites (especially Dakota and Carver counties).

Staff removed artificial containers and modified wet tree holes in several areas including the Lake Minnetonka area. Adult mosquito treatments were done in many high risk areas to lower the immediate disease risk until the mosquito breeding sites could be found and removed.

Three cases of LaCrosse encephalitis occurred within the District, one in Plymouth in July (probable), one in St. Bonifacius (confirmed) and one in Blaine (confirmed), both in August. District staff responded to each case with established surveillance and control efforts. MMCD sent *Ae. triseriatus* reared from eggs, larvae, and pupae collected near these case sites to MDH for viral testing. Waste tires, water-holding containers, and tree holes were found and eliminated during a large control effort after the cases were reported. All three areas will receive further surveillance and control in 1998.

Two cases occurred outside of but very close to District boundaries. A parent of a child who contracted LaCrosse encephalitis in Hudson, Wisconsin (just east of Washington County) contacted MMCD. The District provided technical assistance at the request of local (Hudson) and Wisconsin State Health officials. Another case occurred in Delano (just west of Hennepin County). MDH formally requested District assistance with the Delano case.

Aedes albopictus (Asian tiger mosquito) Surveillance

Aedes albopictus, the Asian tiger mosquito, is an aggressive human biter that can transmit viral diseases including LaCrosse encephalitis. It readily exploits breeding sites created by humans (e.g., tires, cans, bird baths, and other water-filled containers). *Aedes albopictus,* native to Korea and Japan, has quickly spread throughout many parts of the world including the United States. Its known northern range limit in the US is believed to be Chicago, IL.

Three vacuum aspirator samples taken near the case site in Delano yielded a total of five *Ae. albopictus*. *Aedes triseriatus* were also collected. Twenty one more *Ae. albopictus* emerged from larvae collected from tires about 0.25 miles from the case site. MMCD sent 24 *Ae. albopictus* to MDH for LaCrosse encephalitis virus testing. All were negative for LaCrosse encephalitis virus.

Unlike the previous two *Ae. albopictus* discoveries (1991 and 1996) in the District, no site such as a tire recycling facility where one would expect to find *Ae. albopictus* was located near the Delano case site. MMCD and MDH will review the situation this winter to decide how best to detect any successfully overwintering *Ae. albopictus*, delineate the extent of the infestation, and eradicate it.

Weekly monitoring of the Elko tire recycling facility in Scott County where *Ae. albopictus* larvae were collected in September 1996 has not detected a further infestation. District staff met with the business owner and Scott County officials early this year and also examined the site. The owner has taken steps to reduce or eliminate the risk of accidental *Ae. albopictus* introduction into the metropolitan area.

Western Equine Encephalitis (WEE) Surveillance

During 1997, the District continued WEE surveillance efforts by monitoring three sentinel chicken flocks. We placed the flocks in the western metropolitan area (Hennepin, Anoka, and Scott counties), where we felt the highest likelihood of detecting WEE. Weekly blood samples taken from the birds to detect virus presence were negative. Personnel also monitored populations of the WEE vector mosquito (*Culex tarsalis*) using evening sweep net and CO_2 trap collections. *Culex tarsalis* levels were low all season.

Lyme Disease Tick and Spirochete Studies

MMCD personnel continued to sample the network of 100 sites set up in 1991-1992 to monitor potential changes in deer tick distribution over time. As in previous years, the primary sampling method involved capturing small mammals from each site and collecting any attached ticks. Staff processed 728 mammals and identified twenty-four sampling locations where at least one *I. scapularis* occurred. Most *I. scapularis* continued to be found in the northeastern metropolitan area in Washington and Anoka counties. No black-legged ticks were found at the southern Scott County location where a single tick was found in 1995. Numbers of ticks and small mammals collected in 1997 were comparable to 1996, but lower than previous years.

MMCD also continued cooperative studies with Dr. Russell Johnson of the University of Minnesota to identify the distribution and prevalence of *B. burgdorferi*. North Oaks (Ramsey

County) was selected for study because it represents a Lyme disease endemic suburb within the metropolitan area. Personnel in Dr. Johnson's laboratory tested for the presence of spirochetes in the small mammals MMCD collected in North Oaks. Results from 1992-1997 show that occurrences of infection in the small mammal population are localized in the eastern woodlots of North Oaks. This study will continue in 1998.

Public education about Lyme disease continued in 1997. This was accomplished through informational displays at each county and the State Fair, distribution of several thousand copies of a Lyme disease brochure, and presentations on Lyme disease prevention. MMCD also provided tick identification services and produced and distributed wallet-sized tick identification cards.

Ehrlichiosis Surveillance

Ehrlichiosis is a newly discovered bacterial disease that can affect humans and is thought to be caused by several species of *Ehrlichia*. Various regional tick vectors are suspected in the United States, including *I. scapularis*. Cases of human ehrlichiosis have occurred in Minnesota residents.

Collaborative research by MMCD, Dr. Barb Greig, and Dr. Russell Johnson (both of the University of Minnesota) identified *Ehrlichia* bacteria in the metropolitan area small rodent population. Dr. Greig found human granulocytic ehrlichiosis (HGE) agent DNA in rodent blood samples drawn from small mammals collected for MMCD's distribution study in 1995. Results of *Ehrlichia* testing by Dr. Johnson were negative for mammals in North Oaks during 1996.

Collaborative studies with Dr. Johnson continued this year. MMCD provided Dr. Johnson blood samples from white-footed mice (*Peromyscus leucopus*) collected for the distribution study. Dr. Johnson tested the blood samples for the presence of antibodies to *Ehrlichia* species. Results yielded eleven samples that reacted positively to immunofluorescent antibody (IFA) testing and two borderline samples. Dr. Johnson conducted polymerase chain reaction (PCR) tests to verify these positive samples. One sample from May Township was also culture positive and confirmed as HGE.

Rocky Mountain Spotted Fever (RMSF)

RMSF is a rickettsial disease that can be transmitted to humans by a wood tick (*Dermacentor variabilis*). This year a confirmed case of RMSF occurred in Lakeville in Dakota County. Positive serology test results from a sample collected from the family dog provided confidence in the initial result. MMCD staff compiled past *D.variabilis* data from distribution studies to determine whether a significant increase in the average number of *D. variabilis* collected per mammal occurred. Data through the end of June 1997 showed an average of 4.0 *D. variabilis* collected per mammal, which was higher than had been found in recent years. Averages for both 1991 and 1992 were greater than 5.0, however. The District has offered to provide the MDH with *D. variabilis* specimens dating back to 1990 for testing purposes.

Public Education

The District continued to emphasize tick-borne disease in its public education efforts in 1997, focusing on increased awareness of *I. scapularis* distribution, personal protection measures, and tick identifications. In addition to public education efforts at local fairs, District staff gave Lyme disease presentations to Department of Natural Resources staff, employees of the city of Minneapolis, and to members of Kiwanis clubs. Lyme disease brochures and the new District tick identification cards were distributed.

2.3. 1998 Plans

LaCrosse encephalitis prevention services will continue to emphasize *Ae. triseriatus* surveillance and control. Historically surveillance was concentrated within the Lake Minnetonka region of Hennepin County. Due to the recent viral activity in other areas of MMCD, we will increase surveillance efforts throughout the District. Waste tire removal will also continue to be a priority across the entire District. MMCD will clean up small tire piles that produce *Ae. triseriatus*, and continue to work with the Minnesota Pollution Control Agency (MPCA) and county environmental management departments to clean up large tire piles. MMCD plans to monitor the Delano *Ae. albopictus* site in collaboration with the MDH. In addition, the District will continue current WEE monitoring.

MMCD will continue the *I. scapularis* distribution study and will continue its cooperative work with the University of Minnesota. MMCD and the Dr. Johnson will conduct an intensified ehrlichiosis study in May Township where the culture positive HGE isolate was found in 1997. The Lyme Disease Tick Advisory Board (LDTAB), made up of local scientists and agency representatives with Lyme disease expertise, was updated on the progress of tick-borne disease studies during the spring of 1998. MMCD will communicate with the MDH regarding the status of RMSF cases in the metropolitan. Expanded sampling and public education will occur should the risk of RMSF infection to metropolitan area residents appear to be on the rise. A bookmark that highlights tick-borne disease issues is being distributed.

3. Mosquito Control Services

3.1. Background

The mosquito control program targets the principal summer pest mosquito, *Aedes vexans*, several species of spring *Aedes*, and the cattail mosquito *Coquillettidia 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 rain with adults emerging at various times during the summer, ten days to two weeks after the rain. Cattail mosquito larvae develop in cattail marshes over twelve months and emerge as adult mosquitoes in June and July. A more in-depth description of mosquito biologies of the various mosquitoes found in the District is found in the Mosquito Surveillance section of this report.

Floodwater 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. Summer rains which replenish the aquifer also provide the necessary moisture for mosquito development. Lush wooded areas serve as protection from daily heat and low humidity for the resting adult mosquitoes.

3.2. 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 targets the most prolific mosquito breeding locations for all human biting mosquitoes. An insect growth regulator (Altosid® or methoprene) and a soil bacteria (*Bacillus thuringiensis israelensis* or *Bti*) are the larval control materials.

Adult mosquito control supplements the larval control program. Control is done upon request primarily in high use park and recreation areas, for public events and for citizen mosquito annoyance reports. Two synthetic pyrethroids (resmethrin and permethrin) are used for adult mosquito control. In keeping with the District's adult mosquito control policy, adult mosquitoes are only treated when a threshold number is exceeded.

A description of the control materials used for mosquito control services is found in Appendix 1. Appendix 2 summarizes the number of acres treated with each control material and Appendix 3 shows the amount of control materials used for each facility. Pesticide labels are located at the end of the appendix.

3.3. 1997 Mosquito Control

Cattail Mosquito Control

MMCD crews monitored approximately 2,000 *Cq. perturbans* breeding sites in the fall of 1996 to identify sites for treatment the next spring. Larviciding began in February 1997 using Altosid® XR 150-day briquets applied on the ice. Staff applied material to deep sites first and, after the snow melted in April, staff treated the small holes in floating cattail mats. Fifty-six acres were treated with Altosid® briquets through April, and 1,615.3 acres with Altosid® 30-day pellets applied by helicopter in late May.

Floodwater Mosquito Larval Control

Again in 1997 a very limited number of acres were treated with briquets. Ground sites (less than three acres in size) were treated primarily with 30-day Altosid® pellets and *Bti* corn cob granules.

Due to heavy rainfall in July, there was a significant increase in the use of *Bti* from 1996. The threshold for treatment was two larvae per dip in the inner or primary treatment zone of the District, while the threshold in the outer areas was variable depending on the total number of acres breeding mosquitoes and the amount of time and material remaining. Also, Altosid® Liquid Larvicide was used to control spring *Aedes* mosquito species. Below is a summary of the number of acres treated with methoprene products and *Bti* for cattail and floodwater mosquitoes in 1997.

Mosquito Control Service	Briquet Acres 1996	Briquet Acres 1997	Pellet Acres 1996	Pellet Acres 1997	A.L.L. Acres 1997	*Bti* Acres 1996	*Bti* Acres 1997
Cattail Mosquito	166	56	4,650	1,615	NA	NA	NA
Floodwater Mosquito	255	347	6,083	7,363	1,456	78,738	106,220
Total	421	403	10,733	8,974	1,456	78,738	106,220

* Acres treated are calculated from dosage rates and from amount of material used. The actual geographic area treated is smaller because some sites are treated more than once.

Adult Mosquito Control

Adult mosquito control operations were triggered when mosquito levels were above threshold due to the heavy mid to late summer rains. Staff conducted treatments in areas identified by District surveillance and customer mosquito annoyance reports. The number of acres treated with permethrin and resmethrin in 1997 (6,340 and 106,065 acres respectively) was similar to 1996 (5,910 and 120,263 acres respectively).

3.4. 1998 Plans for Mosquito Control Services

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. Wet conditions experienced in 1997 increased the potential number of acres breeding in 1998. As in past years, briquet treatments will start in late February. Beginning in late May, staff will treat with pellets applied by helicopter at a rate of four lbs/ac. MMCD anticipates the treatment acres will increase significantly in 1998 due to more potential breeding sites for *Cq. perturbans*. With the removal of the fishbearing water treatment restriction from methoprene products, MMCD will be testing methoprene materials in fishbearing waters. During the summer months staff will monitor treatment efficacy.

Larval Control

The larval treatment strategy for 1998 will be similar to 1997. Staff will treat ground sites with methoprene products and *Bti* corn cob granules. MMCD also plans to use six helicopters for the treatment of air sites. The added 6th helicopter will allow MMCD to do treatments in the outer townships. Based on a threshold of two mosquitoes per dip, breeding sites in highly populated areas will receive treatments first, during a wide-scale mosquito brood. The District will expand treatments into less populated areas where treatment thresholds are higher.

The primary control material will again be *Bti* corn cob granules, and the amount of material budgeted will be higher than 1997 to supplement the additional sixth helicopter. Thresholds are established to maximize the limited time available to treat each brood. Resources will be used to control mosquitoes until mid-season. After that, resources will be allocated to control annoyance mosquitoes according to the length of season and remaining resources. Regardless of annoyance levels, MMCD will maintain sufficient resources to protect the public from potential disease risk.

Adult Mosquito Control

Both permethrin and resmethrin use in 1998 will be budgeted similar to the use in 1997. 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 (643-8383) will again enable citizens to hear a daily recording on where adult mosquito control operations are taking place (eg. parks, neighborhoods, and public events). MMCD will also have this information on its internet web site. This service provides citizens with useful and current information about where treatments will take place. However, MMCD will continue to call citizens who request treatment notification in advance.

Vector Mosquito Control

Field staff routinely monitors and controls *Ae. triseriatus* (LaCrosse encephalitis vector) and *Cx. tarsalis* (western encephalitis vector) populations. For a more detailed discussion of vector monitoring techniques see the Vector-Borne Disease Management section of this report.

4. Mosquito Surveillance

4.1. Background

The Technical Services Team coordinates a variety of activities that help monitor the District's progress toward reducing mosquito levels. Along with coordinating and gathering rainfall information, staff coordinates and processes larval and adult mosquito collections. 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 to monitor disease vectors and provide historical data of mosquito populations. Additionally, employees and volunteers take sweep net and CO_2 trap collections in the evening to monitor mosquito levels experienced by most citizens.

4.2 Mosquito Biology

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; spring *Aedes*, summer *Aedes*, permanent water species, and the cattail mosquito, *Cq. perturbans.*

—Spring snowmelt *Aedes*—

Spring *Aedes* are the earliest mosquitoes to hatch in the spring. They breed in woodland pools, bogs, and marshes. 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 *Aedes abserratus*, *Aedes excrucians* and *Aedes stimulans*. Spring *Aedes* are not attracted to light, so human or CO_2-baited trapping is recommended.

—Summer floodwater *Aedes*—

Summer *Aedes* eggs hatch in late April and early May. Eggs are laid at the margins of grassy depressions, marshes, and along river floodplains. 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 *Aedes cinereus*, *Aedes sticticus* and *Aedes trivittatus*. New Jersey light traps, CO_2-baited traps, and human-baited sweep net collections are effective methods for surveillance of these species.

—Coquillettidia perturbans —

Coquillettidia perturbans, the cattail mosquito, is a summer species that breeds in cattail marshes. Unlike other mosquito larvae, *Cq. perturbans* obtains oxygen by attaching its specialized siphon to the roots of cattail 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 accomplished 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.

—Disease vectors—
One exception to the habits of the summer *Aedes* is *Ae. triseriatus*. Also known as the eastern treehole mosquito, it breeds in treeholes and artificial containers, especially discarded tires. *Aedes triseriatus* is the vector of LaCrosse encephalitis. The adults are found in wooded or shaded areas and stay within 1/4 to 1/2 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 closely monitors this species using New Jersey light traps and CO_2 traps. Viral activity is monitored by testing blood from sentinel chicken flocks.

4.3. 1997 Summaries

Rainfall

MMCD maintains a network of 78 rain gauges located throughout the District to monitor rainfall amounts. A one-inch rainfall can produce a brood of floodwater mosquitoes. Staff monitor the gauges immediately after a rain and areas that receive high rainfall are sampled for mosquitoes first. This rainfall information is also forwarded to the Minnesota Department of Natural Resources State Climatology Office to supplement their network.

Average rainfall per gauge in the District in from May 1 through September 30, 1997 was 21.33 inches (Table 4.1) . This is 9 percent higher than the 39-year District average of 19.32 inches. Higher than average rainfall occurred in the southern and eastern areas of the District while the northern and western areas were closer to average.

Table 4.1. Average amount of rainfall received in each county from May through September 1997 and 39-year average.

	Anoka	Carver	Dakota	Hennepin	Ramsey	Scott	Wash.	District
1997	19.21	24.01	26.27	19.52	23.21	23.49	22.34	21.33
39-Year Avg.	18.89	NA	19.52	19.48	19.70	19.23	20.04	19.32

The yearly average rainfall amount does not reflect the amount of mosquito production that occurred this season. The 1997 mosquito season started slowly with dry conditions until a major storm of 2-5 inches occurred on July 1 (Fig. 4.1). Rains continued in July with two more major storms of two and three inches on July 17 and July 22. July of 1997 was the second wettest July on record. August was also wetter than normal with storms of three inches on August 19 and one inch on August 30. The wetter than normal cycle continued into September with two more storms on September 8 and September 16.

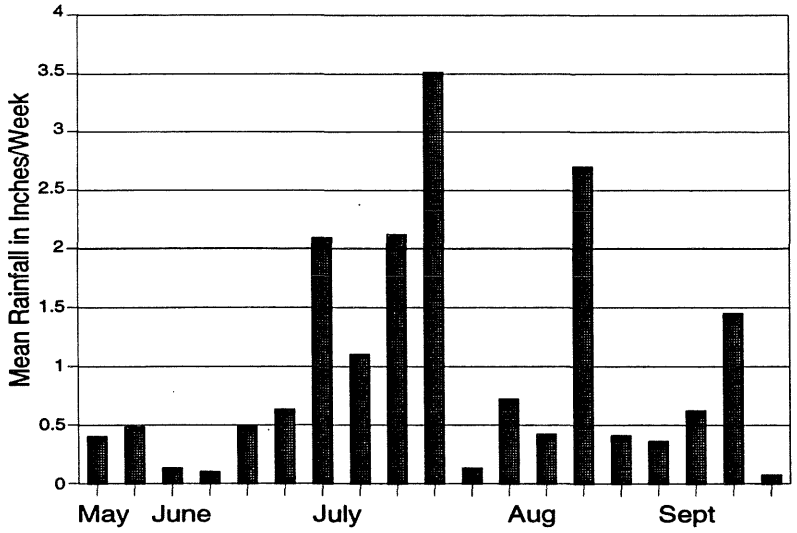

Fig. 4.1. Mean rainfall in inches per gauge per week.

MMCD continues to experiment with NEXRAD radar imaging for viewing rainfall amounts. Staff on the field offices are able to download Nexrad images on their computers to view areas of high rainfall. The NEXRAD system was not always successful and staff still relied on rain gauge readings to determine where to send field crews.

Larval Collections

During a brood, personnel quickly process larval samples and relay the results to field personnel so they can do treatments. Samples taken from sites treatable by helicopter have priority over other samples. Again this year Technical Services seasonal personnel processed samples at some field offices during a brood. This eliminated the need to immediately bring samples to the Entomology Laboratory (an hour drive in some cases) for identifications, and greatly speeded up helicopter treatments.

In 1997 personnel identified 16,887 larval collections. In the past three years the District has had an average of 6-8 small broods and 3-4 medium to large broods. Above average rainfall in 1997 produced nine broods of mosquitoes—five large broods from July and August rains and four small broods in June and September.

Adult Collections

—New Jersey Light Traps—

MMCD has used New Jersey light traps since 1960 and they are the standard collection devices for many mosquito control districts. MMCD uses these light traps 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.

Because the traps are baited with light, they include species that are non human-biting, male mosquitoes, and many other insects. To reduce processing time, the number of New Jersey light traps operated in 1997 were reduced from 18 to five. Trap locations in 1997 were chosen for historical information (traps 1, 9, and 16 have been sampled each year since 1960) and for species diversity (traps CA1 and 20 are in untreated areas). These traps are located in the northern and eastern part of the District (Fig. 4.2).

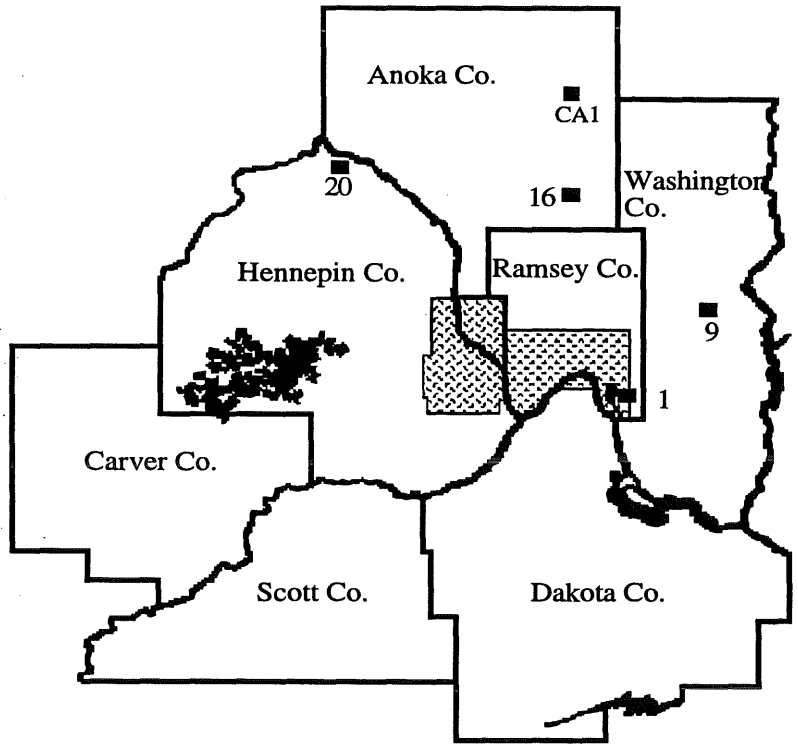

Figure 4.2 New Jersey Light Trap Collection Locations-1997.

All female mosquitoes collected in New Jersey traps are identified to species. *Aedes vexans* was the predominant species collected in the traps, comprising 55 percent of the female mosquitoes collected (Table 4.2). *Coquillettidia perturbans*, the cattail mosquito, was the second most common species at 37 percent. Eight species are included in the spring *Aedes* group. Since these species are not attracted to light, they constituted only 0.30 percent of the female total. *Aedes triseriatus* is also not attracted to light and was only 0.03 percent of the females collected.

Table 4.2. New Jersey light trap collection totals, 1997

Trap No.	1	9	16	20	CA1	Season	Average	% of Female
Location	St. Paul	Lk. Elmo	Lino Lks.	Elm Creek Pk	Carlos Avery	Total	per Night	Total
No. of Collections	139	140	140	130	136	685		
SPECIES								
1. Ae. abs.		3		12	108	123	0.18	0.14%
6. can.				1	6	7	0.01	0.01%
7. cin.	2	9	258	303	738	1310	1.91	1.44%
10. dor.					1	1	0.00	0.00%
11. exc.		6	9	22	20	57	0.08	0.06%
12. fit.	2	7	1	16	1	27	0.04	0.03%
18. punc.				4	35	39	0.06	0.04%
19. rip.	1			1		2	0.00	0.00%
21. stic.		44	14	13	57	128	0.19	0.14%
22. stim.		3		7		10	0.01	0.01%
23. prov.				1		1	0.00	0.00%
24. tris.	1	20	1	3		25	0.04	0.03%
25. triv.	2	251	10	132	51	446	0.65	0.49%
26. vex.	242	5811	10315	10252	23153	49773	72.66	54.85%
261. Ae. sp.		55	41	599	799	1494	2.18	1.65%
118. abs/punc	2	1	2	62	819	886	1.29	0.98%
28. An. earl.	2	1	6	75	118	202	0.29	0.22%
29. punc.		13	11	166	35	225	0.33	0.25%
31. walk.	1	4	104	7	847	963	1.41	1.06%
311. An. sp.		1	6	21	51	79	0.12	0.09%
34. Cx. rest.	4	78	63	25	17	187	0.27	0.21%
35. sal.					4	4	0.01	0.00%
36. tars.		4	55	1	7	67	0.10	0.07%
37. terr.	1	13	26	23	4	67	0.10	0.07%
371. Cx. sp.	5	185	122	101	61	474	0.69	0.52%
38. Cs. inor.	3	19	33	16	18	89	0.13	0.10%
39. melan.			1		1	2	0.00	0.00%
40. minn.		4	152	2	34	192	0.28	0.21%
41. mors.			12		12	24	0.04	0.03%
411. Cs. sp.		17	29	7	28	81	0.10	0.07%
42. Cq. pert.	5	49	795	833	31517	33199	48.47	36.58%
48. Ur. sapp.		22	4	24	3	53	0.08	0.06%
501. Unident.		16	38	150	319	523	0.76	0.58%
Female Total	273	6622	12108	12879	58864	90746	132.48	
Male Total	193	1499	12788	3823	5234	23537	34.36	
Grand Total	466	8121	24896	16702	64098	114283	166.84	
Trap No.	1	9	16	20	CA1	Total		

Mosquito Abundance

—Evening sweep net collections—

Sweep net collections were used to detect mosquitoes annoying to people—both species composition and abundance. Sampling occurs during the peak mosquito activity period, five minutes after the end of twilight, which is about 35-40 minutes after sunset. Employees took two-minute collections in the evening in their yards once per week for 20 weeks. The number of sweep net collections varied from 65-110 per night. Two non-MMCD volunteers mailed in their collections.

Aedes vexans was the predominant species in the evening sweep net collections, with an average of 3.34 mosquitoes per collection (Table 4.3). The 1997 season had the second highest percentage of *Ae. vexans* in the past four years. *Coquillettidia perturbans* was the second most common species, averaging 0.67 per collection. The decrease in the levels of *Cq. perturbans* from 1996 is partly due to many cattail marshes drying up last fall. Although winter snow melt was high, the number of spring *Aedes* was lower in 1997 than in 1996. Compared to *Ae. vexans* or *Cq. perturbans*, the amount of spring *Aedes* collected was very low. Numbers of the District's two disease vector mosquitoes (*Culex tarsalis* and *Ae. triseriatus*) were also very low.

Table 4.3. Mean number of mosquitoes collected per evening sweep net collection.

Species	1997	1996	1995	1994
Aedes vexans	3.34	1.24	5.44	1.84
Cq. perturbans	0.67	2.23	1.67	4.95
Spring *Aedes*	0.10	0.13	0.09	0.04
Cx. tarsalis	0.01	0.01	0.04	0.00
Aedes triseriatus	0.01	0.01	0.01	0.03

—Evening CO_2 trap collections—

CO_2 traps baited with dry ice were used to monitor mosquito population levels during the peak mosquito activity period, and to monitor disease vector mosquito species. Employees set traps in their yards on the same nights as the sweep net collections, once per week for 20 weeks. The traps ran all night this year instead of the 2-hour period used in previous years. Because the duration of trapping was different in 1997, yearly comparisons with previous trapping cannot be made. However, comparisons between this network of CO_2 traps and other CO_2 traps used for treatment threshold determination and disease monitoring were made. We increased the number of traps operated from 46 in 1996 to 69 in 1997.

The CO_2 traps collected predominantly *Ae. vexans* with an average of 161.48 mosquitoes per collection (Table 4.4). *Coquillettidia perturbans* averaged 30.94 mosquitoes per collection, much lower than *Ae. vexans*. Spring *Aedes* were collected more frequently in the CO_2 traps than the sweep nets, but both contained low numbers compared to *Ae. vexans* and *Cq. perturbans*.

CO_2 traps collected *Cx. tarsalis* more efficiently than the sweep net because this species is not usually attracted to humans. Levels of *Cx. tarsalis* were low in 1997. *Aedes triseriatus* adults stay very close to their breeding sites and are daytime biters. When they are found in our evening CO_2 traps, a nearby breeding site can usually be found.

Table 4.4. Mean number of mosquitoes collected per night in CO_2 collections 1997.

Species	Avg./Night
Ae. vexans	161.48
Cq. perturbans	30.94
Spring *Aedes*	2.43
Cx. tarsalis	0.66
Ae. triseriatus	0.54

Seasonal Distribution
—Sweep Netting—
Over the course of the season, *Ae. vexans* populations were low through June but increased sharply in July after the first major storm on July 1 (Fig. 4.3). Overlapping broods from rains in July kept *Ae. vexans* populations high throughout the month. The high populations continued in August and into September as a result of storms on August 19 and August 30. Favorable weather and additional small storms in September maintained mosquito populations into the fall. Mosquitoes bite more aggressively during the day in the fall and are not as readily sampled with evening sweep netting as with the CO_2 trapping.

—CO2 Trapping—
The CO_2 traps reflected the same seasonal distribution for *Ae. vexans* as the sweep nets (Fig. 4.4). *Ae. vexans* peaked in late July and populations continued through September, as described in the sweep net summary. *Coquillettidia perturbans* peaked the second-third week of July, later than the usual 4th of July peak in other years.

4. 3. Plans for 1998
The number of CO_2 traps the District operates has steadily increased over the past five years. MMCD plans to experiment with different models of traps to determine the one most accurate and economical to use. Traps baited with CO_2 from tanks will be compared to traps baited with dry ice. Mosquito taxonomic keys with photographs will be developed to improve training of seasonal Technical Services staff.

MMCD will continue to evaluate the use of Nexrad rainfall imaging to determine if it can replace rain gauges. Staff plan to experiment with the use of a bar code system for tracking inspection and treatment of breeding sites. This would reduce data entry work and increase the amount of real-time data available during the season.

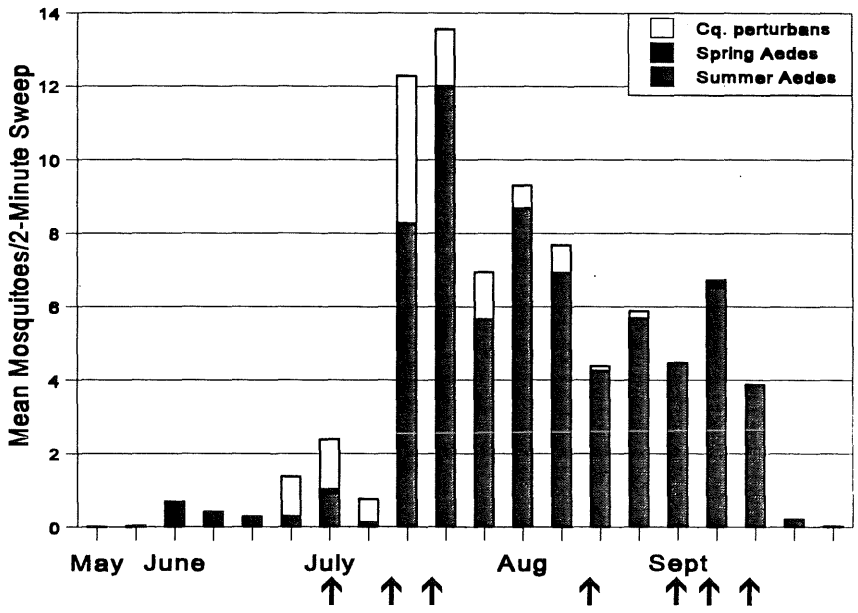

Fig. 4.3. Average number of *Cq. perturbans*, *Ae. vexans* and spring *Aedes* per night in sweep net collections, 1997. Major rainfall events are marked with arrows.

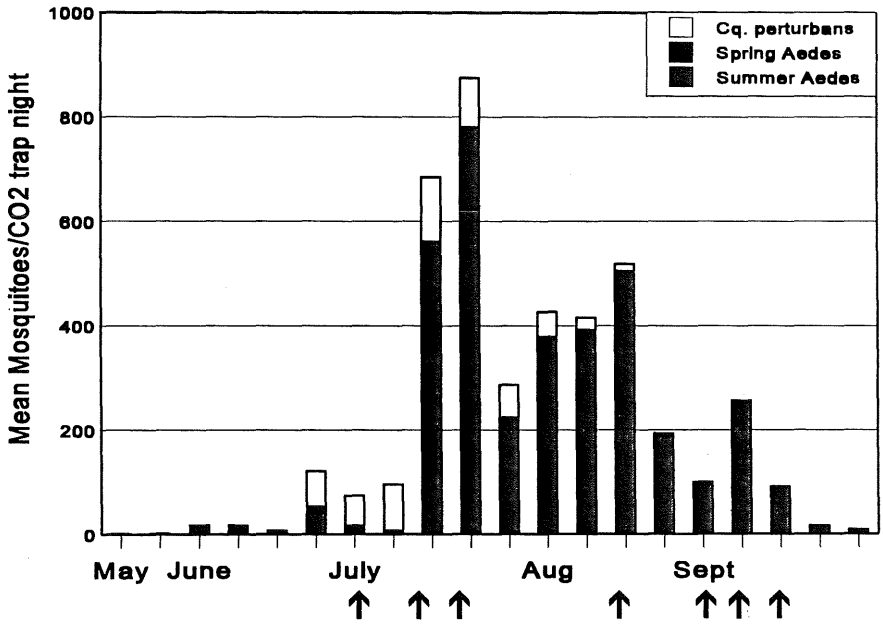

Fig. 4.4. Average number of *Cq. perturbans*, *Ae. vexans* and spring *Aedes* per night in CO_2 trap collections, 1997.

Quality Assurance

5.1. Background

Quality assurance (QA) is an integral part of MMCD services. The QA process focuses on control material evaluations, label compliance, application analysis, and exploration of new technologies to improve our operations. The Technical Services team provides project management and technical support. The regional process teams provide coordination of field testing and data collection.

5.2. 1997 Projects

Quality assurance processes in 1997 focused on improving existing operational methodologies. One improvement made this year was to change the way product testing was conducted. Rather than testing products District-wide, evaluations were done on a more manageable regional level. This change resulted in staff having a sense of project ownership thus increasing productivity and improving data quality. Additionally, MMCD increased calibration efficiency of adulticide equipment by training more staff to help with computer analysis.

The District evaluated nine control materials and completed two equipment evaluations in 1997. These material evaluations lead to two products being certified and therefore eligible for bidding on the 1998 control material contracts. The other evaluations gave the process teams important information on which to base purchasing, budget, and operational decisions.

Acceptance Testing of Altosid® (methoprene) Briquets and Pellets
During 1996 and 1997, staff collected random samples of briquets and pellets from shipments received from the Zoecon Corporation (division of Wellmark Intl.-formerly Sandoz Agro) for methoprene content analysis. MMCD contracted an independent testing laboratory, Legend Technical Services, Inc., to do the analysis. The testing method used was CAP No. 311, "Procedures for the Analysis of S-Methoprene in Briquets and Premix" furnished by Zoecon Corporation, Dallas, Texas. Of the 30 briquets analyzed, all were at or above the label claim of 1.8 percent methoprene (ave. 2.10, SD 0.165). Of the 35 pellet samples analyzed, all were at or above the label claim of 4.0 percent methoprene (ave. 4.06, SD 0.164).

Efficacy of Control Materials

- **Altosid® Briquet, Pellet and Liquid Applications:** Staff applied Altosid® XR briquets by hand to 1,103 breeding sites (403 acres). Applications of Altosid® pellets by helicopter, seeder or by hand to 21,933 sites totaled 8,974 acres. We applied Altosid® Liquid Larvicide (SR-20) to 1,894 sites totaling 1,456 acres using a helicopter, sprayer, or by hand. The pupal collection method recommended by the Zoecon Corporation was used to assess field performance of methoprene products.

  Average control achieved with Altosid® briquets increased to 81 percent, but results were based on a small sample size (n=5 sites). Various pellet applications were evaluated and overall control of Altosid® pellets was similar to previous seasons at 77 percent (n=69 sites). Altosid® Liquid Larvicide was used more extensively as a helicopter-applied material. Average control increased to 65 percent (n=80 sites). Evaluation results are discussed in the control materials evaluation section. Performance of methoprene products must improve if MMCD is to achieve the target rate of at least 95 percent control in treated mosquito breeding sites.

- ***Bti* Corncob Applications**: Vectobac® brand *Bti* from Abbott Laboratories was the main *Bti* product applied by helicopter in 1997. The *Bti* corncob granules are the 5/8" mesh size. The application rate was 8 lbs/acre throughout 1997 due to high water levels and the large mosquito broods found in July.

  Field staff measured efficacy in 15.5 percent of the 4,520 helicopter *Bti*-treated sites during the year. 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.

  The pre/post counts showed an overall *Bti* control rate of 87.7 percent. This control rate was consistent with rates over the past six seasons. The control rate varied throughout the season. The average control rate in spring was 89.4 percent (n= 65). In early summer (June) the control rate was 81.9 percent (n=56). In July and August the control rate was 88.1 percent (n=443).

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 policy 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 small-scale evaluations before using the products operationally.

- **Aquabac G - *Bti* Corncob Granules (Becker Microbial)**: MMCD acquired 40,000 pounds of this newly available brand of *Bti* to evaluate as a mosquito larvicide. All aspects of regular operations extensively used this *Bti*, which provided excellent control. Field tests showed 94 percent control in helicopter applications (n=72) and 97 percent control in ground applications (n=8). Aquabac G met MMCD certification standards and is now eligible for the 1998 *Bti* granule contract.

- **Laginex (AgraQuest, Inc.)**: *Lagenidium giganteum* is a fungal parasite specific to mosquitoes that has become commercially available as the product Laginex AS. Staff conducted an initial test applying Laginex using backpack sprayers to a small area within a 2-acre cattail marsh. Laginex suppressed emergence of adult *Cq. perturbans* by 84 percent (measured using adult emergence cages). These results prompted a larger-scale helicopter application to four additional sites (total of 25 acres) in September. Three weeks after the application staff recovered *Lagenidium* infected larvae. MMCD will evaluate the efficacy of that application in June and July of 1998 using adult emergence cages.

- **Aquabac XT *Bti* Liquid (Becker Microbial)**: The liquid *Bti* was acquired for evaluation and certification as a black fly control material. Three separate evaluations took place in two metro area rivers (Minnesota and Mississippi). The product showed excellent efficacy (95 percent), equivalent to our current product. Aquabac XT met certification standards and is now eligible for the annual liquid *Bti* contract.

- **Altosid Liquid Larvicide - ALL (Zoecon Corporation)**: In previous years, MMCD used this methoprene product primarily in small ground sites. In 1997, larger site helicopter applications were explored as a possible economic alternative to current larviciding

methodologies. Staff treated 14 sites and the material achieved only 49 percent control. MMCD will continue to explore alternative uses of ALL.

- **Vectobac Experimental Corncob Granules (Abbott Laboratories)**: Abbott Labs experimented with a new growth medium for *Bti* fermentation and developed an equivalent *Bti* corncob product. Abbott donated 1,300 lbs. of bulk packaged material to MMCD for a small field trial to evaluate the efficacy of this granule. MMCD submitted a confidential product evaluation and efficacy report to Abbott.

- **LarvX Granules (Meridian Precision)**: MMCD purchased 2,000 lbs. of this newly developed *Bti* sand granule for product evaluation. Prior to the material evaluation, the product showed mixed results in national efficacy trials and the manufacturer chose to redesign the product. Therefore, an extensive evaluation was not undertaken and the product was used in normal field operations.

  A totally dissolvable granule (without the sand as a carrier) was available from Meridian Precision in early summer 1997. The new granule had many of the same desirable characteristics of the sand product but demonstrated improved control. A small field trial showed excellent control 98 percent (n=5). The manufacturer will donate a cost equivalent quantity for MMCD field evaluations in 1998.

- **Biomist 3-15 (Clarke Mosquito Control Products, Inc):** MMCD evaluated this oil-based permethrin/ piperonyl butoxide (PBO) ultra-low volume (ULV) adulticide as a possible alternative to current adulticide materials. Biomist showed an overall reduction of 77 percent (n=6) and staff conveyed that Biomist was basically an equivalent to resmethrin. Further evaluation is suggested and a possible larger scale evaluation could be scheduled for 1998.

- **Flak 2-2 (VECTEC):** The District received this oil-based permethrin/PBO ULV mosquito adulticide product in 1996. In 1997, a new company purchased VECTEC and eliminated Flak 2-2 from its product line. An extensive evaluation was not conducted, but the product was used in normal mosquito control operations. Flak 2-2 worked similarly to MMCD's current ULV product, resmethrin.

- **Garlic Oil (Garlic Research Labs):** Garlic oil is an all natural material staff tested as an area repellent for adult mosquitoes. Preliminary results in 1996 showed no significant reduction of mosquitoes (n=7). The District conducted one small scale evaluation in 1997 and again, no measurable mosquito reduction occurred. MMCD does not plan further testing with the current product.

Equipment Evaluations

- **Seedvac Pneumatic Helicopter Loading System**: The District is evaluating a bulk material loading system that improves staff use and efficiency, staff safety, and reduces the packaging waste of control materials. Scott's Helicopter Services, MMCD's helicopter contractor, provided the experimental loading system. Seven evaluations took place during the mosquito season and staff generally responded positively to this new technology. However, more refinement is needed to further incorporate this equipment into everyday field operations.

- **Curtis Dynafog Twister ULV backpack**: Staff tested a new design of a portable ULV generator. Twenty separate evaluations occurred throughout the District and the general

response to the design was positive. Most staff questioned the ability of the equipment to withstand long-term use. Staff recommended that MMCD wait until the backpack is redesigned before purchase. MMCD provided an in-depth evaluation and recommendations for product improvement to the manufacturer.

Waste Reduction of Control Material Packaging

- **Bulk *Bti* Granule Bags**: Before using the Seedvac System, MMCD used 40 lb. bags of *Bti* for aerial treatments. To increase operational efficiency and decrease the quantity of waste bags, staff evaluated using 1,300 lb. bulk bags. MMCD used 50,060 lbs. of bulk *Bti*, which reduced the amount of waste by 1,250 bags. MMCD spearheaded the redesign of the bulk bags to 1,000 lb. units so all facilities can load and use the bulk material.

- **Recyclable 40 lb. *Bti* Granule Bags**: MMCD produces 16,000 to 20,000 empty *Bti* bags during a mosquito season. Consequently, District staff have been working with *Bti* vendors to develop a recyclable plastic film bag to lower this waste stream. MMCD initiated contact between *Bti* vendors and local recycling centers to develop an acceptable container that is 100 percent recyclable. Staff hope to have a new bag developed for use for the 1998 season.

- **Recyclable 40 lb. Altosid® Granule Bags**: MMCD worked extensively to develop a recyclable bag for Zoecon's new product, XR-G sand. The product will be marketed nationally using the MMCD-developed bag.

5.3 Plans for 1998

Quality assurance processes will continue to be incorporated into the everyday operations of the regional process teams. Emphasis will be placed upon adult mosquito control equipment calibration techniques and equipment evaluations. Control material evaluations will be stressed to assure adequate information is gathered for all materials. The District will continue to improve and make quality decisions based upon fact and efficacy results.

Several new larval mosquito control materials have become available for the 1998 season and will be considered for evaluations. A water-based ULV permethrin, Aqua-Reslin, shows promise as an alternative to the mineral oil-based ULV products. Another synthetic pyrethroid, Anvil, will be available as a non restricted adulticide and might be an environmentally sound choice to add to the District's current adulticides. Altosid® XR-G sand is a 20-day slow release larvicide that has shown excellent swath coverage in prior calibration trials. The XR-G has a tremendous opportunity for residual treatment of large continually breeding sites throughout the season.

6. Black Fly Control Services

6.1. 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 develop in the small streams and large rivers during the spring and summer and are monitored using standardized sampling techniques. Sites where populations reach a treatment threshold are treated with liquid *Bti*. The small stream program began in 1984. The large stream program began with experimental treatments and nontarget impact studies in 1987, but a full-scale treatment program did not go into effect until 1996.

6.2. 1997 Program

Simulium venustum Control

Simulium venustum is a human biting black fly with one early spring generation in the MMCD region. Larvae breed primarily in small streams throughout the District, although the largest populations generally are found in Anoka County.

Staff sampled over 150 potential *S. venustum* breeding sites in mid-April to determine larval density using the standard grab sampling technique. Treatment decisions were based on a threshold of 80 *S. venustum* per sample. Sixty-six sites on 14 streams met the threshold and were treated once with *Bti*. A total of 26.2 gallons of *Bti* was used (Table 6.1).

Table 6.1. Summary of *Bti* treatments for black fly control by the MMCD in 1997.

Water Body	No. of Application Sites	No. of Treatments	Gallons of *Bti* Used
Small Streams	66	66	26.2
Mississippi River	2	13	1882.3
Crow River	2	3	61.0
Minnesota River	7	30	3350.0
Rum River	2	19	126.0
Total	79	131	5445.5

Large River Program

There are three large river-breeding black fly species which the 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 *Simulium johansenni* 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.

In 1987, the District began experimental *Bti* treatments at a few breeding sites on the large rivers. These experimental treatments continued until 1995 when the last of the nontarget impact studies was completed on the Rum River. In 1996, the uppermost monitoring site on the Rum River was included in the list of treatable sites. This gives the District the option of controlling black flies in all reaches of the Rum, Mississippi, Crow and Minnesota rivers that are within its boundaries when treatment thresholds are met.

Staff measured the black fly population density at each treatment location every seven days using artificial substrates at a total of 21 sites on the Rum, Mississippi, Crow and Minnesota rivers. The treatment thresholds used in 1997 were the same as those used since 1990. A total of 5,419.3 gallons of *Bti* were applied to the large rivers for control of black fly larvae in 1997. This was 2423 gallons more than was used in 1996 and 1423 gallons more than was used in 1995. There were two fewer treatments made in 1997 than in 1996 but the total volume of *Bti* used in 1997 was substantially higher due to higher than normal river flows. The average monthly flow on the Mississippi River during the 1997 treatment season (April - September) was 1.6 times higher than the long-term average. On the Minnesota River the 1997 flow was 2.5 times higher than the long-term average, on the Crow River it was 2.7 times higher and on the Rum River it was 1.3 times above the long-term average.

Adult Population Sampling

Staff monitored the adult black fly population at 48 standard locations throughout the MMCD using the over head net sweep technique. Staff took samples twice weekly from early May to mid-September, generally between 8 and 10 A.M.. The average number of all species of adult black flies captured in 1997 was 2.91 (Table 6.2). This is within the range of the average counts observed since the District's area-wide control program began in 1991. The 1997 average was higher than the 1996 count of 0.64 but this is not surprising given the high flows and prime breeding conditions that persisted throughout the summer on the large rivers, particularly the Mississippi and Minnesota. Peaks in black fly adult activity within the MMCD occurred in late June, early August and mid-September.

As in all previous years of the program, the most abundant black fly collected in 1997 was *S. luggeri,* which comprised nearly 85 percent of all adult black flies collected. It was, as in previous years, most abundant in Anoka County in 1997 due to high *S. luggeri* production in the Rum and Mississippi rivers. *Simulium meridionale* was the second most abundant black fly in the MMCD in 1997 and occurred most commonly in Carver and Scott counties, which contain *S. meridionale's* major breeding habitat, the Minnesota River. *Simulium meridionale* populations remained above the treatment threshold levels through July on the Minnesota River due to high flows.

The average number of adult *S. venustum* captured in 1997 was 0.01, which is similar to the results of the previous 12 years of the program. As in previous years, *S. venustum* comprised a very low percentage of the total black fly population as indicated by the standard net sweep samples. In 1997 the District began a study to develop a more accurate method to sample the adult *S. venustum* population. The goal of the 1997 studies was to compare the relative effectiveness of human collectors v. CO_2-baited light traps and to determine the optimal time of day to sample.

Preliminary analysis of the data suggests evening is the optimal time to sample. Both human collectors and CO_2-baited traps were found to be effective for sampling *S. venustum* but CO_2-baited traps are more cost efficient and allow for more sampling locations than if human collectors are employed. Large numbers of *S. venustum* were collected during the study, clearly indicating

that the current method of sampling between 8 and 10 AM with human collectors does not provide a good index of the *S. venustum* population. The study plan for 1998 will include expanded experimental sampling in other regions of the MMCD as well as more detailed studies comparing CO_2 traps and human collectors.

Table 6.2. Annual mean number of black fly adults captured in over-head net sweeps taken twice weekly at 48 standard sampling locations throughout the MMCD between mid-May and mid-September.

Year	All species[a]	*Simulium luggeri*	*Simulium johansenni*	*Simulium 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[c]	6.02	5.70	0.01	0.24
1991	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

a All species includes *S. luggeri*, *S. meridionale*, *S. johansenni*, *S. vittatum* and *S. venustum*.
b 1988 was a severe drought year and limited black fly production occurred.
c The first operational treatments of the Mississippi River began in 1990 at the Coon Rapids Dam.

Non-target Monitoring

Sampling for MMCD's biennial nontarget monitoring program, required as part of our permit from the Department of Natural Resources, began in May and continued through September. We placed multiplate samplers at three locations on the Mississippi River. Staff retrieved the multiplates at 30-day intervals. Samples are currently being processed and a report will be completed in February 1999.

6.3 Black Fly Control Services -1998 Plans

The District's goal is to continue to effectively control black flies in the large rivers and small streams. The thresholds for species that breed in the large rivers will remain the same. The threshold for *S. venustum* will increase to 90 larvae per sample. The *S. venustum* adult sampling study will be continued, and processing and analysis of nontarget monitoring samples from the Mississippi River will be completed.

7. Supporting Work

7.1 1997 Projects

Geographic Information System (GIS) Development

—Field Map Digital Conversion—

Maps of field sites are an essential tool for MMCD field staff. One of the major projects using GIS tools at MMCD is converting current paper-only field site maps to digital format to allow easy revision and expand information use. As of fall 1997, all six field offices had network servers equipped with Digital Orthophotos (USGS, 1991) and basic map templates to allow staff to start using digital mapping. Through the Metro GIS initiative, MMCD has acquired current street data and will receive 1997 digital photos. Staff are working with county surveyors and other agencies to get other existing data. Field staff were trained and began entering mosquito breeding site boundaries and producing field maps. The District plans to complete the mosquito breeding site entry by spring of 1999. By that time, MMCD will need to determine how to handle updates without losing historic records and how to distribute digital information to those who request it. MMCD is also continuing work on database design to ease linkage of data and mapping in the future.

—Digital Map Use for LaCrosse Encephalitis—

Field staff have used the digital photos available as an aid in responding to cases of LaCrosse encephalitis, especially in areas close to the edge of the District. MMCD is also working cooperatively with Dakota County Environmental Health staff to link MMCD's information on vector and control activities with county geographic data. This will allow better examination of risk factors and improve communication with residents in high risk areas.

—Mosquito bite risk maps—

MMCD produced weekly risk maps rating the expected level of mosquitoes in the metro area for use by local media. Ratings were based on adult mosquito counts and other field information.

Rainfall Monitoring Development

—Nexrad—

In 1997 staff developed software that translates Nexrad images from raster to numerical data so that information from Nexrad images can be integrated into Map Info databases. This allows queries based upon precipitation data. For example, staff could display all breeding sites of a particular type that received a certain threshold amount of precipitation. Other data such as larval mosquito sampling can be linked into the database to provide more refined results. In 1998 MMCD will explore real time integration of precipitation data into the District's mapping to more fully automate tools to select sites for inspection. The District also intends to integrate precipitation data into GIS analyses of mosquito production and disease risk. MMCD plans to develop these models during the next few seasons.

—Rain Gauge v. Nexrad—

An initial comparison of rain gauge and Nexrad data on four dates selected to represent rainfall events ranging from quite uniform to quite localized suggested that rain gauge and Nexrad-derived precipitation values become more similar as the precipitation becomes more uniform. Nexrad precipitation estimates tend to be higher than rain gauge measurements with the degree of difference increasing as the precipitation becomes more localized (Table 7.1). This pattern is not affected by the mean amount of precipitation as determined from rain gauge data.

Table 7.1. Comparison of rain gauge and Nexrad-derived precipitation estimates on four dates for precipitation events ranging from localized to uniform. "Difference" is Rain Gauge (categorized*) minus Nexrad. "sd" is standard deviation. Rainfall description is designated by Nexrad sd (uniformity increases as sd decreases).

Date	Rainfall description	Rain Gauge mean (in)	n	Rain Gauge* mean	sd	Nexrad* mean	sd	Difference mean	sd
7/16/97	Most Localized	0.65	36	2.19	2.55	4.33	2.15	-2.14	1.71
5/19/96	More Localized	1.31	35	4.40	2.75	5.80	1.32	-1.40	2.17
6/18/96	More Uniform	0.55	68	2.63	1.27	2.82	0.81	-0.19	1.00
6/17/96	Most Uniform	1.12	71	4.48	1.42	4.48	0.75	0.00	1.37

* Categories used (Rain Gauge and Nexrad): Each category encompasses a range of precipitation values—code 0<0.1 in, 0.1<=code 1<0.25 in, 0.25<=code 2<0.50; 0.50<=code 3<0.75; 0.75<= code 4<1.00; 1.00<= code 5<1.50; 1.50<= code 6<2.00; 2.00<= code 7<3.00; 3.00<= code 8<4.00; 4.00<= code 9<5.00; 5.00<= code 10<6.00 inches

A primary use of precipitation data is deciding which sites to inspect after precipitation occurs (although precipitation is not the only variable considered when deciding which sites to check). An initial evaluation of Nexrad and rain gauge data involved classifying the categorized rain gauge and Nexrad values as "inspect" if they were 4 or higher. Sites with lower values were designated as "don't inspect." After categorization, rain gauge and Nexrad-derived designations for each site were compared to tally agreement and disagreement. Agreement meant that the same decision (inspect or don't inspect) was derived from both rain gauge or Nexrad data (Table 7.2).

Table 7. 2. Comparison of rain gauge and Nexrad-derived decisions to inspect sites based upon a threshold precipitation category of 4.

Date	Rainfall description	Percent don't agree	n	Rain Gauge* inspect	don't inspect	Nexrad* inspect	don't inspect	Comparison agree	don't agree
07/16/97	Most Localized	19.4%	36	7	29	14	22	29	7
05/19/96	More Localized	17.1%	35	21	14	27	8	29	6
06/18/96	More Uniform	8.8%	68	6	62	0	68	62	6
06/17/96	Most Uniform	28.2%	71	37	34	41	30	51	20

No pattern is apparent except that decisions based upon rain gauge and Nexrad data differ for a significant number of sites (8.8-28.2 percent) (Table 7.2). These results further illustrate that rain

gauges provide precipitation data specific to the rain gauge location (no information about areas between rain gauge locations) whereas Nexrad data cover the entire area but do not include as much information about localized variations in precipitation. The simple decision model used here is for illustrative purposes only and does not mean that one data source is more accurate than the other.

In 1998 MMCD intends to investigate further the kinds of remotely sensed data (i.e., Nexrad) that are available, how these data can be used for operational and predictive decisions, and the cost of acquiring these data. Staff also intends to study how rain gauge and Nexrad data can be used (combined and separately as appropriate) to assess the strengths of each (as defined in 1996 and 1997) for operational and predictive decisions.

Nontarget Impact Assessment
—Continuation of Long-Term Study of Nontarget Effects of Mosquito Larvicide—

As recommended by the Scientific Peer Review Panel (SPRP) in their final report (January 1996), MMCD has continued treating the long-term study sites using the same experimental design and funded additional sampling in 1997 to assess the effect of continued treatment.

The 1997 sampling was directed and reviewed by a Continuation Panel including original SPRP members R. Anderson, S. Hurlbert, R. Moon, W. Schmid, M. Zicus and K. Simmons, plus J. Helgen (as available), and TAB member D. Belluck. MDNR staff G. Montz was kept current on Panel activities. Nancy Read from MMCD served as administrative staff.

The Panel sent out a request for proposals for continued sampling of benthic insects (comparable to the earlier work) and additional insect sampling. The contract was awarded to the Lake Superior Research Institute (LSRI), UW-Superior, with Dr. Kurt Schmude and Dr. Mary Balcer as principal investigators.

LSRI staff sampled the Wright County wetlands five times this summer, using dip net and bottle trap sampling for mobile insects in the water column. They used core samples for benthic insects, as done in the previous study. Treatments were done as previously, except the methoprene product used for most of the summer was a slightly different formulation due to manufacturer's problems.

Low water levels on some dates reduced the numbers of dip net and bottle trap samples. Fish were also discovered to be present in a number of sites. All samples were processed and macro-invertebrates identified. Ann Lima, performed the statistical analysis, as she did for the previous study. A report submitted at the end of 1997 is currently being reviewed by the panel.

Treatment data from the study sites for 1994-1997 were compiled by Dr. Lyle Shannon of the University of Minnesota - Duluth and that report was also submitted to the panel.

Funding for additional work is available for 1998, made possible by matching grants from the control material manufacturers. Some possible studies under consideration for 1998 include continuation of aspects of 1997 work, or examining "rebound" of populations in the absence of treatments.

Publications resulting from the various aspects of this long-term nontarget study follow.

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Appendix

- Description of Control Materials
- Control Material Usage and Acres Treated
- Amount of Material Used by Facility or Service 1997
- TAB Recommendations to MMCD Commission (fall meeting)
- Fall TAB Meeting Notes
- Pesticide Labels

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Appendix 1
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 1997 are given. The generic products will not change in 1998, although the specific formulator may change.

ALTOSID® (methoprene) 150-DAY BRIQUETS

(Sandoz Agro-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

(Sandoz Agro-Altosid® Liquid Larvicide Concentrate-A.L.L. Liquid)

Altosid® liquid is mixed with water and applied in the spring to mosquito breeding sites which are breeding 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

(Sandoz Agro-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

(Abbott Laboratories 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

(Abbott Laboratories 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. MMCD will investigate use of *Bti* liquid for mosquito larval control.

PERMETHRIN

(Clarke Mosquito Control Products - Permethrin 57% OS; Vectec- Punt 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 the mosquito to rest during the daylight hours.

Adult control is initiated when MMCD surveillance (harborage 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 complains, MMCD staff evaluate mosquito levels to determine if treatment is warranted. Harborage spraying can also be initiated prior to large outdoor civic events when requested by public officials.

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 oz. of mixed material per acre (0.1 lb active ingredient per acre)

RESMETHRIN

(AgrEvo Environmental Health - 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 2
Acres Treated with Control Materials Used by MMCD for Mosquito & Black Fly Control for 1990-1997

Control Material	1990	1991	1992	1993	1994	1995	1996	1997
Altosid® XR Briquet 150-day	11,351	10,862	10,376	10,537	8,557	7,303	422	403
Altosid® Sand-Products Research only	0	0	625	630	678	871	871	1490
Altosid® Pellets 30-day	0	75	5,689	5,562	5,374	8,219	10,732	8,974
Altosid® SR-20 liquid	0	1	3,279	15	13	668	565	1,456
Bti Corn Cob granules	100,100	134,011	101,877	126,778	102,860	132,773	78,738	106,220
Bti Liquid Black Fly (gallons)	2,009	3,574	4,418	5,090	4,047	3,606	3,025	5,440
Permethrin Adulticide	38,787	22,062	12,812	8,261	10,499	6,305	5,910	7,121
Resmethrin Adulticide	225,900	155,922	48,716	53,345	40,687	62,199	120,263	109,226

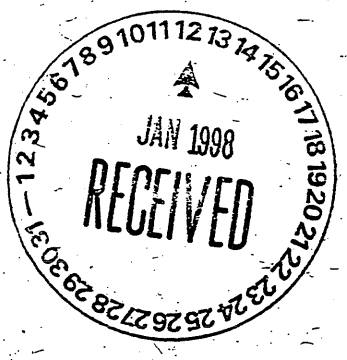
Appendix 3
Amount of Material Used by Facility in 1997

Facility	Altosid® Briquets (cases)	Altosid® Pellets (lbs)	Altosid® Sand (lbs.)	Altosid® A.L.L. (oz)	*Bti* granules (lbs)	*Bti* liquid (gal)	Permethrin (gal)	Resmethrin (gal)
North	73.00	4,198.0	-	984.20	228,662.0	605.04	140.55	344.00
South-Rosemount	69.55	1,229.2	-	150.46	49,331.0	4.87	161.00	55.25
West-Maple Grove	146.50	4,235.0	-	129.00	124,462.5	1,414.30	377.80	223.00
West-Plymouth	51.00	4,829.0	300.0	171.00	126,992.0	61.00	267.50	197.00
East	90.95	5,676.0	-	104.00	152,948.0	-	205.75	196.00
South-Jordan	124.00	4,702.9	-	106.80	163,679.5	3,355.20	246.86	270.80
SPRP	-	-	8,963.0	-	6,840.0	-	-	-
District Totals	555.00	24,870.1	9,263.0	1,645.46	852,915.0	5,440.41	1,399.46	1,286.05

HENNEPIN PARKS
Yours to Enjoy Naturally

SUBURBAN HENNEPIN REGIONAL PARK DISTRICT
12615 County Road 9 Plymouth, Minnesota 55441-1248
Telephone (612)559-9000 TDD (612) 559-6719 FAX 559-3287

An Equal Opportunity Employer



January 9, 1998

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

Dear Commissioner Langfeld:

The Technical Advisory Board (TAB) met on December 4, 1997 to review the activities of 1997. The meeting was active and there were excellent exchanges of questions and information between the Board and the MMCD staff. The minutes of the meeting are attached. Our findings and recommendations from the 1997 wrap up meeting are:

Motion 1. The TAB recommends that the District review the statutory mandate regarding the composition of the TAB and contact those agencies that are not represented by active members.

Motion 2. The TAB recommends continuing investigations into the effectiveness and efficiency of Laginex for controlling mosquitoes in the District with continued attention to possible non-target effects AND that MMCD develop a trial program for the practical application of Laginex in the District's mosquito control program.

Motion 3. The TAB expresses satisfaction with the technical direction, data, materials and methods used by MMCD in its mosquito and black fly control programs that were described at the TAB meeting on Thursday, 4 December 1997.

Sincerely,

Laurence N. Gillette

Laurence N. Gillette
Wildlife Manager

enclosure

I:\USERS\NR1\WP\LG769

Appendix 5
Fall TAB Meeting Notes

Metropolitan Mosquito Control District
TECHNICAL ADVISORY BOARD (TAB)
DRAFT Meeting Notes
December 4, 1997

Members Present	**Member Agency**
Larry Gillette, Chair	Hennepin Parks
Richard Anderson	United States Environmental Protection Agency
Dave Belluck	Minnesota Pollution Control Agency
Howard Krosch	Minnesota Department of Natural Resources
Art Mason	Minnesota Department of Agriculture
David Neitzel (for Craig Hedberg)	Minnesota Department of Health
Dave Noetzel	University of Minnesota, Dept. Entomology
Robert Sherman	Independent Statistical Consultant
Al Singer	Minneapolis Parks-Environmental Group Representative
Bob Wryk	Minnesota Department of Transportation
Members Absent	
Jim Cooper	University of Minnesota, Fisheries and Wildlife
Fred Preiss	Industry Representative

MMCD Personnel Present

Joseph Sanzone, Director	Stephen Manweiler, Technical Services Coordinator
Sandy Brogren, Technical Support	Jeff Luedeman, Vector Ecology
Diann Crane, Technical Support	Dave French, Control Program
Janet Jarnefeld, Technical Support	Ross Green, Control Program
Nancy Read, Technical Support	Mike McLean, Public Information
Mark Smith, Technical Support	Jim Stark, Public Information
John Walz, Technical Support	

Visitor
Gary Montz, Minnesota Department of Natural Resources

1. Call to Order
The meeting was called to order at 12:30 PM. MMCD staff introduced themselves.

2. Review of the Season
Budget: Joe Sanzone presented a summary of the level of control received in different areas of the District in 1997. Beginning in July, we experienced multiple rain events which yielded high numbers of mosquitoes throughout most of the summer. The previous year was dry so the effects of the budget reduction were unseen. The full effect of the budget reduction was evident in this wet year. The high mosquito levels were due in part to the timing of rainfall events and the reduction in MMCD larviciding ability, staff, materials, and number of helicopters.

The budget for 1998 will increase 10%. The District intends to increase the amount of larval control in priority zone one and reestablish larval control in zone two primarily through increases in the number of field inspector staff, amount of control material purchased, and the addition of one helicopter to the fleet.

The question about how the District intends to address the expanding urban and suburban population in the future arose. Basically any county outside of District boundaries would need to petition their particular county to join.

Vector Surveillance: Stephen Manweiler and Janet Jarnefeld summarized results of the Disease Vector Surveillance Program (*Aedes triseriatus*, *Aedes albopictus*, *Culex tarsalis*, *Ixodes scapularis*). Concern was expressed that ornamental ponds may be producing *Ae. triseriatus* mosquitoes. It was suggested MMCD provide people who market such ponds (e.g. landscape design firms) information on ways to reduce mosquito populations in those habitats.
Jim Stark described the cooperative work conducted in the Red River Valley to monitor for *Cx. tarsalis*, the vector of western equine encephalitis. Dave Nietzel reported counts of *Cx. tarsalis* in the Fergus Falls area at 100 times those experienced in MMCD.

Dave Belluck commented that many field practitioners are unaware of the precautions to take when in tick habitat.

Mosquito Abundance: Sandy Brogren presented summaries of mosquito abundance by group (spring *Aedes* v. summer *Aedes*) for the year. The spring *Aedes* group of mosquitoes develop in snowmelt water beginning in early April and emerge beginning in mid-May. These mosquitoes have only one generation per year and produce eggs all summer long. Eggs of spring *Aedes* are conditioned to hatch by freezing. The summer *Aedes*, or floodwater mosquitoes, hatch in response to rainfall. Adults live between 2-4 weeks. Eggs of these mosquitoes hatch after experiencing anaerobic conditions followed by rainwater flooding.

Tactics to use when mosquito abundance is very high were discussed. A subsample of people who requested service from MMCD was surveyed to determine their level of satisfaction. Overall most people were happy with the service provided, even though there were still mosquitoes present. A full survey will be conducted next year.

Bob Wryk noted that MNDOT employees work in the same areas as MMCD does (e.g. road right-of-ways) and perhaps the organizations could identify ways to job share.

Black Fly: John Walz reported results of black fly surveillance and control. The highest levels of black flies were from Anoka County, where sampling indicated larval populations just under the treatment threshold.

Research Projects:
Laginex: Stephen provided a review of laboratory and field studies undertaken this summer to determine if MMCD could successfully use Laginex, a commercially available fungal larvicide, to control mosquitoes. When testing this material MMCD should consider how road salt runoff might affect Laginex. Additionally, MMCD should conduct bioassays against cladocerans since some tests have indicated effects on them as well as chironomids. Other tests indicated no effect.

Long Term Nontarget Study: Nancy Read reported that samples have been processed and the report should be completed by the spring TAB meeting. One last year of sampling has been approved by the

commission. Next year studies may include frog sampling. Judy Helgen or Bill Schmid may be asked to attend the spring TAB meeting to address the frog deformity issue.

Public Information: Jim Stark gave members a copy of the new LaCrosse brochure and asked for comments by January 1, 1998. Al Singer suggested that the District contact organizations like the Boy Scouts to have a spring clean up day targeting *Ae. triseriatus* breeding sites.

3. TAB Membership

Several members of the TAB have recently retired from the organizations which they represent. These people will remain on the Board, but MMCD may need to get additional members from the organizations they no longer actively represent. Those organizations identified in statute 473.713 include: MN Departments of Agriculture, Natural Resources, Transportation, and Health, and the Entomology Department at the University of Minnesota.

4. Motions

Motion 1: The TAB recommends that the District review the statutory mandate regarding the composition of the TAB and contact those agencies that are not represented by active members.

Motion 2. The TAB recommends continuing investigations into the effectiveness and efficiency of Laginex for controlling mosquitoes in the District with continued attention to possible nontarget effects AND that MMCD develop a trial program for the practical application of Laginex in the District's mosquito control program.

Motion 3. The TAB expresses satisfaction with the technical direction, data, materials and methods used by MMCD in its mosquito and black fly control programs that were described at the TAB meeting on Thursday, 4 December 1997.

The meeting was adjourned by consensus at 3:30 PM

Appendix 6
Pesticide Labels

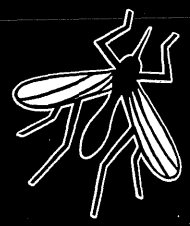
Note:

In 1991, the Environmental Protection Agency (EPA) attempted to make the product registration process more uniform and understandable. Before this label standardization, the EPA accepted various methods for reporting the amount of active ingredient (AI). Examples of the various accepted AI reporting were as follows: (1) a percentage of total weight at the time of product expiration, (2) a percentage as an average AI over the lifespan of products' shelf life or, (3) a percentage at the time of manufacture. These label AI differences caused confusion for regulators, applicators and others trying to interpret and compare product labels. Therefore, the EPA established the nominal concentration as the only acceptable label claim for the amount of AI in the product.

Nominal concentration is the amount of an ingredient expected to be present in a typical sample of a pesticide product at the time the product is produced, expressed as a percentage by weight. This amount is the average of the high and low limits of the target AI as set within manufacturers' specifications. The EPA allows this small variance (~5%) to give some flexibility in product manufacturing.

Re-registration of Altosid® labels was completed in 1997 and the new labels reflect the AI nominal concentrations. The new methoprene labels express AI concentrations as 2.1% for briquets, 4.25% for pellets, 1.5% for XR-G sand and 20.0% for SR-20 Altosid® liquid. Although the reported AI concentration levels have changed, the methoprene products have not physically or chemically changed in any way.

Altosid® XR
EXTENDED RESIDUAL BRIQUETS



Supplemental Labeling

All label restrictions and Directions for Use of Altosid® XR Extended Residual Briquets apply. Now Labeled for use in known fish habitats.

ACTIVE INGREDIENTS:

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

**US patents: 3,904,662 and 3,912,815*

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.

KEEP OUT OF REACH OF CHILDREN

CAUTION

EPA Reg. No. 2724-421-64833

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

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 rancid 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 (≤ 2 feet in depth), treat on the basis of surface area, placing 1 methoprene 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 hyacinth beds. 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 phosphate 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.*

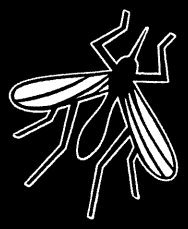
For information, call 1-800-248-7763

SANDOZ
SANDOZ AGRO, INC.
1300 EAST TOUHY AVENUE, DES PLAINES, ILLINOIS 60018

April 1997
Des Plaines, IL

97-24-0060

Altosid® PELLETS
MOSQUITO GROWTH REGULATOR



Supplemental Labeling

All label restrictions and Directions for Use of Altosid® Pellets Mosquito Growth Regulator apply. Now Labeled for use in known fish habitats.

ACTIVE INGREDIENTS:

(S)-Methoprene [Isopropyl(2E, 4E, 7S)-11-methoxy-3,7,11-trimethyl-2,4-dodecadienoate]: 4.25%*

INERT INGREDIENTS: *. 95.75%*

TOTAL: *. 100.00%*

**US patents: 3,904,662 and 3,912,815*

KEEP OUT OF REACH OF CHILDREN

CAUTION

EPA Reg. No. 2724-448-64833

PRECAUTIONARY STATEMENTS

ENVIROMENTAL 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 rancid 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. ALTOSID 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, floodplains, 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: Store closed containers of ALTOSID Pellets in a cool, dry place. Do not contaminate water, food, or feed by storage or disposal. Wastes resulting from the use of this product may be disposed of on site or at an approved waste disposal facility. 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.

For information, call: 1-800-248-7763.

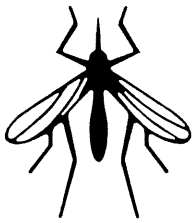
Registrant:

SANDOZ
SANDOZ AGRO, INC.
1300 EAST TOUHY AVENUE, DES PLAINES, ILLINOIS 60018

April1997
Des Plaines, IL

97-24-0061

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%
INERT INGREDIENTS:	80.0%
Total	100.0%

Contains 1.72 lb/gal (205.2 g/LITER) active ingredient

EPA Reg No. 2724-446-64833

KEEP OUT OF REACH OF CHILDREN

CAUTION

Because of the unique mode of action of **ALTOSID** Liquid Larvicide Mosquito Growth Regulator, 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.

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.**

METHODS OF APPLICATION

AERIAL

Use the recommended amount of **A.L.L.** listed below in sufficient water to give complete coverage. One-half to 5 gals. 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 on the following page.

APPLICATION RATE

Apply 3/4 to 1 fl. oz. of **A.L.L.** per acre in water as directed.

APPLICATION SITES

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 removal of livestock.

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, and, dredging spoil sites, drainage areas, waste treatment and settling ponds, ditches and other natural and man-made depressions.

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 & DISPOSAL

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. 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. Wastes resulting from the use of this product may be disposed of on site or at an approved waste disposal facility. Do not contaminate water, food or feed by storage or disposal.

For information call 1-800-248-7763

Always read the label before using the product.

SANDOZ
SANDOZ AGRO, INC.
1300 EAST TOUHY AVENUE, DES PLAINES, ILLINOIS 60018

SP-431
ZPP0094

March 1996
Des Plaines, IL

ABBOTT LABORATORIES

VectoBac® G

Biological Larvicide
Granules

Active Ingredient:

Bacillus thuringiensis, subspecies *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 Registration 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 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.

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 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 biological larvicide is an insecticide for use against mosquito larvae.

Application Rate for Mosquitoes

Mosquito Habitat	Suggested Range Rate*
(Such as the following examples):	
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.

Do not apply directly to treated, finished drinking water reservoirs or drinking water receptacles.

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 the 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 Worldwide
Agricultural Products, North Chicago IL 60064 (800) 323-9597

AG4916/R1 2/95

ABBOTT LABORATORIES

VectoBac® 12AS

Biological Larvicide
Aqueous Suspension

Active Ingredient:

Bacillus thuringiensis, subsp. *israelensis*, 1200 International Toxic Units (ITU) per milligram (Equivalent to 4.84 billion ITU per gallon; 1.279 billion ITU per liter) 1.2%
Inert Ingredients 98.8%
Total 100.0%

EPA Registration No. 275-102
EPA Establishment No. 33762-IA-1 List No. 5605

INDEX:

KEEP OUT OF REACH OF CHILDREN

CAUTION

1.0 STATEMENT OF PRACTICAL TREATMENT

If in Eyes:

Flush with plenty of water. Get medical attention if signs of irritation persist.

If on Skin:

Wash thoroughly with plenty of soap and water. Get medical attention if signs of irritation persist.

2.0 PRECAUTIONARY STATEMENTS

2.1 Hazards To Humans and Domestic Animals

Caution. Harmful if absorbed through skin, causes moderate eye irritation. Avoid contact with skin, eyes, or clothing. Wash thoroughly with soap and water after handling. Remove contaminated clothing and wash contaminated clothing before reuse.

2.2 Physical or Chemical Hazards

Diluted or undiluted VectoBac 12AS Aqueous Suspensions can cause corrosion if left in prolonged contact with aluminum spray system components. Rinse spray system with plenty of clean water after use. Care should be taken to prevent contact with aluminum aircraft surfaces, structural components and control systems. In case of contact, rinse thoroughly with plenty of water. Inspect aluminum aircraft components regularly for signs of corrosion.

3.0 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.

Do not apply when weather conditions favor drift from treated areas. Do not apply to metallic painted objects such as automobiles, as spotting may occur. If spray is deposited on metallic painted surfaces, wash immediately with soap and water to avoid spotting.

Chemigation: Do not apply this product through any irrigation system unless the labeling on chemigation is followed.

4.0 STORAGE AND DISPOSAL

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

Storage:
Store in a cool, dry place 59°F to 86°F (15°C to 30°C).

Pesticide Disposal:
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.

5.0 APPLICATION DIRECTIONS

Do not apply when wind speed favors drift beyond the area of treatment.

5.1 Application Rate For Mosquitoes

Mosquito Habitat	Suggested Rate Range*
(Such as the following examples):	
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	0.25 pt - 1 pt/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.	
Polluted water (such as sewage lagoons, animal waste lagoons)	1 pt - 2 pts/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.	

When applying this product to standing water containing moquito larvae in fields growing crops, do not apply this product in a way that will contact workers or other persons, either directly or through drift. Only protected handlers may be in the area during application.

5.2 Application Rate For Black Flies

Black Fly Habitat	Suggested Rate Range
**Discharge is a principle factor determining carry of Bti. Use higher rate or increase volume by water dilution in low discharge rivers or streams under low volume (drought) conditions.	
Stream water** (=ppm) for 1 minute exposure time	0.5 - 25 mg/liter
Stream water** (=ppm) for 10 minutes exposure time	0.05 - 2.5 mg/liter

* Use higher rate in polluted water and when late 3rd and early 4th instar larvae predominate, mosquito populations are high, water is heavily polluted, and/or algae are abundant.

** Use higher rate when stream contains high concentration of organic material, algae, or dense aquatic vegetation.

5.3 Small Quantity Dilution Rates

	Gallons Spray Solution/Acre		
	10 Gal/A	25 Gal/A	50 Gal/A
Rates in Pints Per Acre	(Ounces Needed/Gallon of Spray)		
0.25	0.2	0.1	0.04
0.5	0.4	0.2	0.08
1.0	0.8	0.33	0.16
2.0	1.6	0.65	0.32

6.0 GROUND AND AERIAL APPLICATION

VectoBac 12AS may be applied in conventional ground or aerial application equipment with quantities of water sufficient to provide uniform coverage of the target area. The amount of water needed per acre will depend on weather, spray equipment, and mosquito habitat characteristics. Do not mix more VectoBac 12AS than can be used in a 72 hour period.

For most ground spraying, apply in 5-100 gallons per acre using hand-pump, airblast, mist blower, etc., spray equipment.

For aerial application, VectoBac 12AS may be applied either undiluted or diluted with water. For undiluted applications, apply 0.25 to 2.0 pts/acre of VectoBac 12AS through fixed wing or helicopter aircraft equipped with either conventional boom and nozzle systems or rotary atomizers.

For diluted application, fill the mix tank or plant hopper with the desired quantity of water. Start the mechanical or hydraulic agitation to provide moderate circulation before adding the VectoBac 12AS. VectoBac 12AS suspends readily in water and will stay suspended over normal application periods. Brief recirculation may be necessary if the spray mixture has sat for several hours or longer. AVOID CONTINUOUS AGITATION OF THE SPRAY MIXTURE DURING SPRAYING.

Rinse and flush spray equipment following each use.

For black fly aerial applications, VectoBac 12AS can be applied undiluted via fixed wing or helicopter aircraft equipped with either conventional boom and nozzle systems or open pipes. Rate of application will be determined by the stream discharge and the required amount of VectoBac 12AS necessary to maintain a 0.5-25 ppm concentration in the stream water. VectoBac 12AS can also be applied diluted with similar spray equipment. Do not mix more VectoBac 12AS than can be used in a 72 hour period.

7.0 CHEMIGATION

Apply this product only through flood (basin) irrigation systems. Do not apply this product through any other type of irrigation system.

Crop injury, lack of effectiveness, or illegal pesticide residues in the crop can result from nonuniform distribution of treated water.

If you have questions about calibration, you should contact State Extension Service Specialists, equipment manufacturers or other experts.

A person knowledgeable of the chemigation system and responsible for its operation, or under the supervision of the responsible person, shall shut the system down and make necessary adjustments should the need arise.

8.0 RICE - FLOOD (BASIN) CHEMIGATION

Systems using a gravity flow pesticide dispensing systems must meter the pesticide into the water at the head of the field and downstream of a hydraulic discontinuity such as a drop structure of weir box to decrease potential for water source contamination from backflow if water flow stops.

VectoBac 12AS is metered or dripped into rice floodwater at application stations positioned at the point of introduction (levee cut) of water into each rice field or pan. One pint of VectoBac 12AS is diluted in water to a final volume of 5 gallons. The diluted solution is contained in a 5 gallon container and metered or dispersed into the irrigation water using a constant flow device at the rate of 80 ml per minute. Introduction of the solution should begin when 1/3 to 1/2 of the pan or field is covered with floodwater. Delivery of the solution should continue for a period of approximately 4 1/2 hours. Floodwater depth should not exceed 10-12 inches to prevent excessive dilution of VectoBac 12AS which could result in reduced larval kill. Agitation is not required during the period in which the VectoBac 12AS solution is being dispersed.

Application of VectoBac 12AS into rice floodwater is not permitted using a pressurized water and pesticide injection system.

9.0 NOTICE TO USER

Seller makes no warranty, express or implied, of merchantability, fitness or otherwise concerning the use of this product other than as indicated on the label. User assumes all risk of use, storage or handling not in strict accordance with accompanying directions.

Abbott Laboratories – Quality Health Care Worldwide
Agricultural Products, North Chicago IL 60064 (800) 323-9597

AG4910/R2 3/96

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

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

STATEMENT OF PRACTICAL TREATMENT

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

ENVIRONMENTAL HAZARDS

his product is extremely toxic to fish and other aquatic organisms. Do not apply irectly to water, to areas where surface water is present or to intertidal areas below ie mean high water mark. Drift and runoff from treated areas may be hazardous to quatic organisms in treated areas. Do not contaminate water when disposing of quipment washwaters. This product is highly toxic to bees. Do not apply this roduct or allow it to drift to blooming crops or weeds while bees are actively visiting ie treatment area.

PHYSICAL OR CHEMICAL HAZARDS

o not use or store near heat or open flame.

DIRECTIONS FOR USE

t is a violation of Federal Law to use this product in a manner nconsistent with its' labeling.

CONDITIONS and RATES to USE for MOSQUITO CONTROL

FOR A BARRIER SPRAY

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

ormal use pattern of product requires a residual application on plant and other urfaces where mosquitoes may rest. Product commonly provides sustained control wooded areas lasting up to 14 days in shaded areas. Secondary activity of product through repellency. Apply product by ground application equipment such as mist lower, ULV equipment, power backpack or pressure sprayer. Not to be used within 00 feet (30 meters) of lakes and streams. To kill or repel mosquitoes, midges, deer es and other biting flies, mix with enough oil mixture so as to easily apply 0.1 ounds of Permethrin per acre. The oil-mixture is obtained by mixing one part of oybean oil to two parts of mineral oil. Non-phytotoxic oils must be used. The llowing chart represents some possible dilutions based on a 2 MPH walking speed ith a fifty (50) foot swath. If a different dilution ratio or walking speed is used, adjust ow 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

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 _____

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 0.6 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.

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

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SCOURGE®

INSECTICIDE
with SBP-1382®/PIPERONYL BUTOXIDE
18% + 54% MF
FORMULA II

* *A SYNTHETIC PYRETHROID FOR EFFECTIVE ADULT MOSQUITO (INCLUDING ORGANOPHOSPHATE RESISTANT SPECIES), MIDGE (BITING AND NON-BITING), AND BLACKFLY CONTROL*
* *FOR AERIAL OR GROUND APPLICATION*
* *TO BE APPLIED BY MOSQUITO ABATEMENT DISTRICTS, PUBLIC HEALTH OFFICIALS AND OTHER TRAINED PERSONNEL IN MOSQUITO CONTROL PROGRAMS.*
* *CONTAINS 1.51 LB/GAL (181 G/L) OF SBP-1382 AND 4.51 LB/GAL (540 G/L) OF PIPERONYL BUTOXIDE*

ACTIVE INGREDIENTS:

*†Resmethrin [5-(phenylmethyl)-3-furanyl] methyl 2,2-dimethyl-3-(2-methyl-1-propenyl) cyclopropanecarboxylate	18.00%w/w
**Piperonyl Butoxide Technical	54.00%
INERT INGREDIENTS:‡	28.00%
	100.00%w/w

‡Contains Petroleum Distillates
*Cis/trans isomers ratio max. 30% (±) cis and min. 70% (±) trans.
†AgrEvo Environmental Health, Inc.'s SBP-1382® brand of resmethrin insecticide.
**Equivalent to 43.2% (butylcarbityl) (6-propylpiperonyl) ether and 10.8% related compounds.
®Scourge and SBP-1382 are registered trademarks of AgrEvo Environmental Health, Inc.

PRECAUCION AL CONSUMIDOR: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. 432-66 **EPA EST. NO.**

KEEP OUT OF REACH OF CHILDREN
CAUTION

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.

IF IN EYES: Flush with plenty of water. Get medical attention if irritation persists.

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

See Side Panel For Additional Precautionary Statements

NET CONTENTS:

Scourge has recently been reclassified as a Restricted Use Pesticide. This classification is currently being re-evaluated by EPA. Until the Agency review is completed, please refer to the new Scourge labeling.

PRECAUTIONARY STATEMENTS
Hazards To Humans & Domestic Animals

CAUTION
Harmful if swallowed. Avoid breathing vapor or spray mist. Avoid contact with skin, eyes, or clothing. Wash thoroughly after handling.

Environmental Hazards

This product is toxic to fish and birds. For terrestrial uses, do not apply directly to water, or 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 areas treated. Do not contaminate water by cleaning of equipment or disposal of wastes.

Physical And Chemical Hazards

Do not use, pour, spill or store near heat or open flame. Flash point minimum 145°F (63°C).

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: FOR CONTAINERS ONE GALLON AND UNDER: 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: FOR CONTAINERS 1 GALLON AND UNDER: Do not reuse empty container. Wrap container and put in trash. FOR CONTAINERS OVER 1 GALLON: 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 professional or 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 ONLY: For use by local districts or other public agencies which have entered into and operate under a cooperative agreement with the Department of Public Health pursuant 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 & 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 theHudson B.P. Mix 9.75 fl oz (288 ml) of this product with 1 gal (3.79 L) of refined soybean oil, light mineral oil of 54 second viscosity or other suitablsolvent 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 orMICRO-GEN or WHISPERMIST-XL, mix product with refined soybean oil, light mineral oil of 54 second viscosity or other suitable solvent or diluent. Adjust equipment to deliver fog particles of 8-20 microns mass median diameter. Consult the following chart for dilution and application rates.

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

NOTE: One gal (3.79 L) of product treats up to 1510 A (611 ha) for adult mosquito control.

Treatment lb ai/A of Scourge Wanted SBP-1382/PBO	Fl oz/A of finished Spray to be Applied	Scourge	Dilution by Scourge solvent	Application Rate - 5 mph 5 mph	10mph
0.001/0.003	0.5(15 ml)	1 part	4.5 parts	1.5(44.4 ml)	3.0 (88.7 ml)
	1.0(30 ml0	1 part	10 parts	3.0(88.7 ml)	6.0(177.4 ml)
	3.0(90 ml)	1 part	34 parts	9.0(266.2 ml)	18.0(532.3 ml)
0.00175/0.00525	0.5(15 ml)	1 part	2.37 parts	1.5(44.4 ml)	3.0 (88.7 ml)
	1.0(30 ml0	1 part	5.74 parts	3.0(88.7 ml)	6.0(177.4 ml)
	3.0(90 ml)	1 part	19.2 parts	9.0(266.2 ml)	18.0(532.3 ml)
0.0035/0.0105	0.5(15 ml)	1 part	0.68 parts	1.5(44.4 ml)	3.0 (88.7 ml)
	1.0(30 ml0	1 part	2.33 parts	3.0(88.7 ml)	6.0(177.4 ml)
	3.0(90 ml)	1 part	9 parts	9.0(266.2 ml)	18.0(532.3 ml)
0.007/0.021	0.5(15 ml)	1 part	0.68 parts	1.5(44.4 ml)	3.0 (88.7 ml)
	1.0(30 ml0	1 part	4 parts	3.0(88.7 ml)	6.0(177.4 ml)

DIRECTIONS FOR STABLE FLY, HORSE FLY, DEER FLY CONTROL:
Treat shrubbery and vegetation where 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 best results, fog 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 equip-ment in a manner to insure even distribution of the fogthroughout 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.

For control of adult flies in residential and recreational areas, apply this product undiluted at a rate of 36 fl oz/hr (1.065 L/hr) by use of a suitable ULV generator traveling at 5 mph (8 kph) or at a rate of 72 fl oz/hr (2.129 L/hr) while traveling 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 USE OF AIRCRAFT
This product is used in specially designed aircraft capable of applying ultra low volume of finished 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. 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.

USE OF FIXED WING AIRCRAFT OR HELICOPTERS
Thoroughly mix 25.5 fl oz (755 ml) of this product with 102.5 fl oz (3030 ml) of light mineral oil of 54 second viscosity, refined soybean oil or other suitable solvent.For a treatment rate of 0.007 lb ai/A (7.85 gm/ha) SBP-1382 plus 0.021 lb ai/A (23.55 gm/ha) piperonyl butoxide tech., apply at a rate of 3 fl oz /A (219 ml/ha). For a treatment rate of 0.0035 lb ai/A (3.93 gm/ha) SBP-1382 plus 0.0105 lb ai/A (11.77 gm/ha) piperonyl butoxide tech., apply at a rate of 1.5 fl oz/A (109.5 ml/ha).

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

MIXING INSTRUCTIONS FOR PRODUCT IN AIRCRAFT USAGE
This product is used diluted in mineral oil of 54 second viscosity, refined soybean oil or other suitable solvent.
AgrEvo Environmental Health

Fl oz/A of Finished Spray to be Applied	lb ai/A Wanted SBP-1382/PBO	Volumetric Dilution Product	Needed Solvent
0.5 (15 ml)	0.001/0.003	1 part	4.5 parts
	0.00175/0.00525	1 part	2.37 parts
	0.0035/0.0105	1 part	0.68 parts
	0.007/0.021 - Apply as is 0.6 fl oz (17.7 ml)/acre		
1.0 (30 ml)	0.001/0.003	1 part	10 parts
	0.00175/0.00525	1 part	5.74 parts
	0.0035/0.0105	1 part	2.33 parts
	0.007/0.021	1 part	0.68 parts
3.0 (90 ml)	0.001/0.003	1 part	34 parts
	0.00175/0.00525	1 part	19.2 parts
	0.0035/0.0105	1 part	9 parts
	0.007/0.021	1 part	4 parts

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