METROPOLITAN Mosquito Control District

MMCD 1996 Operational Review and Plans for 1997

EDITORIAL STAFF

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

ACKNOWLEDGEMENTS

I would like to thank the following individuals for their contributions which made and improved this document—Sandra Brogren, Scott Helling-Christy, Janet Jarnefeld, Laurene Lozoski, Dave Neitzel, Scott Ranta, Nancy Read, Joe Sanzone, Ken Simmons, Mark Smith, Jim Stark, John Thompson, and John Walz. Also thank you to Martyn Kirkman who provided the artwork for the report cover.

March 1997

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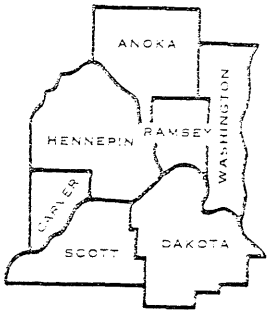

METROPOLITAN MOSQUITO CONTROL DISTRICT
METRO COUNTIES GOVERNMENT CENTER
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612-645-9149 ■ FAX 612-645-3246 TDD use Minnesota Relay Service

JOSEPH F. SANZONE
Director

W.J. CAESAR
Business Admin.

Dear Reader:

The following report is the Metropolitan Mosquito Control District's (MMCD's) 1996 Operational Review and Plans for 1997. It outlines program operations based on the goals 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). The 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 April 3, 1997 meeting are included in this report.

The TAB's recommendations and report were accepted by the Commission at their June 25, 1997 meeting. The Commission approved the MMCD 1996 Operational Review and Plans for 1997, and thanked the TAB and District staff for their work.

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

Sincerely,

Joseph Sanzone

Joseph F. Sanzone
Director

EXECUTIVE SUMMARY

In 1994 the Metropolitan Mosquito Control District (MMCD) began a process of structural and operational reorganization to provide services more efficiently. This process was essentially completed in 1996, and only fine tuning remains. The District's new team structure is now functioning fairly effectively, and will improve as individual and team skills increase through training and experience. MMCD appears to be functioning more effectively now that staff are empowered with more decision making authority, and that there is a free flow of information throughout the organization.

1996 was the first year that the District had to significantly reduce larval mosquito control operations, as the result of a 26% reduction in budget. The potential effects of this reduction were undoubtedly mitigated by the exceptionally dry weather we had from July through September. This drought greatly reduced the production of floodwater mosquitoes. In addition, many cattail marshes dried partially or completely during this period. This resulted in the destruction of nearly half the anticipated 1997 production of cattail mosquitoes, our second most important pest species. The results may be long lasting, as some of these marshes may not produce cattail mosquitoes for at least two years.

There were two confirmed cases of LaCrosse (LAC) encephalitis within the District during 1996. Both cases occurred in an endemic area near Lake Minnetonka. Appropriate larval and adult control measures were taken in the area. Other areas at moderate to high risk for LAC were surveyed for *Aedes triseriatus*, the LAC vector mosquito. Monitoring for western equine encephalitis by sentinel chicken flocks was continued in 1996. However, numbers of the vector mosquito (*Culex tarsalis*) were generally low and no virus activity was discovered. The Asian tiger mosquito was discovered in Elko (Scott County), in September. This mosquito is an important vector of several diseases, and would be a likely vector of LAC in Minnesota. The tiger mosquito 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. It was discovered in this area in 1991, and was eradicated. This is the first reinfestation found since then; we believe we eradicated this infestation as well. An intensive surveillance effort for this mosquito will be made in 1997.

In 1996 monitoring continued for the black-legged tick (*Ixodes scapularis).* This tick is the known vector of Lyme disease and ehrlichiosis. Numbers of ticks collected were much lower than in previous years and no changes in tick distribution were detected.

The District's black fly control program on small streams and large rivers continues to be highly effective. Improved control strategies helped to reduce adult infestations in 1996 to their lowest level since 1984. In 1997 we will collect and process nontarget monitoring samples in the Mississippi River.

We increased our public affairs activities significantly in 1996, especially with the electronic and print media. In addition we provided MMCD's message to citizen groups, government agencies, and the public. Information booths and panels were set up at county fairs, the State fair, conventions, public buildings, nature centers, and special events. These efforts to increase public and elected official awareness of District services will be increased in 1997.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
NATIONAL HEALTH AND ENVIRONMENTAL EFFECTS
RESEARCH LABORATORY
MID-CONTINENT ECOLOGY DIVISION
6201 CONGDON BOULEVARD • DULUTH, MN 55804- 2595

OFFICE OF
RESEARCH AND DEVELOPMENT

April 16, 1997

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 April 3, 1997 to discuss the activities of 1996 and to review the 1997 MMCD program. 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 meeting are:

The TAB has reviewed the 1996 operational results and the plans for 1997 and approve the current plan. The acceptance of the plan is in the context of the motions noted below.

Motion 1

The TAB reaffirms its belief that the MMCD mosquito control programs should focus primarily on larvicides. Adulticides should be used judiciously to complement but not supplant larvicides in this program.

Motion 2

The TAB affirms that the tick-borne disease efforts being conducted by the MMCD are an appropriate response at an appropriate level for this public health threat and should be continued.

Sincerely yours,

Richard L. Anderson
TAB Chair 1997

Metropolitan Mosquito Control District
Technical Advisory Board (TAB)
April 3, 1997

Members Present	Member Agency
Richard Anderson, Chair	United States Environmental Protection Agency
Dave Belluck	Minnesota Pollution Control Agency
Larry Gillette	Hennepin Parks
Craig Hedberg	Minnesota Department of Health
Howard Krosch	Minnesota Department of Natural Resources
Art Mason	Minnesota Department of Agriculture
Robert Sherman	Independent Statistical Consultant
Bob Wryk	Minnesota Department of Transportation

MMCD Staff

Joseph Sanzone, Director	Stephen Manweiler, Technical Services Coordinator
Sandy Brogren, Technical Services	Janet Jarnefeld, Technical Services
Diann Crane, Technical Services	Mark Smith, Technical Services
David Neitzel, Control Program	John Walz, Technical Services
Scott Ranta, Control Program	Jim Stark, Public Information
Nancy Read, Technical Services	Mike McLean, Public Information

Visitor
Gary Montz, Minnesota Department of Natural Resources

Call to Order

Chairman Anderson called the meeting to order at 12:25 pm and the TAB members and MMCD staff introduced themselves.

Approval of Minutes from December 5, 1996 meeting of TAB

Chairman Anderson noted that the final report from the University of Wisconsin-Superior study on the effect of Bti on chironomid populations has not been received. Minutes from the December meeting were approved.

Review and Discussion of MMCD 1996 Operational Review and Plans for 1997.

The review began with an overview by Joe Sanzone followed by specific descriptions by the principals in each topic area. In the overview, it was noted that the MMCD is working to reduce costs and increase effectiveness. This is due, on part, to a reduction in funding and is reflected in the purchase and use of fewer briquets and a switch to other formulations of the larval control agents. Cattail mosquito control has begun and their populations will be monitored since the drought last summer may produce a multiple year reduction in their populations. Spring Aedes populations are affected by the extent of the seasonal flooding and estimates of their populations are not available yet. Two newly-available products may also be evaluated this year. One is the fungus Lagenidium and the second is an improved formulation of Bti. Both are already registered by the EPA and registered by the MDA for use in Minnesota.

The overview presentation also noted that current funding does not allow for enough material to control mosquito larvae throughout a year with normal rainfall, so the plan is to make larval treatments as needed at the beginning of the control season to produce the greatest initial reductions. This revelation led to questions by the TAB about the great increase in adulticide use last year and whether the decrease in larvicide applications is related to the increase in adulticide use. After discussion on the reasons for the changes, the TAB defined the following motion:

MOTION 1. (L. Gillette, second R. Sherman)

The TAB reaffirms its belief that the MMCD mosquito control programs should focus primarily on larvicides. Adulticides should be used judiciously to complement but not supplant larvicides in this program.

Motion approved.

Several members requested that MMCD staff bring more information to the next TAB meeting on the observed increase in use of adulticides.

Dave Neitzel reviewed the vector-borne disease management program. He discussed the Asian Tiger Mosquito (*Aedes albopictus*) surveillance program and described the cooperation between the District and the Minnesota Pollution Control Agency on waste tire removal, and cooperation with the Minnesota Department of Health on tick-borne disease monitoring and education programs. The TAB defined and approved the following motion:

MOTION 2. (R. Sherman, second L. Gillette)

The TAB affirms that the tick-borne disease efforts being conducted by the MMCD are an appropriate response at an appropriate level for this public health threat and should be continued.

Motion approved.

Joe Sanzone mentioned that the high levels of water in the major rivers this year may make it difficult to do cost-effective Bti treatments for control of black flies early in the season. Personnel are currently monitoring water levels.

Jim Stark described the public education and program evaluation activities. Programs to monitor customer response were described, including a new system for handling customer telephone calls and a post card public perception survey, as well as an outreach program to public service organizations and new brochures.

Update on continuation of Long-Term Nontarget Study

The request for proposals for the study this year was published and six proposals were received. They were evaluated by a panel that included members from the original Scientific Peer Review Panel and current TAB, and the University of Wisconsin-Superior was selected as the contractor. Work is expected to begin at the sites in May.

Input by TAB members on agency activities related to MMCD activities

This agenda item lead to a general discussion about the continuing interest in discovering the causes for deformed frogs. Other items mentioned were a Hennepin Parks classification of wetlands according to impacts of surface water runoff, and work by Dave Belluck with MnDOT using comparative risk bioassays to evaluate environmental impacts of road materials.

RECOMMENDATIONS TO THE MMCD COMMISSION:

The TAB has reviewed the 1996 operational results and the plans for 1997 and approved the current plan. The acceptance of the plans is in the context of the motions noted earlier and repeated here:

The TAB reaffirms its belief that the MMCD mosquito control programs should focus primarily on larvicides. Adulticides should be used judiciously to complement but not supplant larvicides in this program.

The TAB affirms that the tick-borne disease efforts being conducted by the MMCD are an appropriate response at an appropriate level for this public health threat and should be continued.

The meeting was adjourned by consensus at 2:52 pm

Metropolitan Mosquito Control District
1996 Operational Review and Plans for 1997

Table of Contents

Background and Overview

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

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Metropolitan Mosquito Control District
TECHNICAL ADVISORY BOARD
1997

Richard Anderson, Chair	**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
Ron Chatfield	**Solvay Animal Health Inc. (Industry Representative)** 1201 Northland Drive Mendota Heights, MN 55120
Jim Cooper	**University of Minnesota, Fisheries and Wildlife** 200 Hodson Hall St. Paul, MN 55108
Laurence Gillette	**Hennepin Parks** 3800 County Road 24 Maple Plain, MN 55359
Craig Hedberg	**Minnesota Department of Health** 717 SE Delaware Street Minneapolis, MN 55440
Howard Krosch	**Minnesota Department of Natural Resources** Box 25 DNR Building 500 Lafayette Road St. Paul, MN 55155
Art Mason	**Minnesota Department of Agriculture** 90 W. Plato Boulevard St. Paul, MN 55107
Dave Noetzel, Chair	**University of Minnesota, Entomology** 226 Hodson Hall St. Paul, MN 55108
Robert Sherman	**Independent Statistical Consultant** 2421 Sheridan Avenue So. Minneapolis, MN 55405

Alan Singer	**Minneapolis Parks (Environmental Group Representative)** 200 Grain Exchange Building 400 South 4th Street Minneapolis, MN 55415
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-1997

Margaret Langfeld, Chair	Anoka County
Dick Lang	
David McCauley	
Ursula Dimler/	Carver County
John Siegfried (alt)	
Don Maher	Dakota County
James Mueller	
Willis Branning	
Randy Johnson, Vice-Chair	Hennepin County
Mike Opat	
Penny Steele	
Tony Bennet	Ramsey County
Janice Rettman	
Victoria Reinhardt	
Dallas Bohnsack, Secretary	Scott County
Ed Mackie	
Dennis Hegberg	Washington County
Dave Engstrom	

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 Mosquito Control District
Staff in Attendance

Joseph Sanzone, Director	M.S. Biology/Entomology, B.S. Entomology
Stephen Manweiler, Technical Services Coordinator	Ph.D., Entomology M.S., Entomology, B.S. Entomology
Sandy Brogren, Technical Services	B.S. Entomology
Diann Crane, Technical Services	M.S. Entomology, B.A. Biology
Janet Jarnefeld, Technical Services	B.S. Forestry
Dave Neitzel, Group Leader	M.S. Environmental Health, B.S. Wildlife Management
Mike McLean, Public Information	B.A. Speech Communication
Scott Ranta, Group Leader	
Nancy Read, Technical Services	Ph.D., Entomology, M.S. Entomology, B.S. Biology
Mark Smith, Technical Services	B.S. Biology
James Stark, Public Affairs Coordinator	B.S. Journalism
John Walz, Technical Services	

Administration

1. Background

The administration of the Metropolitan Mosquito Control District leads and 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 reorganization. Particularly focusing on maintaining high morale and obtaining the best use of human resources, in meeting the District's mission and goals.

- Strengthen improvement in the quality of services provided and responsiveness to citizen expectations through the efforts of the Continuous Quality Improvement (CQI) initiative of the District.

- Provide direction & support for District problem solving teams.

2. 1996 Program

Progress in 1996

Staff have reacted well to the changes that have taken place. The team structure has allowed greater input from all areas of the organization. A major focus on customer satisfaction has taken place and will be the focus in the coming year. An Activity Based Costing pilot project has been implemented and is being expanded for 1997.

3. 1997 Plans

Service levels will be similar to 1996. We will continue to focus on decentralizing processes which can be effectively accomplished by operational staff. Centralized procurement of major resources such as control materials will continue. Notable changes for 1997 include a full year contract for governmental relations consulting, human resources services and expansion of the Activity Based Costing project.

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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 our program. Communication with our 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 districts within the District. Media releases to newspapers, television and radio also provide information about program activities. In addition, informational literature is developed, updated and distributed to citizens throughout the District.

1.2. 1996 Program

Media Relations
In the spring of 1996 MMCD staff contacted metropolitan media outlets, both electronic and print, and offered them the opportunity to go out into the field and observe our operation. This effort was supported with a press release describing our early season control efforts. We made a number of good contacts, and continued to provide press releases, and information pertaining to the wide variety of District services throughout the season. This personal contact led to information about the District being published or broadcast by many of these outlets.

County Newsletters
MMCD provides articles on District operations to all participating county newsletters each quarter throughout the year.

Informational Panels
Staff developed a number of information panels describing District operations. These panels are distributed to libraries, nature centers and other public buildings. Each operating division has its own inventory of panels to distribute. Key messages cover program effectiveness, safety and cost effectiveness.

MMCD Information Displays
MMCD staffs information booths at a variety of venues. On display are samples of mosquito and biting gnat larvae, black-legged ticks and information on Lyme disease, an infected dog heart and information on heartworm disease, control materials and printed information pertaining to District services. In 1996 MMCD staffed information booths for the following functions:

League of Minnesota Cities Convention
Association of Minnesota Counties Convention
Earth Day in the St. Paul Skyway
Minnesota Office of Environmental Assistance - Environmental Conference
City Showcases: Rosemount, Shakopee, Prior Lake, New Prague, Belle Plaine

Information displays are also staffed at the State and seven metro county fairs. Following is a tabulation of the number of people who visited MMCD fair booths in 1996 (Table 1.1).

Table 1.1 Tabulation of estimated State and county fair attendance at MMCD information booths.

Event	Date	Estimated Attendance
Ramsey County Fair	July 19-23	1,331
Hennepin County Fair	July 27-30	1,950
Scott County Fair	July 27-30	1,485
Anoka County Fair	August 1-6	2,746
Washington Co. Fair	August 2-6	1,847
Dakota County Fair	August 7-13	3,172
Carver County Fair	August 9-13	2,159
Minnesota State Fair	August 24- Sept. 3	14,713
Total		29,403

Wetland Map Inventory

MMCD maintains one of the most complete and up-to-date wetland map inventories in the metropolitan area. Many local governing units (LGU) have asked for copies of our aerial photographic maps to help with their water resource management plans. Since 1995 MMCD has provided maps of over 2000 square miles of wetlands to LGUs in the metropolitan area.

CD-ROM

The District has developed a computer-based interactive CD-ROM entitled *The Minnesota Mosquito.* It contains information about mosquito biology, disease prevention, and ways to reduce annoyance in your own backyard. In our ongoing efforts to help Minnesota citizens protect their health and well-being, this CD-ROM has been provided to every public school and library in the state.

Telephone Response to Citizen Inquiry

In 1996 the District designed its media contacts to solicit calls from the public. Citizens were asked to call MMCD to express opinions and concerns, or get questions answered. In addition, MMCD employees staffed the KARE-TV Pest Line phone bank for three evenings in June. These outreach efforts were very successful in getting increased contacts, many resulting in service requests from customers. In 1996 the District received over 1800 telephone calls inquiring about District operations (Table 1.2), compared to 914 in 1995.

Adult Mosquito Control Information Line - 643-8383.

To inform citizens concerned 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 stating 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. Results from the number of calls received were tallied at the end of the season (Table 1.3).

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

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

Table 1.3. Number of telephone inquiries received by Division, 1993-1996

Facility	Number of inquiries, 1993	Number of inquiries, 1994	Number of inquiries, 1995	Number of inquiries, 1996	1996 % by county
Anoka	151	106	96	66	16.4
Carver	52	43	68	18	4.5
Dakota	35	51	92	32	8.0
North Hennepin	87	85	116	48	11.9
South Hennepin	286	186	230	130	32.3
Ramsey	98	95	119	53	13.2
Scott	63	44	96	22	5.5
Washington	54	30	74	33	8.2
Total	826	640	891	402	100%

1.3. 1997 Plans

To make media releases more attractive to metro media outlets, we will include graphics and photographs. We will also continue to nurture personal contacts to increase media placements to provide citizens information regarding District operations.

We will be making information presentations, or providing information about the District to every newly elected official in the metropolitan area. In addition, staff plan on contacting a variety of adult service groups and offering presentations. These efforts will assist in increasing the awareness of District services among elected officials and members of adult service groups.

We will also contact local school districts to become more involved in curriculum development. Our goal is to increase student and teacher awareness of the District and its activities.

2.Vector-borne Disease Management

2.1. Background

In 1996, District field staff provided a variety of disease surveillance and control services to help prevent the following diseases: LaCrosse encephalitis, western equine encephalitis, Lyme disease and ehrlichiosis. With the District change to a team structure, and resulting elimination of specialized "focus" programs, this was the first 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 *Ae. 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, we have mapped the current distribution of black-legged ticks, and have initiated cooperative spirochete studies with the University of Minnesota. All data collected are summarized and given to the Minnesota Department of Health (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. 1996 Program

Aedes triseriatus Surveillance.

Intensive surveillance was conducted in several hundred wooded neighborhoods within 2-3 miles of Lake Minnetonka (Hennepin and Carver counties). The majority of past LaCrosse encephalitis cases have occurred in this area, including two confirmed cases in 1994, and two again in 1996. Populations of *Ae. triseriatus* within this region have been monitored every year since 1987, and high risk neighborhoods were identified for control efforts. The current surveillance effort included a systematic sampling of most significant wooded areas in each square mile to evaluate past treatment success, and identification of any problem areas missed during prior surveillance. Adult mosquitoes were collected from each site using a large aspirator. Adult *Ae. triseriatus* were found at 238 locations, which will now receive control efforts before the 1997 mosquito season. Similar surveillance was conducted at all past confirmed LaCrosse encephalitis case locations to prevent further cases in those areas.

Aedes triseriatus Control.

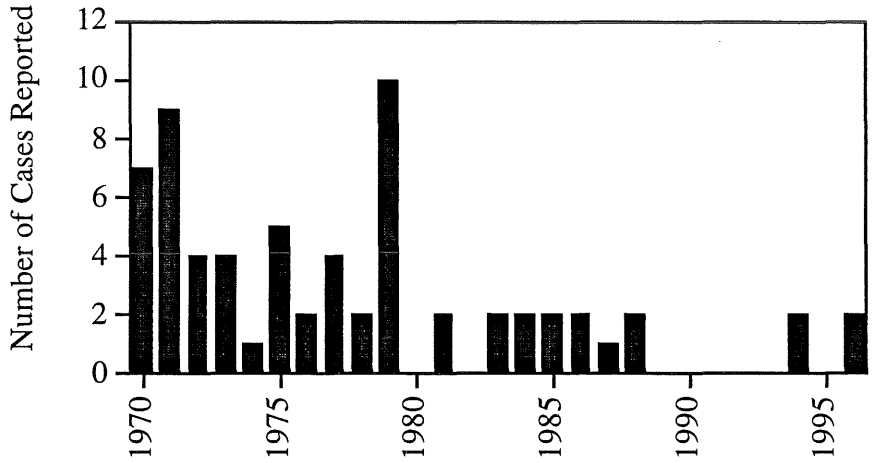
As in past years, staff continued to distribute the LaCrosse encephalitis prevention brochures to citizens living in identified risk areas. We also supplied brochures to county and state fairs, and other public functions. In addition, interpretive posters and other information were presented at

each county fair and the State Fair. These brochures and presentations outlined LaCrosse encephalitis, and stressed water-holding container removal to prevent the disease.

In 1996, staff removed 45,075 waste tires from high risk areas of the District (247,541 tires picked up since 1988). Cooperative tire dump cleanup efforts continued with several county environmental management departments resulting in the elimination of many waste tire sites (especially Dakota, and Carver counties).

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

There were two confirmed cases of LaCrosse encephalitis reported in the District in 1996 (Fig. 2.1). Both sites were on the southeast side of Lake Minnetonka (near the 1994 case locations). Waste tires, water-holding containers, and tree holes were found and eliminated during a large control effort after the cases were reported in August. Both areas will receive further surveillance and control in 1997.



Aedes albopictus (Asian Tiger mosquito) Surveillance.

In September, staff collected several *Ae. albopictus* larvae from a used truck tire business in Elko (Scott County). Due to a back log of mosquito larvae to identify, the sample from this site was not looked at until December. However, staff had treated the site in September with *Bti* at the time the larvae were found. Staff are currently working with Scott County and the

Minnesota Pollution Control Agency (MPCA) to clean up the site. Although *Ae. albopictus* has not been shown to overwinter north of Chicago, we will intensify surveillance and control efforts at the site this spring to eliminate any *Ae. albopictus* that may have survived the winter. The only prior infestation of this mosquito in Minnesota was discovered and eradicated in 1991, at a waste tire recycling facility in Scott County.

Western equine encephalitis (WEE) surveillance.
During 1996, the District continued WEE surveillance efforts by monitoring three sentinel chicken flocks (20 birds/flock). The flocks were located in the western metropolitan area in Wright, Anoka, and Scott counties. Blood samples were taken from the birds weekly to determine if they had been exposed to the virus. Staff at the MDH laboratory tested the samples, and found no evidence of the virus in 1996. Populations of the WEE vector mosquito (*Culex tarsalis*) were also monitored by staff using evening sweep net and CO_2 trap collections. Numbers were low all season.

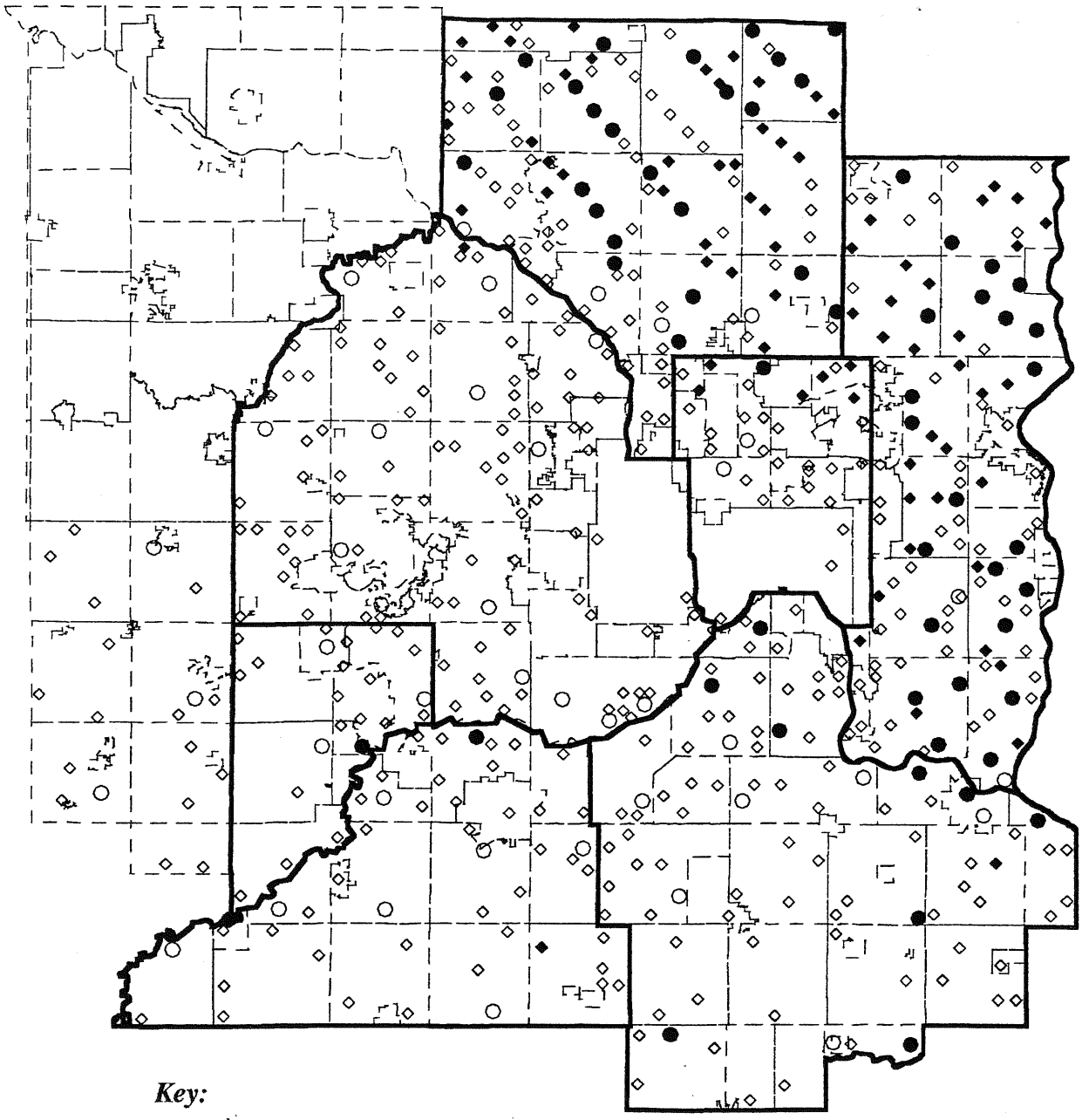
Lyme disease tick and spirochete studies.
We continued sampling the network of 100 sites set up in 1991-1992 to look for changes in black-legged tick distribution over several years. As in previous years, the main sampling method involved capturing small mammals from each site, and removing all attached ticks from them. Almost 800 mammals were inspected this year, and black-legged ticks were found at 30 of the sampling locations. *I. scapularis* numbers and small mammal numbers were much lower than in previous years (by at least 1/2). Most ticks were found in the northeastern part of the District,Washington, Anoka, and northern Ramsey counties (Fig. 2.2). No further *I. scapularis* were found at the southern Scott County location where a single tick was found in 1995.

We also continued cooperative studies with Dr. Russell Johnson of the University of Minnesota to determine the distribution and prevalence of *B. burgdorferi*. Small mammals from six study sites in North Oaks (Ramsey County) were brought to Dr. Johnson to be tested for the spirochetes. North Oaks was chosen for study, as it represents a Lyme disease endemic suburb within the metropolitan area. Lyme disease spirochetes still appear to be quite localized in the eastern woodlots of North Oaks, however the full 1996 results are not yet available.

Lyme disease public education activities continued in 1996. Personal protection measures, tick identification, and black-legged tick distribution were stressed during presentations at each county fair and the State Fair. Staff distributed several thousand copies of a Lyme disease brochure that the MMCD helped develop with the Minnesota Department of Health, as part of a multi-agency Lyme disease education work group. As part of this work group, staff also helped to train public health officials to give presentations on Lyme disease prevention.

Ehrlichiosis Surveillance
In 1995, we began a cooperative study with Dr. Steve Dumler (Johns Hopkins Medical Institutions) to determine if ehrlichiosis is present within the District. This bacterial disease, transmitted by *I. scapularis* ticks, has been associated with human illness and several deaths near Duluth, Minnesota and in northwestern Wisconsin. Sera samples were taken from small mammals that were collected as part of our Lyme disease studies, and tested by Dr. Dumler. Results showed that approximately 10% of the 190 mammals tested had been exposed to the

Fig. 2.2. Presence/Absence Status of Ixodes scapularis at the 545 Sites Sampled by the Metropolitan Mosquito Control District: 1990-1996



Key:

- ● *Repeat Sampling Site; I. scapularis detected*
- ○ *Repeat Sampling Site: I. scapularis not detected*
- ◆ *Single Season Sample: I. scapularis detected*
- ◇ *Single Season Sample: I. scapularis not detected*

bacteria or showed evidence of *Ehrlichia* DNA. These mammals came from 17 different locations in the northeastern part of the metropolitan area. Unfortunately few mammals from the southwestern metro counties were tested.

In 1996, Dr. Johnson tested some of the mammals we collected during our cooperative Lyme disease studies in North Oaks for ehrlichiosis. Results are not yet available.
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In 1996, Dr. Johnson tested some of the mammals we collected during our cooperative Lyme disease studies in North Oaks for ehrlichiosis. Results are not yet available.

2.3. 1997 Plans

LaCrosse encephalitis prevention services will continue to emphasize *Ae. triseriatus* surveillance and control within the Lake Minnetonka region of Hennepin County, due to the recent viral activity in the area. However, we will also begin systematic sampling of woodlots in northern Dakota County to locate and eliminate *Ae. triseriatus* mosquitoes and their breeding habitat. Waste tire removal will also continue to be a priority across the entire District. We will clean up small tire piles that produce *Ae. triseriatus*, and continue to work with the MPCA and county environmental management departments to clean up larger tire piles. We plan to eliminate the Elko *Ae. albopictus* site, and monitor any other sites in the metropolitan area that could produce this mosquito. In addition, we will maintain the current WEE monitoring.

We will also continue the *I. scapularis* distribution study and cooperative Lyme spirochete and ehrlichiosis studies with the University of Minnesota. The Lyme Disease Tick Advisory Board (LDTAB), made up of local scientists and agency representatives with Lyme disease expertise, will be updated on the progress of our Lyme studies during the spring of 1997.

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 augmented by adult mosquito control when necessary. *Aedes* larvae hatch in response to rain with adults emerging at various times during the summer, 10 days to 2 weeks after the rain. Cattail mosquito larvae develop in cattail marshes over twelve months and emerge as adult mosquitoes in June and July.

Floodwater mosquitoes are adept at utilizing the natural resources of the metropolitan area. These same natural resources contribute to the recreation and enjoyment for the citizens living here. The rolling topography provides an unusually high number of highly productive breeding sites for mosquito larvae. Summer rains which replenish the aquifers 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, 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 (*Bti*) are the larval control materials. 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.

Adult mosquito control is a comparatively minor part of the MMCD 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. As specified in the adult mosquito control policy, adult mosquitoes are only treated when a threshold number is exceeded. A description of control materials and summaries of material usage are found in the appendix.

3.3. 1996 Mosquito Control

Cattail Mosquito Control

MMCD crews inspected approximately 2,000 *Cq. perturbans* breeding sites from late-August through November 1995. Larviciding began in February 1996 using Altosid® XR 150-day briquets applied on the ice. Deep sites were treated first and applications continued into April, after the snow melted and staff could see the small holes in the floating mats. A total of 240 acres were treated with Altosid® briquets through April and then 4000 acres with Altosid® 30-day pellets applied by helicopter in late May.

Floodwater Mosquito Larval Control
In 1996, because of the District's decreased budget, the use of 150-day Altosid® briquets was drastically reduced due to the high cost of the briquets and their inconsistent effectiveness. Only 166 acres were treated with briquets. To supplement the reduction in the briquets, ground sites (less than 3 acres in size) were treated primarily with 30-day Altosid® pellets and *Bti* corn cob granules. Approximately 6083 acres were treated with pellets for floodwater mosquitoes in 1996, compared to 3885 acres treated in 1995. A summary of the number of acres treated with briquets and pellets for cattail and floodwater mosquitoes in 1995 and 1996 follows.

Mosquito Control Service	Briquet Acres 1995	Briquet Acres 1996	Pellet Acres 1995	Pellet Acres 1996
Cattail Mosquito	520	166	4,334	4,650
Floodwater Mosquito	6,783	255	3,885	6,083
Total	7,303	421	8,219	10,733

Bacillus thuringiensis israelensis granules were applied to 1752 acres of ground sites. Air sites (3 acres or more in size) were treated with *Bti* corn cob granules by helicopter. Approximately 76,986 acres were treated in 1996, which is less than the 132,773 acres treated in 1995 and the 102,860 acres treated in 1994. This was due to below average rainfall in 1996. The threshold for treatment was 2 larvae per dip in the inner or primary treatment zone of the District, while the threshold in the outer zone was variable depending on the total number of acres breeding mosquitoes and the amount of time and material remaining.

Adult Mosquito Control
Permethrin usage (5,910 acres) was less than usage in 1995 (6,305) and in 1994 (10,499). Resmethrin usage (120,263 acres) was greater than in 1995 (62,199) and in 1994 (40,687). More adult mosquito control operations were targeted at high populations of *Cq. perturbans* and customer identified mosquito annoyance. Also, adult mosquito operations were used more in the outer areas of the District were larviciding operations had been reduced.

3.4. Supporting Research

The following studies were conducted to evaluate present and possible future control methods.

Efficacy Studies
As in past years, staff monitored the efficacy of Altosid® XR 150-day briquets and Altosid® 30-day pellets for *Cq. perturbans* control. Six emergence cages were placed in each of 8 sites treated with the 150-day briquets, 30-day pellets, and in reference sites that have never been treated. Each cage covered approximately one square meter of breeding area within the site. Adult mosquitoes were vacuumed from cages twice weekly from June 6 through August 6. Overall, briqueted sites had a 96% reduction in mosquito emergence, pellets a 99% reduction compared to the untreated reference sites. Both Altosid® briquets and pellets markedly reduced the number of *Cq. perturbans* emerging from treated sites compared to untreated sites throughout the study period (Fig 3.1).

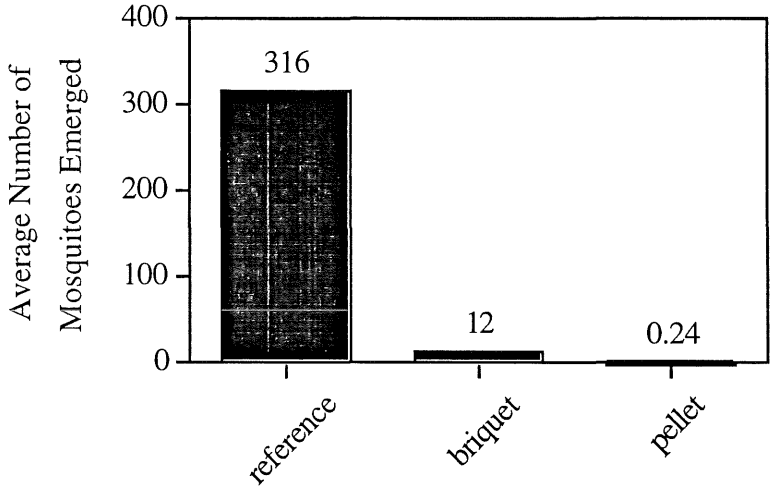


Fig. 3.1 Average number of *Cq. perturbans* collected per week in emergence cages from briquet- or pellet- treated and reference sites, 1996

Altosid® Liquid Larvicide Testing for Use as Spring Aedes Control

A larval control material that has a residual capability can play an effective role in the control of spring species of *Aedes* mosquitoes. MMCD currently uses Altosid® briquets and pellets for residual control of the spring *Aedes* mosquitoes, but Altosid® Liquid Larvicide (A.L.L.) may be an effective and less expensive alternative. Preliminary testing showed that A.L.L. was found to have a residual effect up to 30 days. In 1996 more spring *Aedes* ground sites were treated with A.L.L. and showed promising results. Air applications of A.L.L. were also done, but showed unclear results because sites dried up before tests were completed.

Briquet Site Breeding History

Because of the drastic reduction in the use of Altosid® briquets the Briquet Site Breeding History study was not done in 1996.

Park Study

In June of 1996, the checking and treating of sites with *Bti* corn cob granules in the Minneapolis Parks resumed. Due to dry conditions there were only a few opportunities to treat the sites in these parks. Due to budget reductions that limited resources, field personnel discontinued larval sampling of agency "refused entry" lands (MDNR, USFWS, etc.). Information gathered in the previous 3 to 4 years from sites in these areas should provide some baseline information.

Resistance Testing

Resmethrin resistance trials using *Cq. perturbans* were run using various concentrations of resmethrin to determine EC_{50}, EC_{95}, and EC_{99}. These data will be added to previous years'

data and will serve as a baseline from which to evaluate future years' resistance monitoring.

3.5. 1997 Plans for Mosquito Control Services

Cattail Mosquito
Because *Cq. perturbans* have a limited flight range of 5 miles, control activities will be focused on the most productive marshes near human population centers. Dry conditions experienced in 1996 will result in reduction in the total number of acres treated in 1997. As in past years, briquet treatments will begin in late February. Pellet treatments are made to large cattail marshes, applied by helicopter at a rate of 4 lb/ac, in late May. We anticipate the treatment acres to be half of what we treated in 1996. During the summer months we will monitor the efficacy of the treatments.

Larval Control
The larval treatment strategy for 1997 will be similar to 1996. We will treat ground sites with 30-day methoprene pellets and *Bti* corn cob granules.

In 1997, we plan to use 5 helicopters for the treatment of air sites. In 1996, we reserved the fifth helicopter for use during District-wide broods and for widespread mosquito production. This year we will be distributing the budgeted helicopter acres more evenly between 5 helicopters, which will allow access to all the helicopters at the beginning of each brood. Based on a threshold of 2 mosquitoes per dip, breeding sites in highly populated areas will receive treatments first, during a wide scale mosquito brood. Treatments will then be expanded into less populated areas where treatments will be based on a higher dip count of mosquito larvae.

The primary control material will again be *Bti* corn cob granules, and the amount of material budgeted will be similar to 1996. Thresholds are set to maximize the limited time available to treat each brood. Resources will be used to the extent needed to control mosquitoes until mid-season, and then resources will be allocated to control annoyance mosquitoes according to the length of season and remaining resources. This may result in drastically reduced annoyance control later in the season. Regardless of annoyance levels, we will maintain sufficient resources to protect the public from normal levels of disease risk and set aside a fund earmarked for emergencies.

Approximately 2,000 acres of spring *Aedes* sites in the North region will be treated with A.L.L. by helicopter.

In 1997, we again do not plan to treat floodwater mosquitoes with 30-day pellets by helicopter, due to the unresolved difficulties in applying the low dose (2.5 lb./ac.) in a uniform manner. However, we continue to attain fairly uniform applications at the 4 lb./ac. rate used for cattail mosquito control. We will continue working on the calibration of the application system to uniformly apply pellets from helicopters for floodwater mosquito treatments.

Adult Mosquito Control
Both permethrin and resmethrin use in 1997 will be budgeted similar to the use in 1996. We will direct our adult mosquito control treatments where they provide the greatest customer benefit, such as, high use park and recreation areas, areas with high cattail and *Aedes* mosquito

numbers, public functions, citizen mosquito annoyance reports, and high risk areas for mosquito-borne disease.

The adult mosquito control information line (643-8383) will be in use again this year. The use of the information line enables citizens to hear a daily recorded message on where adult mosquito control operations are taking place (within parks, for public events, and neighborhood evening fogging operations). This provides a greater service to the citizens since they do not have to be at home to receive our call. However, staff will continue to call citizens who wish to be notified in advance of adult mosquito control treatments.

Vector Mosquito Control

Field staff will be responsible for control of *Ae. triseriatus* (LaCrosse encephalitis vector) and *Cx. tarsalis* (western encephalitis vector), and again this year will also be responsible for monitoring vector populations. For a more detailed discussion of vector monitoring techniques, see the Vector-Borne Disease Management section.

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 coordinate and process 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. We use 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. 1996 Summaries

Rainfall

Technical Services maintains a network of 82 rain gauges located throughout the District to monitor rainfall amounts. A one-inch rainfall can produce a brood of floodwater mosquitoes. Staff read the gauges immediately after a rainfall and areas that receive high rainfall are sampled for mosquitoes first. This rainfall information also forwarded to the Minnesota Department of Natural Resources State Climatology Office to supplement their network.

Average rainfall per gauge in the District in 1996 was 13.27 inches (Fig. 4.1) from May 1 through September 30. This is 31% lower than the 38-year average District average of 19.27 inches (Appendix 4). The Dakota County average was higher than other counties and above average mainly due to localized heavy rains in August. The remaining counties were below the district average with similar amounts.

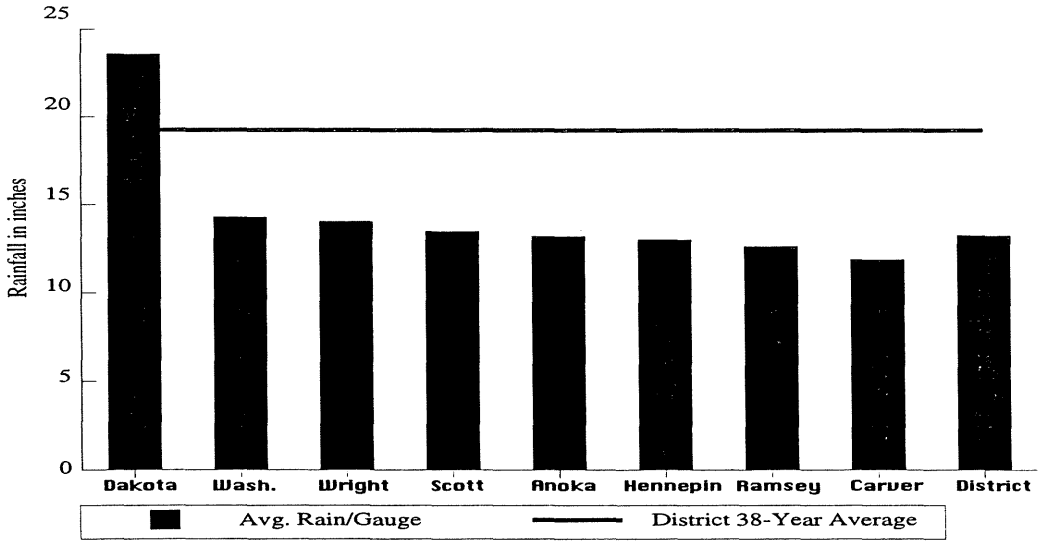


Fig. 4.1. Average amount of rainfall received in each Division from May through September. Solid line depicts the 30-year District average from May through September.

This year we experimented using NEXRAD radar imaging for rainfall. The field offices were equipped to read Nexrad images on their computers to view areas of high rainfall. The NEXRAD system was not always successful and we still relied on the rain gauge readings to determine where to send field crews.

Larval Collections

During a brood, we quickly process larval samples and communicate the results to field personnel so they can perform treatments. Samples from sites to be treated by helicopter are given priority over sites that can be treated by an inspector in the field. Technical Services seasonal staff are trained to identify the high priority larval samples and were sent to field offices to process samples during a brood. This process was successful because it eliminated the need to immediately bring the samples to our Entomology Laboratory, located in the District Headquarters, for identification, which expedited helicopter treatments.

In 1996 staff identified approximately 15,000 larval collections. In the past 3 years we have had an average of 6-8 small broods and 3-4 medium to large broods. Below average rainfall in 1996 produced only 6 broods of mosquitoes; 1 large brood from May 19 rains, 1 medium brood (June 16-17) and 4 small broods.

Adult Collections—New Jersey Light Traps

New Jersey light traps operate at night with a 25-watt light bulb used as an attractant. Traps are turned on and off by a timer and are emptied daily for 20 weeks from May to September. MMCD has used New Jersey light traps since 1960 and they are the standard collection devices for many mosquito control districts. In 1996, we operated 18 traps in various areas inside and outside the District (Fig. 4.2). These collections monitor disease vector mosquitoes and give us historical data of mosquito population fluctuations. The processing of these samples is still in progress.

Evening sweep net collections

The human-baited sweep net collection data is used to determine annoyance levels and species present at the peak mosquito activity period. Employees took 2-minute sweep net collections in the evening in their yards once per week for 17 weeks. The collections were taken at 5 minutes after the end of twilight, which is about 35-40 minutes after sunset. The number of sweep net collections varied from 81-145 per night. We recruited five non-MMCD volunteers who mailed in their collections for analysis.

Coquillettidia perturbans was the predominant species collected in the evening sweep net collections, with an average of 2.23 mosquitoes per collection (Table 4.1). *Aedes vexans* was the second most common species, averaging 1.24 per collection. The higher percentage of *Cq. perturbans* may be skewed by the absence of *Ae. vexans*, due to the lack of rainfall. The 1996 average of *Ae. vexans* is much lower than in 1995 when we had slightly above normal rainfall.

Figure 4.2 New Jersey light trap collection locations, 1996.

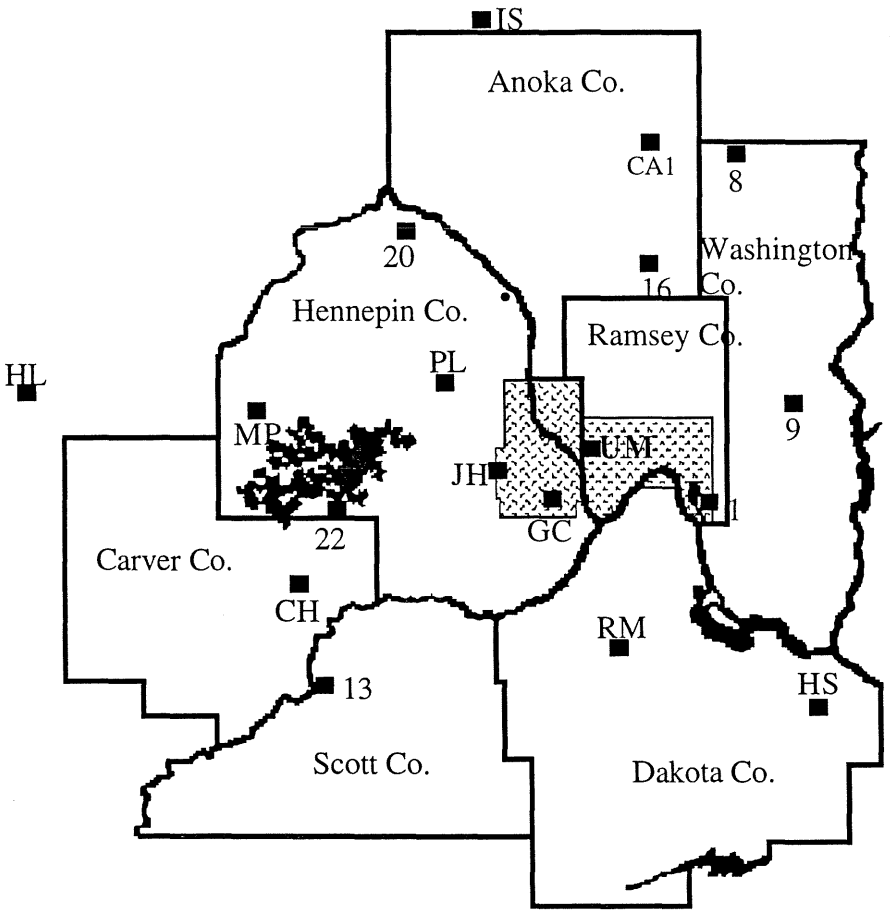


Table 4.1. Season's average number of mosquitoes collected per night in sweep collections.

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

The number of spring *Aedes* was up slightly in 1996 from the previous two years, but the amount collected is very low compared to *Ae. vexans* or *Cq. perturbans*. The numbers of our two disease vector mosquitoes (*Culex tarsalis* and *Ae. triseriatus*) were very low in the sweep collections. The average levels of mosquitoes per sweep net collection during the 1996 season varied throughout the District (Fig. 4.3). Higher levels of mosquitoes were collected outside the inner treatment zone, while inside the treatment zone most of the mosquito counts were between zero and three mosquitoes per 2 minute sweep collection.

The one major brood of *Ae. vexans* occurred in June (Fig. 4.4) as a result of a storm on May 19 that produced 1.5-3.0 inches of rain. The rest of the season was below average for rainfall and only a few small broods of *Ae. vexans* occurred. As expected, *Cq. perturbans* emergence began in mid-June with highest levels detected from early to mid-July (Fig. 4.4).

Evening CO_2 trap collections

We use CO_2 traps to monitor mosquito population levels during the peak mosquito activity period and to monitor disease vector mosquito species. The traps run for 2 hours, ending 10 minutes after the sweep net collection. We increased the number of traps operated from 29 in 1995 to 46 in 1996.

The CO_2 traps collected predominantly *Ae. vexans* with an average of 22.87 mosquitoes per collection (Table 4.2). This average is significantly lower than the previous two years. *Cq. perturbans* averaged 17.47 mosquitoes per collection, slightly higher than in 1995. Spring *Aedes* are collected more frequently in the CO_2 traps than the sweep nets and the average this year was the same as in 1995. The CO_2 trap collects *Cx. tarsalis* more efficiently than the sweep net because this species is not usually attracted to humans. Levels of *Cx. tarsalis* were low in 1996.

Fig. 4.3. 1996 season average number of mosquitoes per 2-minute sweep net collection at end of twilight

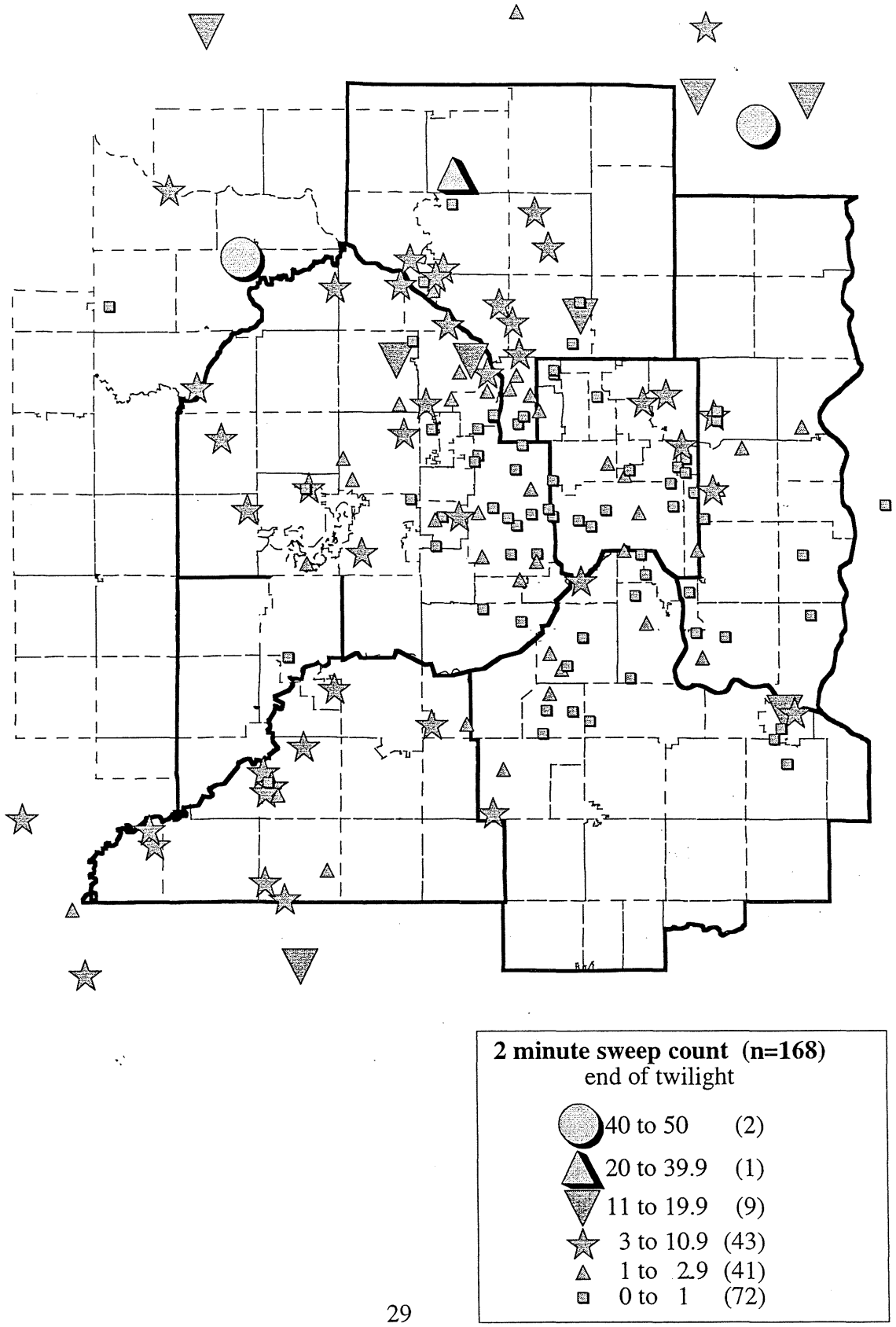


Fig. 4.4 Average number of *Ae. vexans* and *Cq. perturbans* in evening sweep net collections, 1996.

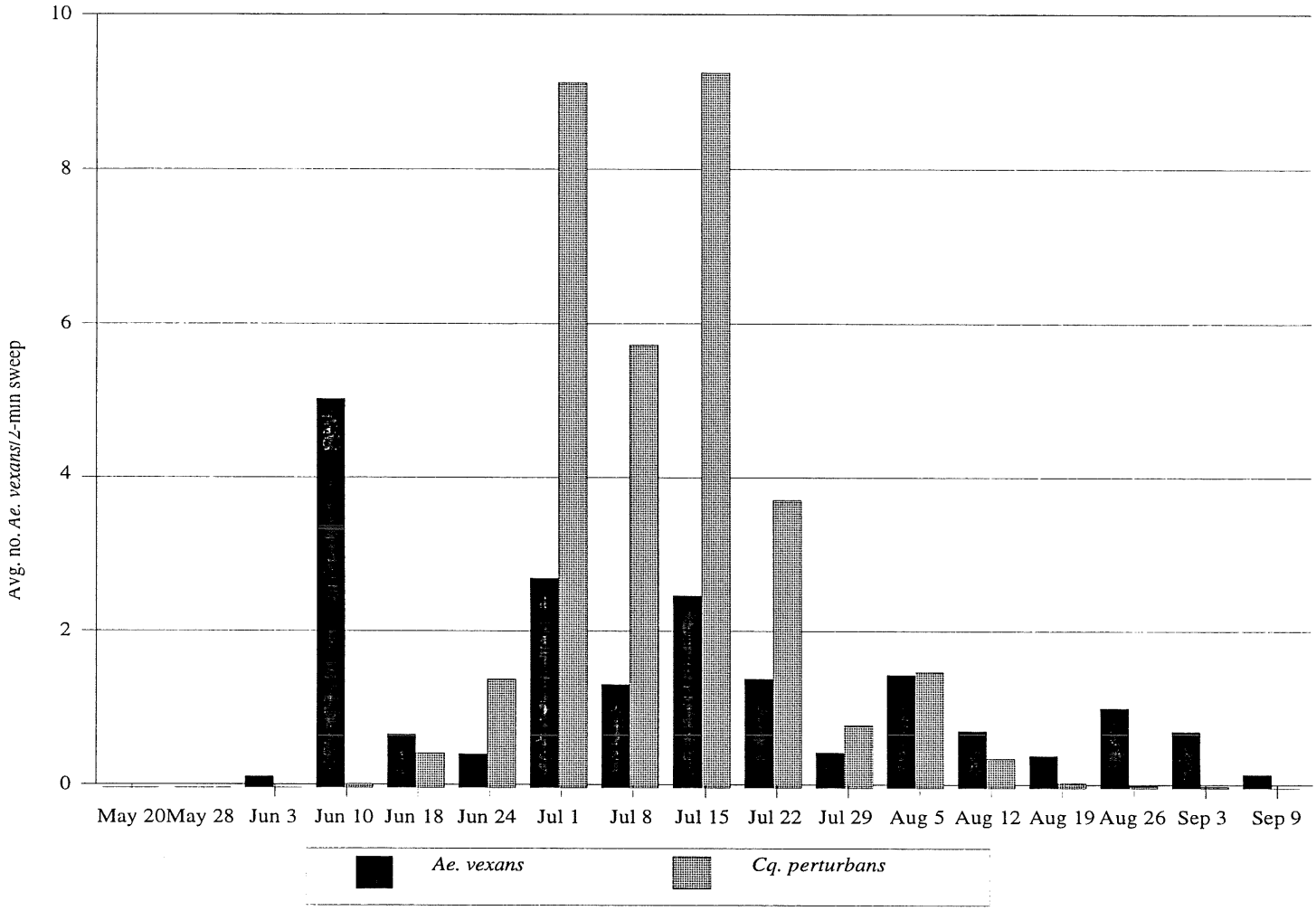


Table 4.2. Season's average number of mosquitoes collected per night in CO_2 collections.

Species	1996	1995	1994
Ae. vexans	22.87	139.54	54.44
Cq. perturbans	17.47	15.47	25.68
Spring Aedes	0.27	0.24	0.12
Cx. tarsalis	0.05	0.97	0.05
Ae. triseriatus	0.27	0.09	0.04

The season average number of mosquitoes collected in CO_2 traps was higher in the northern part of the District (Fig. 4.5), which is generally outside of our primary treatment zone.

The CO_2 traps reflected the same seasonal distribution for *Ae. vexans* as the sweep nets (Fig. 4.6). The *Cq. perturbans* season peak is one week earlier in the traps than in the sweep nets and a more normal distribution is evident. The addition of 17 traps this year helped reduce the variability in CO_2 trap results we had in 1995.

4. 3. Plans for 1997

We plan to reduce the number of New Jersey light traps from 19 to 6-10. Technical Services is in the process of re-evaluating our adult monitoring services. Due to increased taxonomic tasks and reduced personnel the past few years, the trap collections were backlogged and processed in the fall and winter and the data was not available until a year after collection. Because our goal is to have "real-time" data, we considered the function of the New Jersey light traps and our ability to process them. Six light traps, which have been in the same location since the start of the District, will be maintained. Up to four more traps will be distributed throughout the District to monitor for *Cx. tarsalis* and to fill in holes in the data. We plan to increase the number of CO_2 traps and place some in permanent locations so they can be used to compare mosquito populations yearly.

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

Fig. 4.5. 1996 season average number of mosquitoes per 2-hour evening CO2 trap collection

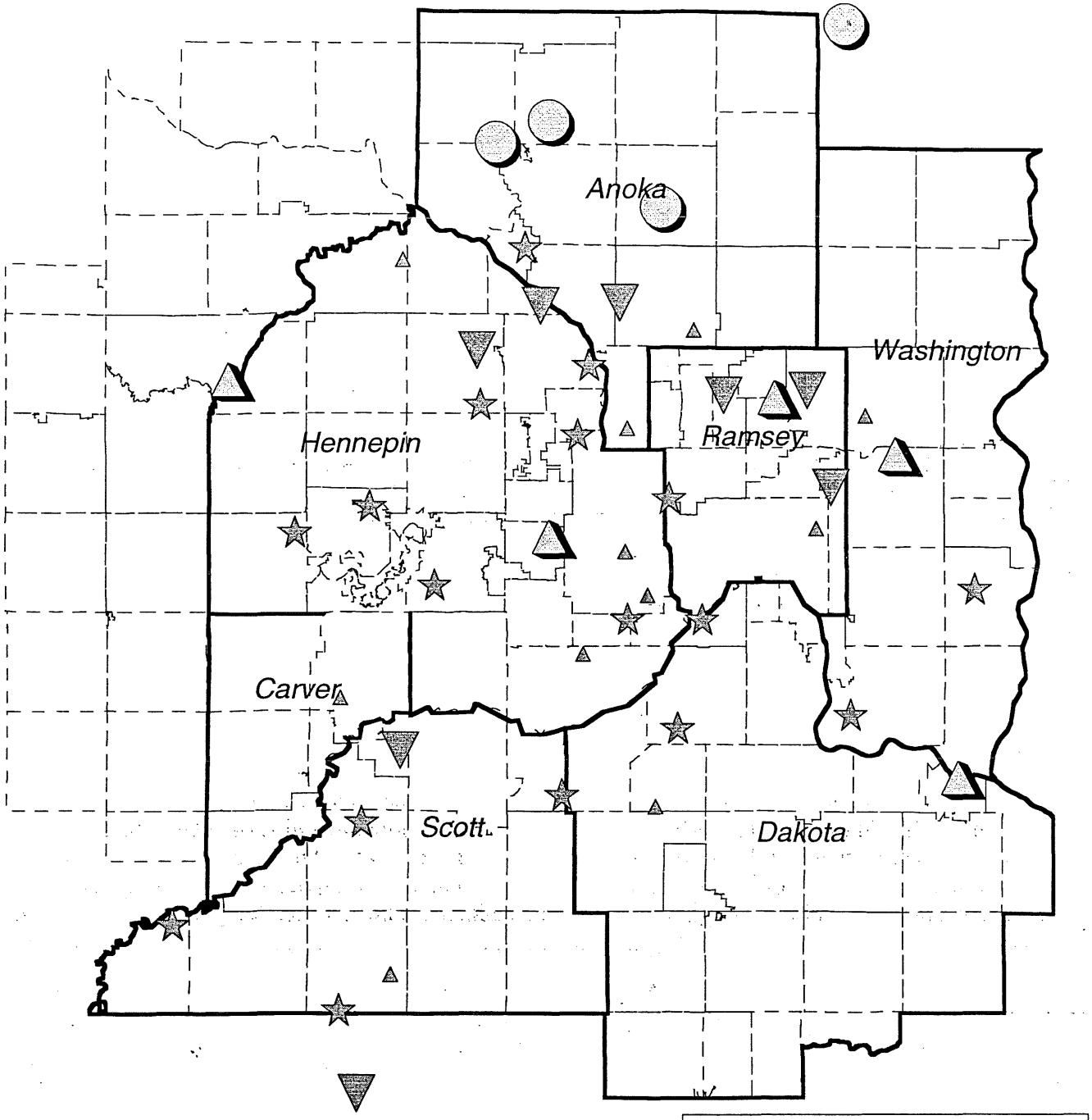
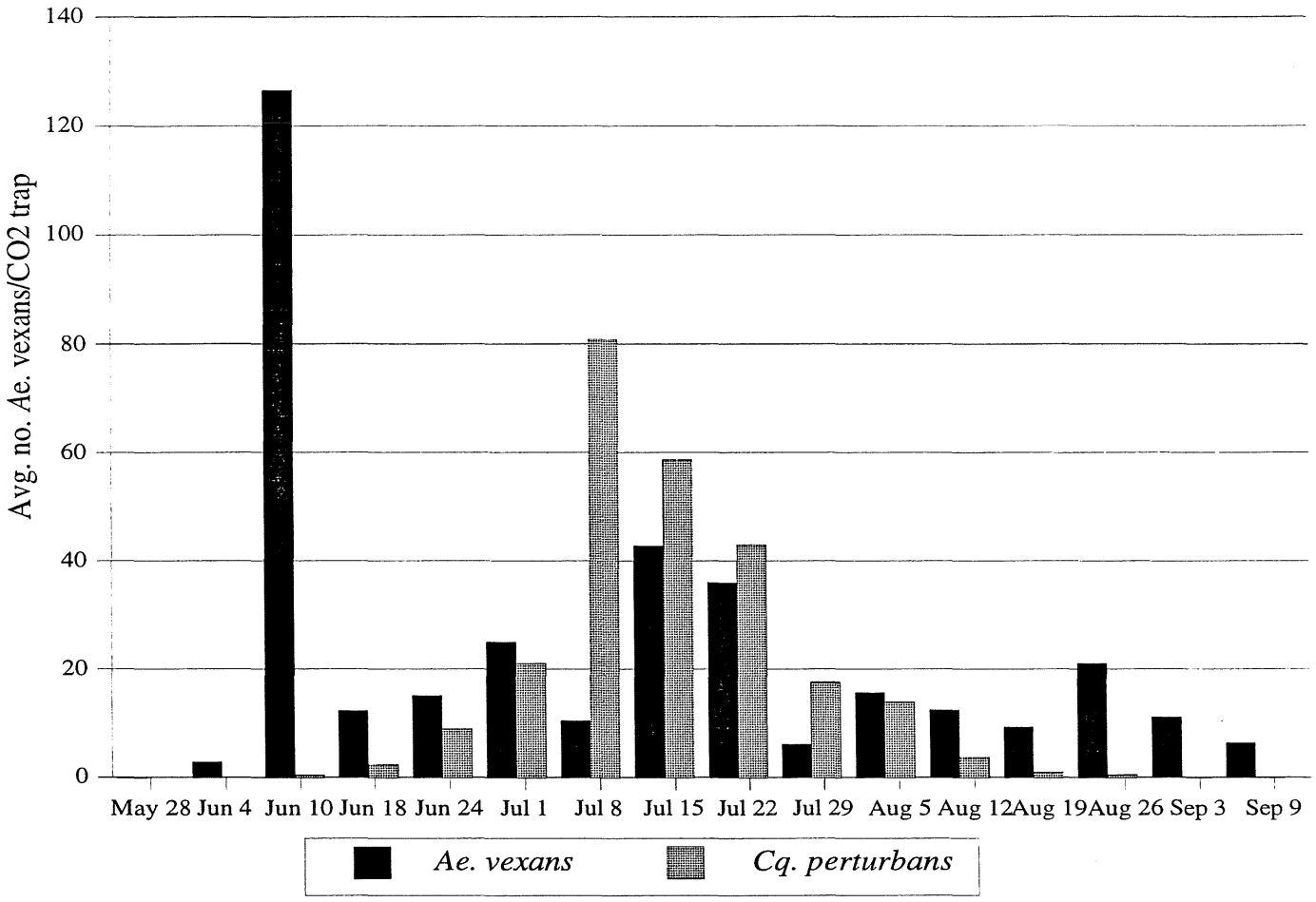


Fig. 4.6 Average number of *Ae. vexans* and *Cq. perturbans* in evening CO_2 trap collections, 1996.



5. Quality Assurance

5.1. Background

The Quality Assurance (QA) of control materials is an integral part of MMCD services. The Technical Services Team provides project management and technical support, and the regional process teams provide coordination of field operations and data collection. 1996 projects include:

- Incorporation of QA tasks into regular field staff operations.
- Acceptance testing of control materials
- Efficacy of control materials
- Evaluation of new control materials

5.2. 1996 Projects

1996 was a transitional year for QA functions. Due to the District's reorganization, the former QA program lost one full time staff member and six seasonal inspectors. Many QA functions were to be incorporated into the services provided by each regional process team. Therefore, we concentrated on transferring the specialized efficacy monitoring tools and calibration techniques into the process teams' regular operations.

This year was also a transition year for the District's control materials. Because of the budget reduction, control strategies for small hand-treated sites changed from using the Altosid® briquet to using other control materials, primarily *Bti* granules and Altosid® pellets. Briquet use was reduced from 7,303 acres in 1995 to 422 acres in 1996.

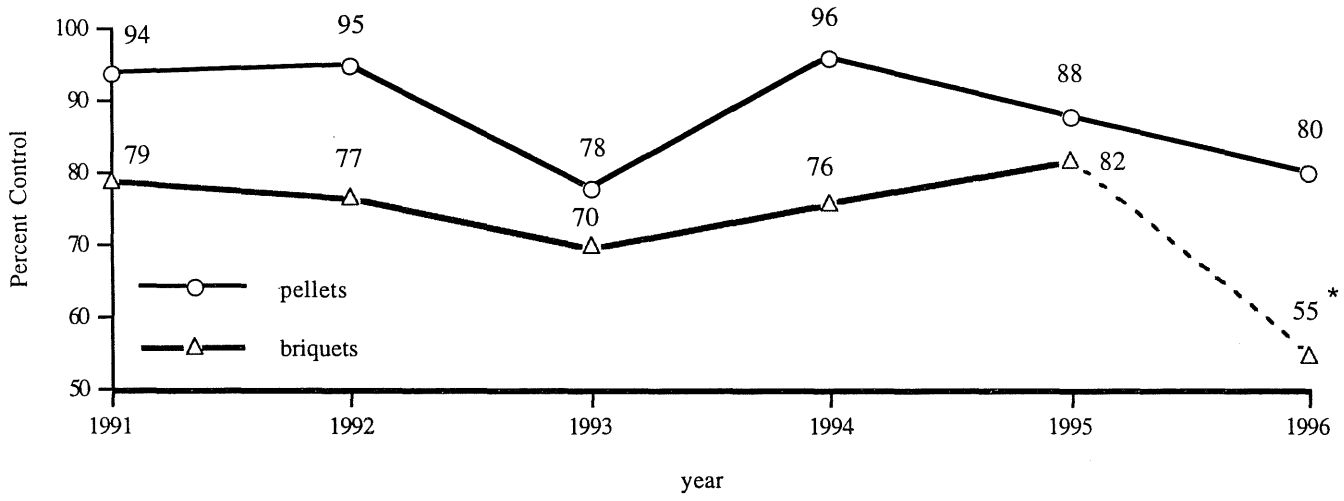
As mentioned in the Mosquito Surveillance section, below normal rainfall experienced this season resulted in only 6 broods of mosquitoes compared to an average of nine to twelve broods per year. The low number of broods limited the amount of testing that was completed in 1996.

Acceptance Sampling of Altosid (methoprene) Briquets and Pellets
During 1996, we collected random samples of briquets and pellets from shipments received from Sandoz Agro (formerly Zoecon Corporation) and had them analyzed for methoprene content by an independent testing laboratory, Legend Technical Services, Inc. The analysis method used was CAP No. 311, "Procedures for the Analysis of S-Methoprene in Briquets and Premix" furnished by Sandoz Agro, Dallas, Texas. Of the 20 briquets analyzed, all were at or above the label claim of 1.8% methoprene (ave. 2.10, SD 0.053). Of the fifteen pellet samples analyzed, all were at or above the label claim of 4.0% methoprene (ave. 4.25, SD 0.118).

Efficacy of Control Materials*: *Altosid ®briquet, pellet and liquid applications
Materials and Methods: Altosid® XR briquets were applied by hand to 865 breeding sites totaling 421 acres. Altosid® pellets were applied by helicopter, seeder or hand to 22,219 sites totaling 10,733 acres. Altosid® Liquid Larvicide (SR-20) was applied by helicopter, sprayer or hand to 617 sites totaling 565 acres. We used the pupal collection method to assess the field performance of methoprene products. This method is recommended by Sandoz Agro.

Results and Discussion: Briquet usage changed significantly this year. Briquets were predominately used as a specialized material for sites with a high difficulty to treat or access. Due to the significant reduction of briquet usage, briquet bioassays were given a lower priority which resulted in insufficient monitoring data in 1996. Average control declined to 55% (n=5) but results were negatively affected by treating only the more difficult sites. Pellet usage increased but application remained similar to previous seasons and average control was 80% (n=66). Figure 5.1 depicts the percent control achieved by Altosid® briquets and Altosid® pellets over the past five years. Altosid® Liquid Larvicide usage changed from primarily a hand-applied small site material to a helicopter-applied large site test material. Average control decreased from 77% to 56% (n=27) but lower results can be attributed to testing under a wide variety of conditions.

Performance of methoprene products must improve if MMCD is to achieve the target rate of at least 95% control in treated mosquito breeding sites.



* Insufficient data (n=5) collected in 1996

Figure 5.1 Percent control of Altosid® briquets and Altosid® pellets, 1991-1996

Efficacy of Bti Corncob Applications

Materials and Methods: Vectobac brand *Bti* from Abbott Laboratories was the main *Bti* product applied by helicopter in 1996. The *Bti* corncob granules were the 5/8" mesh size. The application rate varied throughout season; in water temperatures below 50° F, the application rate of 8 lbs/acre is used to compensate for the slower feeding activity of mosquitoes in cold water. After water temperatures rise above 50° F, the rate is lowered to 5 lbs/acre without a

significant loss of efficacy. As vegetation grows and the water's organic content rises, the rate is raised to 8 lbs./acre to compensate for these environmental changes.

Efficacy was measured by foremen and seasonal staff in 16 % of the 2,884 sites treated with *Bti* during the year. The evaluation method was pre-treatment and post-treatment larval sampling. This method consists of taking a series of dips in breeding sites soon after a rain event and estimating the average number of mosquito larvae per dip (pre-treatment count). The process is repeated in a randomly selected sample of sites 24-48 hours after treatment (post-treatment count). Counts are recorded on an airwork treatment form (FF-10) and control percentages calculated as a percent reduction based on the difference between the two counts.

Results and Discussion: The pre/post counts showed average control of 78% (n= 231) for the spring's 8 lbs/acre rate, 87% (n=98) for the summer's 5 lbs/acre rate, and 88% (n=74) for the later summer's 8 lbs/acre rate. The spring's low control rates were investigated but all additional randomly sampled field sites showed good control (90% mortality). The spring control rate is lower as the result of a change in control strategy in 1996. In previous years, the 5 lb rate was used operationally from early spring until mid summer. Therefore, the 8 lb rate was not used under these tougher spring conditions and the result was reflected in a lower than average control rate. The improved control of the 5 lb/acre rate can also be attributed to seasonal rate change. The following figure depicts efficacy of *Bti* corncob from 1991 through 1995 and the results of 3 trials conducted at different dosage rates in 1996.

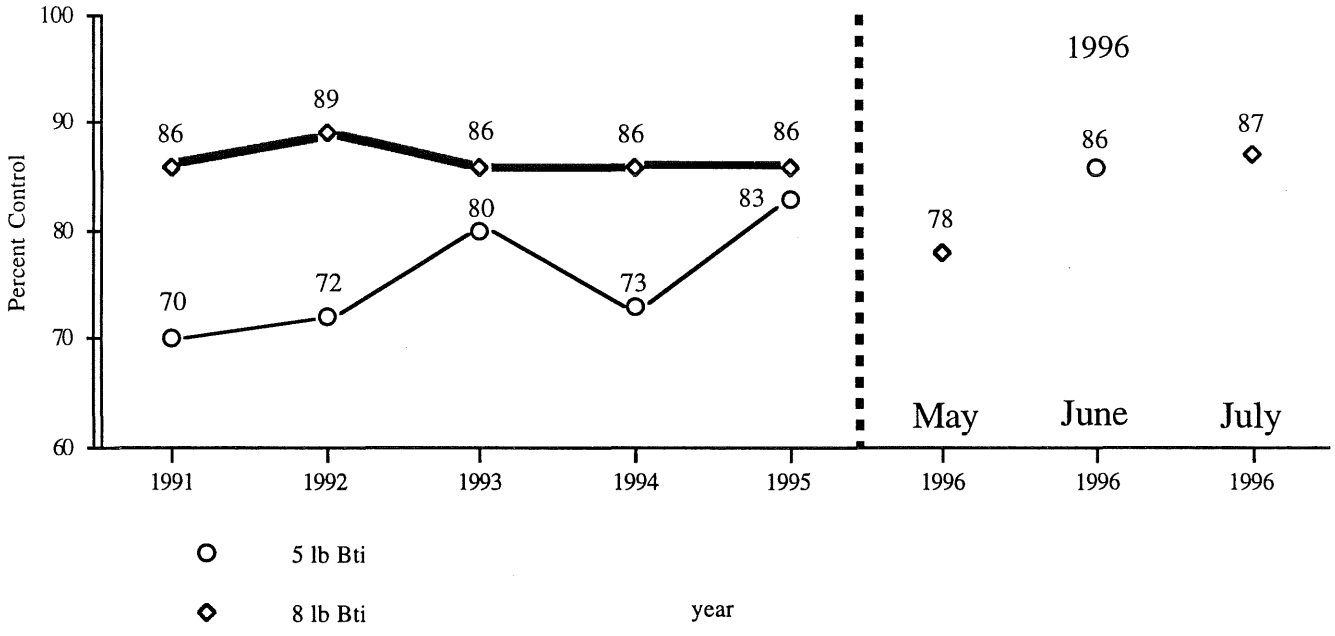


Fig. 5.2 Average percent control of *Aedes* mosquitoes with *Bti* corncob granules from 1991-1995 and percent control of *Aedes* mosquitoes at the 5 or 8 lb/acre rate in 1996.

Efficacy of Resmethrin and Permethrin Mixture Applications
Adulticide usage was expanded slightly to increase the District's ability to respond to customer requests and public events. Permethrin 5.7% mixture was applied by backpack to vegetation as a barrier treatment (mainly in public parks) and their treatments covered 5,910 acres. Resmethrin applications were applied primarily during peak mosquito activity periods by truck foggers or hand-held units. Resmethrin was applied as a Ultra-Low Volume (ULV) cold fog and treatments covered 120,263 acres in 1996.

Prior to any adulticide treatment, it is MMCD policy to first evaluate the area to see if mosquito counts meet treatment threshold limits. The current threshold limits are two mosquitoes in five minutes for slap counts or 130 mosquitoes collected in an overnight CO_2 trap collection. Pre- and post- treatment counts are taken to evaluate the overall reduction of mosquitoes. The average adult mosquito reduction in MMCD treated sites was 56.9% (n=20).

MMCD expanded its use of CO_2 traps (baited with dry ice) for pre- and post- treatment collections. This sampling method provides the District a more standardized measurement than the widely used slap count and will assist us with treatment decisions and resource allocation. The information gathered from the CO_2 trap pre- and post- treatment collections are used to augment our monitoring program to give a more detailed District distribution of adult mosquito populations.

Evaluation of New Control Materials
The District as part of its Continuous Quality Improvement process desires to continually improve our control methods. District's policy is to attempt to use the most environmentally friendly products possible and still achieve acceptable control rates. As part of this process, we certify materials acceptable with small-scale evaluations before using the product operationally.

Garlic Oil: This all natural material was tested as adult mosquito area repellent. This material could be used to treat areas where public land is in close proximity to fish bearing waters (e.g., Rambling River Park, Farmington) or where citizens had expressed concern with our adulticides (e.g., organic farms). Preliminary testing (n=7) showed no significant reduction of adult mosquitoes but the District will continue limited evaluations in 1997.

Aquabac® *Bti* Corncob Granules and *Bti* Liquid: This newly available brand of *Bti* was tested for the purpose of certifying the products for the 1997 control material bid process. Due to the reorganization of the District, the purchase of the Aquabac® products was purposefully delayed until July. The lack of rain events after receiving the products limited our evaluations. Preliminary testing of the granules for mosquito control showed encouraging results (92% control) (n=12) but staff felt the 1996 testing was insufficient for certification. Aquabac *Bti* granules testing will continue in 1997.

Aquabac® XT Bti Liquid: The liquid *Bti* was purchased for evaluation as a black fly control material. After receiving MN DNR approval for evaluation in the Minnesota River, black fly populations in the test site never reached treatment threshold limits and testing was not done. Certification testing will be completed in 1997.

AquaPermanone: This water-based permethrin ULV adult mosquito control product was

tested as a possible alternative to our currently used mineral/soybean oil-based permethrin mixture. The water carrier would be more economical but limited results (54% reduction)(n=3) encouraged more evaluation.

Biomist 3-15: This oil-based permethrin/Piperonyl Butoxide (PBO) ULV adult mosquito control product was evaluated as a possible alternative to our currently used products. Product was received in July and minimal testing occurred due to low adult mosquito populations. A 45% (n=4) reduction of adult mosquitoes was observed but staff has encouraged more extensive testing be completed in 1997.

Flak 2-2: This oil-based permethrin/PBO ULV adult mosquito control product was received in July but we were unable to conduct tests due to low mosquito levels. This product will be evaluated in 1997.

5.3 Plans for 1997

Quality Assurance processes will continue to be incorporated into the regular operations of the regional process teams. An 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 in 1997 and will be evaluated throughout next season. The most promising of these materials, LarvX, a *Bti*-coated sand granule and Laginex, a water mold fungus (*Lagenidium*) will be evaluated in 1997 in conjunction with the various other control materials listed previously.

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 which develop in the small streams and large rivers during the spring and summer are monitored using standardized sampling techniques. Sites where the population reaches a treatment threshold are treated with liquid *Bti*. The small stream program began in 1984. The large stream program began with experimental treatments and non-target impact studies in 1987, but a full-scale treatment program did not go into effect until 1996. Figure 6.1 depicts the larval sampling locations for both small stream and large river black fly control services.

6.2. 1996 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.

More than 150 potential *S. venustum* breeding sites were sampled in mid April in order to determine larval density using the standard grab sampling technique developed by the MMCD in 1990. Treatment decisions were based on a threshold of 70 *S. venustum* per sample. A total of 74 sites on 14 streams met the threshold and were treated once with *Bti*. A total of 28.6 gallons of *Bti* was used (Table 6.1).

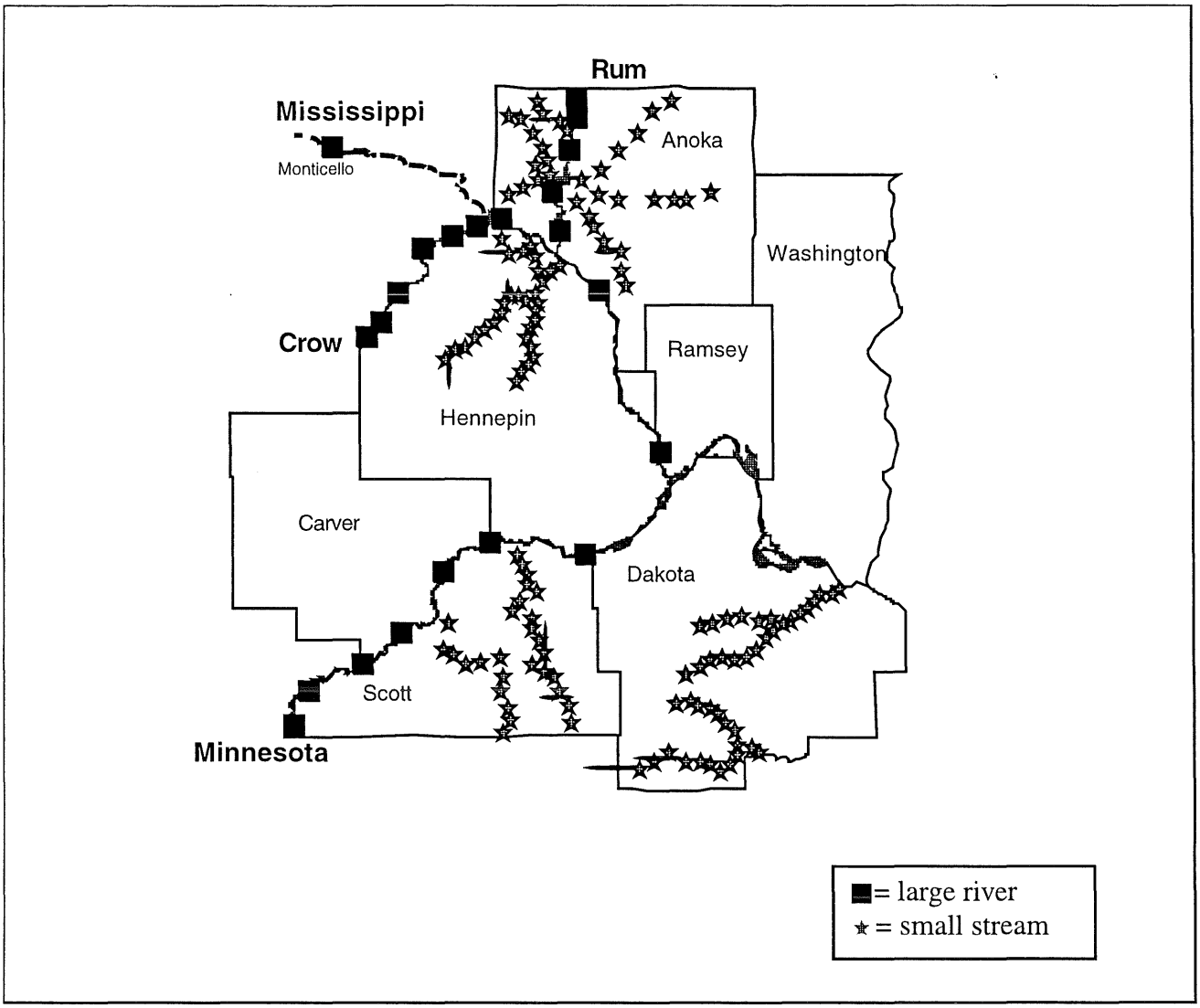
Table 6.1. Summary of *Bti* treatments for black fly control by the MMCD in 1996.

Water body	Number of application sites	Total number of treatments	Gallons of *Bti* used
Small streams	74	74	28.64
Mississippi River	2	9	912.50
Crow River	2	5	107.50
Minnesota River	7	21	1822.60
Rum River	4	32	153.50
Total	89	141	3024.74

Large River Program

There are 3 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 *S. johansenni* breed primarily in the Crow and Minnesota rivers. These species are most abundant in May and June, although

Fig. 6.1 Black fly larval sampling locations for large rivers and small streams, 1996-1997.



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 non-target 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.

The black fly population density at each treatment location was measured every 7 days using artificial substrates at a total of 21 sites on the Rum, Mississippi, Crow and Minnesota rivers. The treatment thresholds used in 1996 were the same as those used since 1990.

A total of 2,996.1 gallons of *Bti* were applied to the large rivers for control of black fly larvae in 1996. This was 500 gallons less than was used in 1995 and around 1000 gallons less than 1994. The primary reason that less material was used in 1996 was lower flows in the rivers due to less rainfall.

Adult Population Sampling

The adult black fly population was monitored in 1995 at 48 standard locations throughout the MMCD using the over-head net sweep technique established in 1984. Samples were taken twice weekly from early May to mid-September, generally between 8 and 10 AM. The number of sampling locations was reduced from 99 to 48 stations in 1995. The 48 stations were randomly selected from the original list of 99 stations. The mean number of adult black flies collected at the 48 stations v. 99 stations in each year between 1984 and 1994 were not statistically different.

The average number of all species of adult black flies captured in 1996 was 0.64, which was the lowest average adult count observed since sampling began in 1984 (Table 6.2). This low adult count is believed to be related to effective larval monitoring and efficient control, as well as the low flow conditions in the large rivers that occurred during the summer. Peaks in black fly adult activity within the MMCD occurred in late May/early June, early July and mid-September. These peaks were comprised primarily of *S. luggeri.*

The most abundant black fly collected in the over head net-sweep samples in 1996 was *S. luggeri*, comprising nearly 80% of all adult black flies collected. *Simulium luggeri* was most abundant in Anoka County in 1996, as it has been in all previous years of the program. This is due to the close proximity of the Rum and Mississippi rivers. *Simulium meridionale*, the second most abundant black fly in the MMCD in 1996, was most commonly found in Carver and Scott counties. These two counties are near the Minnesota River which is *S. meridionale's* major breeding habitat in the MMCD.

The average number of adult *S. venustum* captured in 1996 was 0.03, which is similar to the results of the previous 11 years of the program. As in previous years, *S. venustum* comprised a very low percentage of the total black fly population that was collected. The number of *S. venustum* captured in the net-sweep samples always is quite low and is not believed to be representative of the actual population density. This is due to the fact that samples are averaged for the entire field season but *S. venustum* adults are rare after late May because there is only one, early spring generation. However, this method allows for comparison of adult abundance between years. Studies will begin in 1997 that will lead to a better estimate of the adult *S. venustum* population in the MMCD.

Non-target Monitoring_

Processing of the non-target monitoring samples collected on the Mississippi River in 1995 was completed in 1996. The data indicate that since the start of the *Bti* treatments on the Mississippi River in 1990 the only major change observed in the invertebrate community that is collected on multiplate samplers has been a decline in the black fly population and an increase in the hydropsychid and chironomid populations. Samples will be collected monthly from the same reference sampling stations in the Mississippi River again in 1997.

Table 6.2. Annual mean number of black fly adults captured in over-head net sweeps in bi-weekly samples taken at 48 standard sampling locations throughout the MMCD between mid-May and mid-September. The first operational treatments of the Mississippi River began in 1990 at the Coon Rapids Dam. 1988 was a severe drought year and limited black fly production occurred.

year	All species[1]	*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	1.60	1.54	0.05	0.00
1989	6.16	5.52	0.29	0.18
1990	6.02	5.70	0.01	0.24
1991	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

[1]All species includes *S. luggeri*, *S. meridionale*, *S. johansenni*, *S. vittatum* and *S. venustum*.

The final report on production of the stonefly *Paragnetina media*, stonefly community composition and stonefly standing crop in the Rum River was completed in 1996. Results of this study suggested that *Bti*-control of black flies has not negatively impacted *P. media* production, stonefly standing crop, or the community composition of stoneflies in the Rum River.

6.3 Black Fly Control Services -1997 Plans

Our 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 80 larvae per sample. We will begin a study to more effectively sample *S. venustum* adult and will continue to collect and process non-target monitoring samples in the Mississippi River.

7. Supporting Work

7.1 1996 Projects

Public Opinion Survey - 1996

A telephone survey of 400 metropolitan area residents (5% margin of error) was done from July 23 through July 30, using mostly the same questions used in 1994. Results were similar to 1994, with some changes: 79% of respondents rated the importance of controlling mosquitoes 5, 6, or 7 on a 7 point scale (1 = not important, 4 = neutral, 7 = very important), up from 72% in 1994. The percent of respondents agreeing that "MMCD funding should be increased" was up significantly, from 32% in 1994 to 42% in 1996. People who reported being bothered by mosquitoes more often were more likely to consider MMCD important and a good buy, and to support increased funding. The percent "somewhat" or "very" satisfied with MMCD's efforts to control mosquitoes was 53%, up from 48% in 1994; 13% expressed dissatisfaction (15% in 1994). Of those dissatisfied, most wanted increased control, but did not feel that MMCD reduced the mosquito problem in their neighborhood, and were less likely than satisfied respondents to support increased funding.

Geographic Information System Development

One of the main goals for this project for 1996 was expanding the use of GIS software and concepts to more MMCD staff. A major purchase of computers in 1996, resulting in a computer for every full-time staff member, has made it possible to expand use of this technology. In 1996 and early 1997 field staff entered their master lists of breeding sites in the District, which not only enabled better understanding of control needs, but can be used as a data layer for future GIS site entry. Methods to automate the production and use of field maps using USGS digital orthophotos and street maps were developed and demonstrated to staff and other agencies. We are working on collecting existing digital wetlands boundary information from other agencies to reduce digitizing work for our staff. The current plan is to begin a major project of on-screen digitizing of breeding sites in the fall of 1997. We are also participating in the Metro GIS initiative, a major effort to make information that many government units collect or use, more easily accessible to increase efficiency and lower costs. A key advantage of computer based mapping is the ability to use up to date street files produced by other agencies. Through the Metro GIS initiative, a metro street base will soon be available that should be very useful to MMCD's mapping.

In 1996 District offices were connected to the Internet, allowing field staff to download NEXRAD rain maps to help guide control efforts. We anticipate some technical aspects will need work, and hope to automate as much of the process as possible. We are also exploring ways to work with the data from the NEXRAD images, e.g., calculating average rainfall for a section or township for use in other analyses.

Wetlands Conservation Plan

Diann Crane and Kurt Pennuto participated in the planning process for the development of the state's Wetland Conservation Plan. They provided input in the developing stage of the State Wetlands Conservation Plan and participated in work groups. The Wetland Conservation Plan should be finalized in spring 1997.

Nontarget Impact Assessment
On Dec. 5, 1996 the Scientific Peer Review Panel (SPRP) presented their report on nontarget impacts of mosquito larvicides to the Environmental Quality Board (EQB). Funding for continuation of the SPRP designed long term study in Wright County has been approved. An in depth discussion of the background and planning process for the current study is in the appendix.

Interagency Panel on MMCD Effectiveness
The work of the Interagency Panel on MMCD Effectiveness is finished and members of the panel presented their findings on the District to the EQB on Dec. 5, 1996. See the 1995-'96 TAB report for an overview of the panel's findings.

Publications

Read, Nancy R. and Roger D. Moon. 1996. *Simulation of Development and Survival of Aedes vexans (Diptera:Culicidae) Larvae and Pupae*. Environ. Entomol. 25 (5): 1113-1121.

APPENDIX

- Description of Control Materials
- Control Material Usage and Acres Treated
- Amount of Material Usage by Facility or Service in 1996
- Rainfall Totals by County
- Continuation of Long Term Study of Nontarget Effects of Mosquito Larvicides
- 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 1996 are given. The generic products will not change in 1997, 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 3 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 3 acres in size are treated by the helicopter at a rate of 1 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 3 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 3 acres in size at a rate of 5-10 lbs. per acre. In sites less than 3 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 Minnesota Department of Natural Resources. *Bti* is applied at pre-determined sites, usually at bridge crossings (applied from the bridge) or river 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 ATV mounted Ultra Low Volume (ULV) machines which produce a fog which contacts mosquitoes when they are flying. Fogging may also be done with hand held cold fog machines which enable the applications to made 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 Control Materials Usage and Acres Treated (1989-1996)

Control Material	1989	1990	1991	1992	1993	1994	1995	1996
Altosid® XR Briquet 150-day	11,700	11,351	10,862	10,376	10,537	8,557	7,303	422
Altosid® Sand-GFM Research only	0	0	0	625	630	678	871	712
Altosid® Pellets 30-day	0	0	75	5,689	5,562	5,374	8,219	10,732
Altosid® SR-20 liquid	0	0	1	3,279	15	13	668	565
Bti Corn Cob granules	67,300	100,100	134,011	101,877	126,778	102,860	132,773	78,738
Bti Liquid Black Fly (gallons)	214	2,009	3,574	4,418	5,090	4,047	3,606	3,025
Permethrin Adulticide	9,225	38,787	22,062	12,812	8,261	10,499	6,305	5,910
Resmethrin Adulticide	58,880	225,900	155,922	48,716	53,345	40,687	62,199	120,263*

* See explanation, p. 21.

Appendix 3. Amount of Material Usage by Facility in 1996

Facility	Altosid® XR Briquet (cases)	Altosid® Pellets (lbs)	Altosid® GFM Sand (cases)	Altosid® A.L.L. (oz)	*Bti* granules (lbs)	*Bti* liquid (gal)	Permethrin (gal)	Resmethrin (gal)
North	73.01	7,804.2	-	467.6	138,546.0	165	233.21	402.0
South-Rosemount	87.49	1,210.5	-	98.9	31,595.6	5.0	117.70	56.76
West-Maple Grove	99.00	7,436.55	-	33.7	67,671.4	982.24	261.33	275.8
W-Plymouth	37.00	5,610.0	-	18.5	88,500	37.5	170.33	286.0
East	176.50	7,678.0	-	0	77,511.5	0	203.58	310.9
South-Jordan	82.00	3,533.75	-	38.0	68,460.25	1,835	198.83	120.7
SPRP	-	-	3,300	-	4,700	-	-	-
District Totals	555.0	33,273	3,300	656.7	476,984.75	3,024.74	1,230.0	1452.16

Appendix 4. Rainfall totals in inches by county May-September

Year	Anoka	Carver	Dakota	Hennepin	Ramsey	Scott	Wash.	Wright	District
1959	19.34		26.33	21.92	20.73	27.62	18.58		22.42
1960	23.02		17.60	23.00	21.06	18.90	21.10		20.11
1961	16.88		16.41	16.15	16.34	16.71	16.84		16.56
1962	24.45		21.17	25.24	26.42	23.86	26.78		24.65
1963	16.77		14.81	17.09	16.38	14.07	17.66		16.03
1964	17.43		22.41	23.25	20.99	22.47	19.88		21.07
1965	26.87		28.01	29.19	28.87	25.32	30.52		27.97
1966	14.11		15.61	14.41	14.13	13.13	15.95		14.41
1967	14.27		15.27	18.13	17.08	13.26	15.59		15.60
1968	19.97		22.65	24.11	22.77	22.30	23.58		22.62
1969	7.39		10.60	11.07	8.74	10.32	9.69		9.75
1970	16.05		18.39	17.28	16.41	18.28	17.68		17.55
1971	16.80		19.62	16.35	19.06	15.15	21.68		17.82
1972	19.38		17.85	18.34	17.73	15.63	19.85		18.06
1973	17.72		18.30	15.54	19.49	18.24	19.79		17.95
1974	16.23		13.84	15.80	13.09	10.84	14.46		14.32
1975	23.93		22.44	19.99	22.66	16.60	20.02		21.47
1976	8.16		9.27	9.52	9.43	10.74	9.06		9.48
1977	20.28		21.03	22.42	22.66	18.68	24.13		20.90
1978	24.58		26.67	24.41	26.49	21.98	27.98		24.93
1979	18.10		22.01	20.58	20.78	22.68	22.43		19.98
1980	22.79		20.94	19.13	20.55	16.00	24.34		19.92
1981	17.13		19.36	18.01	19.35	21.40	20.01		19.08
1982	16.84		16.21	15.46	14.32	16.71	14.62		15.59
1983	18.17	24.53	19.99	20.14	19.55	23.32	19.09		20.31
1984	20.18	27.31	17.35	21.63	22.58	22.09	20.75		21.45
1985	24.42	18.29	17.38	20.47	21.74	18.02	21.37	26.26	20.73
1986	22.81	21.90	24.87	21.55	24.56	24.85	25.59	24.28	23.39
1987	17.10	20.17	20.17	22.21	19.72	17.11	17.11	15.70	19.48
1988	13.50	10.50	12.46	11.69	14.33	11.90	14.42	9.35	12.31
1989	14.94	16.62	16.16	16.83	15.92	18.50	17.66	18.08	16.64
1990	25.23	23.38	22.73	23.54	24.61	24.89	22.97	22.49	23.95
1991	27.49	27.14	22.06	28.19	27.31	23.15	25.65	27.26	26.88
1992	15.40	18.29	21.67	19.33	20.72	25.13	19.37	17.02	19.10
1993	27.81	28.00	26.99	27.40	28.73	31.04	27.42	25.46	27.84
1994	15.90	20.99	23.37	17.50	15.05	22.67	17.85	17.62	17.72
1995	22.75	18.85	17.42	20.18	21.99	19.39	23.59	17.14	21.00
1996	13.23	11.91	15.64	13.04	12.66	13.50	14.31	14.06	13.27
Thirty-eight year average									
	18.88		19.34	19.48	19.61	19.12	19.98		19.27

Appendix 5: Continuation of Long-Term Study of Nontarget Effects of Mosquito Larvicides

In 1985 the MMCD formed an independent Scientific Peer Review Panel, known as the SPRP, to direct research and assess possible environmental impacts of control methods. The panel identified research needs, chose independent contractors to carry out research, and reviewed the results.

The largest project directed by the SPRP was a long-term study on the effect of methoprene and *Bti* on zooplankton, insects, and birds in 26 field sites in Wright County. For 3 years (1991-93) these sites were treated with *Bti* or methoprene and results compared with untreated sites.

Results showed no effect of mosquito control treatments on the zooplankton, breeding birds, and non-insect invertebrates studied. In the first year of treatments no effects were found on non-target insects, but in the second and third years some effects were found in several kinds of aquatic insects. The sensitive populations were similar at the beginning of each year but during the second and third year, those populations decreased through the treatment season. The reductions in the third year were greater than in the second.

Because of the length of time it took before differences were apparent, the SPRP was concerned that effects might change over time. In its final report in January 1996, they strongly recommended that MMCD continue treating the long-term study sites using the experimental design, and re-sample those sites in 1996 or 1997 to look for changes in response. The SPRP also suggested collecting insect samples from artificial substrates and activity traps to see if other insects are affected.

As recommended by the SPRP in their final report (January 1996), MMCD has continued treating the long-term study sites using the same experimental design. Materials for treatment have been generously donated by the product manufacturers. A grant proposal submitted to Legislative Commission on Minnesota Resources (LCMR) to fund re-sampling was rated highly but not chosen for state funding.

In November 1996, the MMCD Commission agreed to fund additional sampling in 1997 to assess the effect of continued treatment and demonstrate our commitment to providing service in an environmentally safe manner.

A Continuation Review Panel has been organized, including many original SPRP members, an additional member from MMCD's Technical Advisory Board,and one representative from MMCD serving 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. To date it has reviewed proposals and chosen a contractor. The Panel will also arrange for any additional sampling that can be accomplished within the funding limits, and monitor progress and review results.

Appendix 6: Fall TAB Meeting Notes

Metropolitan Mosquito Control District
TECHNICAL ADVISORY BOARD (TAB) DRAFT FOR REVIEW
Meeting Notes—1996 Fall Technical Advisory Board Meeting
December 5, 1996

Members Present:	**Member Agency**
Richard Anderson, Chair	United States Environmental Protection Agency
Dave Belluck	Minnesota Pollution Control Agency
Larry Gillette	Hennepin Parks
Craig Hedberg	Minnesota Department of Health
Howard Krosch	Minnesota Department of Natural Resources
Art Mason	Minnesota Department of Agriculture
Dave Noetzel	University of Minnesota, Entomology
Robert Sherman	Independent Statistical Consultant
Alan Singer	Environmental Interest Groups (Minneapolis Parks)
Bob Wryk	Minnesota Department of Transportation

Members Absent	**Member Agency**
Ron Chatfield	Industry Representative (Solvay Animal Health Inc.)
Jim Cooper	University of Minnesota, Fisheries and Wildlife
Dave Warburton	United States Fish and Wildlife Service

MMCD Staff

Joseph Sanzone, Director	Scott Ranta, Control Program
Sandy Brogren, Technical Support	Nancy Read, Technical Support
Diann Crane, Technical Support	Mark Smith, Technical Support
Janet Jarnefeld, Technical Support	Jim Stark, Public Information
David Neitzel, Control Program	John Walz, Technical Support

Visitors
Gary Montz, Minnesota Department of Natural Resources

Call to Order

Chairman Anderson called the meeting to order at 12:40 PM and TAB members and MMCD staff introduced themselves.

Introduction

Joe Sanzone outlined MMCD's proposed budget for 1997, which includes a 7.1% increase in expenditures over 1996. Service levels will be increased in 1997 with an emphasis on improving effectiveness of larval control in problem areas. Other expenditures include an increase in seasonal staff, truck fleet maintenance, and cost of living increases.

I. 1996 Overviews

MMCD staff answered questions on various District activities outlined in the mailing sent with

the agenda.

Dave Neitzel described the ehrlichiosis study and gave a background on ehrlichiosis in response to a question from Dave Belluck.

Jim Stark outlined how the District evaluates the need for adult mosquito treatments in public areas, in response to a question from Al Singer. In general, when a request for service is received, staff sample the mosquito population in that area and if mosquito numbers reach a threshold value (e.g. > 120 in an overnight carbon dioxide baited light trap collection) a treatment is justified. We will refuse treatment if the mosquito numbers are under the established threshold. Notification is made before treatments are made via the Mosquito Adulticide Hotline and to any citizens who have requested a notification call before treatments are made in their area.

In response to a question from Larry Gillette, Jim Stark described District efforts in providing wetland maps to organizations who request them. The National Wetland Inventory maps are good for larger wetlands or drained areas but MMCD maps are valuable in identifying ditch sites and smaller sites in woods. The District provided over 1,500 square miles of wetland maps to local units of government in 1996.

Joe Sanzone responded to a question from Al Singer regarding the lack of late summer rainfall and its effects on mosquito and black fly populations. The lack of rainfall will probably not have much of an effect on the populations of *Aedes* mosquitoes which overwinter in the egg stage. Those mosquitoes which will be most affected are the permanent water breeders, like the cattail mosquito whose breeding sites may have dried up in the fall.

Dave Neitzel discussed District efforts related to mosquito and tick-borne disease issues. Bob Sherman stressed the importance of keeping track of populations in dry years. The District intends to continue in this capacity and would like to expand ehrlichiosis efforts.

II. Follow-up on Scientific Peer Review Panel (SPRP)

Report to EQB

Earlier in the day on December 5, Richard Anderson, the scientific chair of the SPRP, made a presentation to the Minnesota Environmental Quality Board (EQB) on the final SPRP report. The EQB members acknowledged the report with few comments.

Study on Chironomids and *Bti*

The data from the last SPRP-sponsored study, done by Dr. Karsten Liber, is being revised. A final report is expected within one to two months, and results will be presented at the next TAB meeting.

Continuation of Wright County Long-Term Study

As recommended by the SPRP, MMCD Commissioners have approved funding in the 1997 budget to follow up on the long term study on nontarget effects of MMCD larval control materials. TAB members discussed procedures for a study to sample the Wright County wetlands used in the long-term study sponsored by the SPRP.

The first set of questions was whether MMCD personnel or an independent contractor should conduct the study. Concerns included the availability of MMCD staff time and public perceptions if the MMCD staff conducted the study. The Board noted that although the MMCD staff were capable of conducting the study, it should be done by an outside contractor. The next point discussed was review and oversight of the contractor. The Board decided that a small panel should oversee the project. The suggested composition of the panel would be a MMCD representative, several (2-3) of the original SPRP and any additional people who show interest. This panel will interact with the contractor and thereby aid in setting procedures for sampling and quality assurance. The TAB recommended that the MMCD should first contact Dr. Anne Hershey, who conducted the earlier study in Wright County, before solicitation of other contractors. The TAB also recommended that the MMCD should poll SPRP members for their interest in monitoring the 1997 study.

The possibility of conducting a "rebound study,"i.e. sampling after treatments ceased in 1998, was also discussed for future years. Larry Gillette commented that there may be a "lag" effect — we have had wet years until recently that could mask some effects, and dry years might make it difficult for affected insects to rebound. It would be valuable to get an assessment of effects on other species and to see what effects there are this year. Further discussion of additional studies was left for future meetings.

III. Miscellaneous Items

Al Singer asked if any materials are due to be recertified. Joe Sanzone responded that none of the larvicides MMCD uses are due for recertification, and he was not aware of any recertification question with adulticides. Joe also mentioned that the fish restriction has been removed from controlled release methoprene products.

Due to time constraints, MMCD staff asked that the winter TAB meeting date be scheduled for April so that staff will have time to process 1995 samples and to compile results. The meeting was scheduled for April 3, 1997.

Larry Gillette expressed his relief that the District assesses the necessity of treatment before applying adult mosquito control materials. He wondered if a fee charged to other agencies would be prohibitive to organizations (people) who continually call and assume they will get control.

Meeting adjourned with no motions made at 2:35 PM

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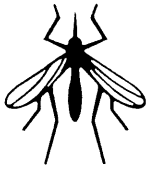

Altosid® XR
EXTENDED RESIDUAL BRIQUETS

A SUSTAINED RELEASE PRODUCT TO PREVENT ADULT MOSQUITO EMERGENCE

ACTIVE INGREDIENT: *(S)*-Methoprene [Isopropyl (2*E*, 4*E*, 7*S*)-11-methoxy-3,7,11-trimethyl-2,4-dodecadienoate]* (Dry Weight Basis) 1.8%
INERT INGREDIENTS: 98.2%

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

NET WT. 2.9 LBS. (1.32 kg) DRY WEIGHT BASIS CONTAINS 36 BRIQUETS

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

PRECAUTIONS: Do not apply to known fish habitat.

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 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 (less than 2 feet in depth), treat on the basis of surface area, placing 1 Briquet per 200 ft². Briquets should be placed at 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 1 **ALTOSID** XR Briquet per 100 ft²

Coquillettidia and *Mansonia* spp.: For application to cattail marshes, and water hyacinth beds. For control of these mosquitoes, place 1 Briquet per 100 ft²

APPLICATION SITES: ALTOSID XR Briquets are designed to control mosquitoes in small bodies of water which are not known fish habitats. Examples of application sites are: storm drains, catch basins, roadside ditches, ornamental ponds and fountains, cesspools and septic tanks, waste treatment settling ponds, flooded cavities, transformer vaults abandoned swimming pools, construction and other man-made depressions, cattail marshes, water hyacinth beds, pastures, meadows, rice fields, freshwater swamps and marshes, salt and tidal marshes, woodland pools, flood plains and dredge spoil sites.

Storage and Disposal:

Storage: Store in a cool place. Do not contaminate water, food or feed by storage or disposal. Wastes resulting from use of this product may be disposed of on site or at an approved waste disposal facility. Do not reuse empty container.

Disposal: Triple rinse (or equivalent), then offer for recyling or reconditioning. Dispose in a sanitary landfill, or incinerate, or, if allowed by State and local authorities, by burning. If burned, stay out of smoke.

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

EPA Reg. No. 2724-421-64833
Sold by
Vector Management Division
A Division of Zoecon Corporation
A Sandoz Company
12200 Denton Drive, Dallas, Texas 75234
For information call 1-800-248-7763
ALTOSID is a trademark of Sandoz Ltd.

Always read the label before using the product.

Made in USA

Printed in USA
EPA Est. No 39578-TX-1
2724-TX-1

zoëcon

93-24-0047

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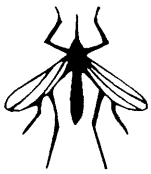

Altosid® PELLETS
MOSQUITO GROWTH REGULATOR

A GRANULAR PRODUCT TO PREVENT ADULT MOSQUITO EMERGENCE

ACTIVE INGREDIENT: (*S*)-Methoprene [Isopropyl (2*E*, 4*E*, 7*S*)-11-methoxy-3, 7, 11-trimethyl-2, 4-dodecadienoate] 4.0%
INERT INGREDIENTS: 96%

KEEP OUT OF REACH OF CHILDREN
CAUTION

NET WT. 22lb. (10kg)

Precautionary Statements
ENVIRONMENTAL HAZARDS: Do not apply to known fish habitat.

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, includlng Culex and Culiseta spp., as well as adults of the floodwater mosquitoes such as Aedes, Anopheles 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:

HABITAT	RATES (Lbs/Acre)
Floodwater sites	
Pastures, meadows, ricefields, freshwater swamps and marshes, salt and tidal marshes, woodland pools, floodplains, tires, other artificial water holding containers	2.5 - 5
Dredge spoil sites, waste treatment settling ponds, ditches and other man-made depressions	5 - 10
Permanent water sites	
Ornamental ponds and fountains, flooded crypts, transformer vaults, abandoned swimming pools, construction and other man-made depressions, treeholes, other artificial water holding containers	2.5 - 5
Storm drains, catch basins, roadside ditches, cesspools, septic tanks, waste treatment settling ponds	5 - 10

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 floodlng or in permanent water sites. Fixed wing aircraft or helicopters equipped with granular spreaders capable of applying rates from 2.5 - 10 lbs/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 &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 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.

EPA Reg. No. 2724-448-64833
Sold by
Vector Management Division
A Division of Zoecon Corporation
A Sandoz Company
12200 Denton Drive, Dallas, Texas 75234
For information call 1-800-248-7763

Always read the label before using the product.

Made in USA

Printed in USA
EPA Est. No. 8329-IL-1

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92-24-0058

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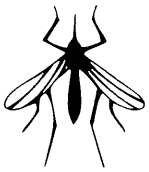

Altosid® Liquid Larvicide CONCENTRATE

PREVENTS EMERGENCE OF ADULT FLOODWATER MOSQUITOES

ACTIVE INGREDIENT: (*S*)-Methoprene [Isopropyl (2*E*, 4*E*, 7*S*)-11-methoxy-3, 7, 11-trimethyl-2, 4-dodecadienoate] 20%
INERT INGREDIENTS: 80%
Contains 1.72 lb/gal (205.2 g/liter) active ingredient

KEEP OUT OF REACH OF CHILDREN

CAUTION

SEE PANEL BELOW FOR ADDITIONAL CAUTIONS

640 fl. oz. (5 gals.) 18.9 ℓ

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.

INSTRUCTIONS FOR USE — 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 below.

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

Application Sites — *Pastures:* **A.L.L.** may be applied after each flooding without removal of grazing livestock.

Rice: **A.L.L.** must be applied to 2nd, 3rd and/or 4th instar larvae of mosquitoes found in rice, usually within 4 days after flooding. Use only where multiple flooding rice culture is practiced. **A.L.L.** treatment may be repeated with each flooding. Do not apply after rice reaches the heading stage of growth.

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, woodland pools and meadows, dredging spoil sites, drainage areas, waste treatment and settling ponds, ditches and other natural and man-made depressions. Around estuarine areas, treat high salt marsh or tidal marsh above mean high tide water level.

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.**

Mixing and Handling instructions: 1. Add measured amount of **A.L.L.** to spray tank partially filled with water, mix and complete filling with recommended quantity of water. 2. Use diluted spray solution within 48 hours of mixing. Agitate before each use.

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.

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

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A Sandoz Company
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For information call 1-800-248-7763

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EPA Est. No.55947-CA-1

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92-24-0056

Always read the label before using the product.

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.

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.

PERMETHRIN 57% OS

CLARKE

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

Precautionary Statements

HAZARDS TO HUMANS AND DOMESTIC ANIMALS

CAUTION

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

STATEMENT OF PRACTICAL TREATMENT

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

ENVIRONMENTAL HAZARDS

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

PHYSICAL OR CHEMICAL HAZARDS

Do not use or store near heat or open flame.

DIRECTIONS FOR USE

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

CONDITIONS and RATES to USE for MOSQUITO CONTROL

FOR A BARRIER SPRAY

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

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

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

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

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

Contains petroleum distillates.

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

Contains 5 lb./gal. Permethrin

CAUTION

KEEP OUT OF REACH OF CHILDREN

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 _____

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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

1/95

AgrEvo™ A company of Hoechst and Schering Berlin

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

SCOURGE®

INSECTICIDE

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

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

ACTIVE INGREDIENTS:

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

*Cis/trans isomers ratio: max. 30% (±)cis and min. 70% (±)trans
‡'AgrEvo Environmental Health, Inc.'s SBP-1382® brand of resmethrin insecticide.
**Equivalent to 9.94% (butylcarbityl) (6-propylpiperonyl) ether and 2.48% related compounds.
†Contains Petroleum Distillates.
®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. 432-716 **EPA EST. NO.**

KEEP OUT OF REACH OF CHILDREN

CAUTION

STATEMENT OF PRACTICAL TREATMENT

IF SWALLOWED: Call a doctor or get medical attention. Do not induce vomiting. Do not give anything by mouth to an unconscious person. Avoid Alcohol. This product contains aromatic petroleum solvent. Aspiration may be a hazard.

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

See Side Panel For Additional

Precautionary Statements

NET CONTENTS:

716rest 100995tk

PRECAUTIONARY STATEMENTS

Hazards To Humans & Domestic Animals

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

Environmental Hazards

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

DIRECTIONS FOR USE

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

STORAGE AND DISPOSAL

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

READ ENTIRE LABEL FOR DIRECTIONS
For use only by certified applicators or under the supervision of such applicators, for the reduction in annoyance from adult mosquito infestations and as a part of a mosquito abatement program.
IN THE STATE OF CALIFORNIA: For use only by local districts or other public agencies which have entered into and operate under a cooperative agreement with the Department of Public Health pusuant to Section 2426 of the Health and Safety Code.

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

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

ULTRA LOW VOLUME APPLICATIONS
For use in nonthermal ULV portable backpack equipment similar to the Hudson B.P., mix 70 fl oz (2068 ml) of this product with 1 gal (3.79 L) of refined soybean oil, light mineral oil of 54 second viscosity or other suitable solvent or diluent. Adjust equipment to deliver fog particles of 18-50 microns mass median diameter. Apply at the rate of 4.25-8.50 fl oz of finished formulation per acre (311-621 ml/ha) as a 50 ft (15.2 m) swath while walking at a speed of 2 mph (3.2 kph). This is equivalent to 0.0035-0.0070 lb ai SBP-1382/A (3.92- 7.85 gm/ha) plus 0.0105- 0.0210 lb ai

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 ⅓ to ½ of the pan or field is covered with floodwater. Delivery of the solution should continue for a period of approximately 4½ 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.

piperonyl butoxide tech./A (11.77-23.54 gm/ha). Where dense vegetation is present, the higher rate is recommended.

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

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

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

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

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

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

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

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

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

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

Aerial application should be made preferably in the early morning or evening. Application should be made preferably when there is little or no wind.

It is not recommended to make application when wind speeds exceed 10 mph (16 kph). Repeat applications should be made as necessary. Apply preferably when temperatures exceed 50°F (10°C).

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

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

APPLICATION INSTRUCTIONS FOR PRODUCT IN AIRCRAFT USAGE

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

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

AgrEvo Environmental Health
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Montvale, NJ 07645