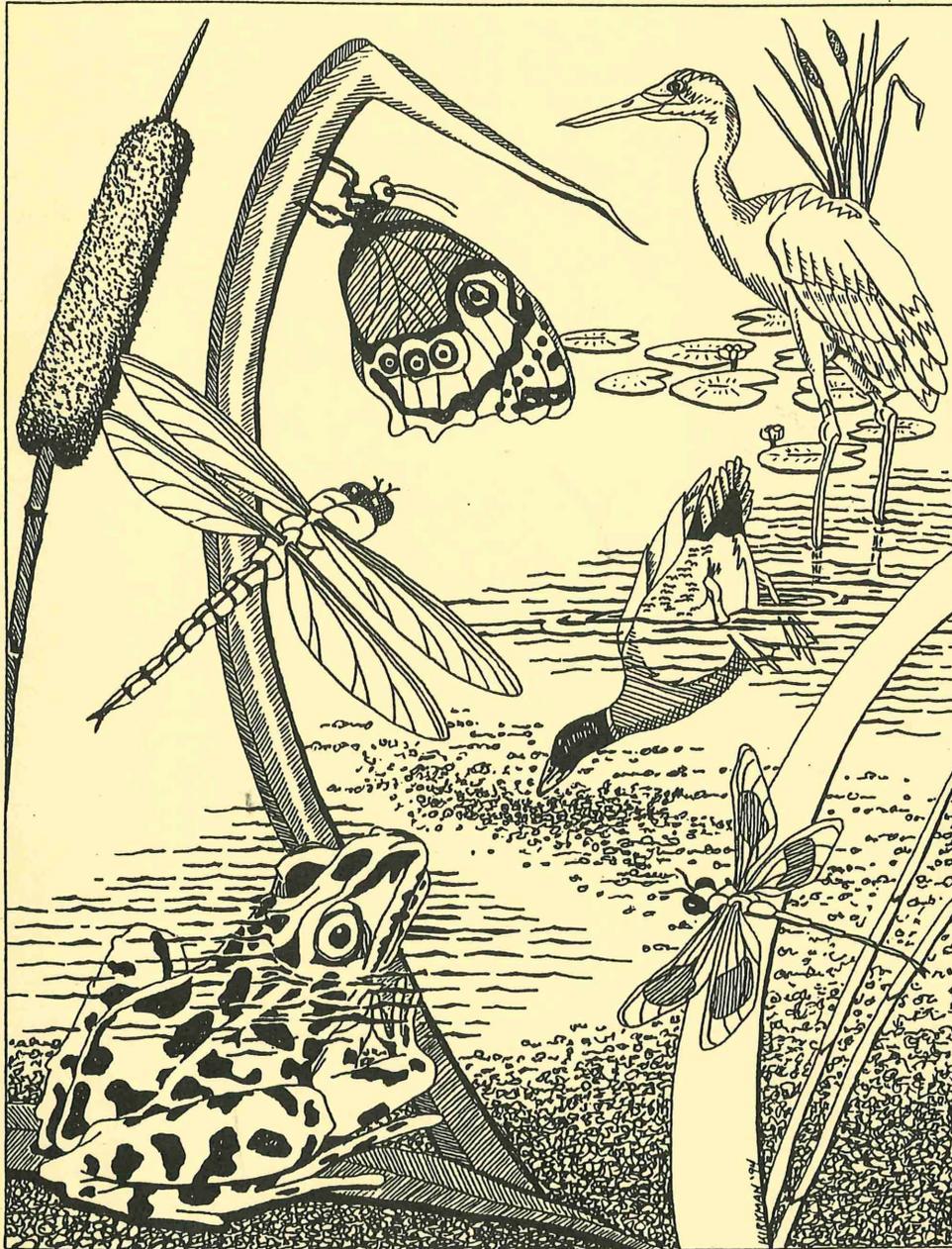


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# Metropolitan Mosquito Control District



## I. Technical Advisory Board 1994 Minutes

and Recommendations

MCD Response to 1993 TAB Recommendations

MCD 1993 Operational Review & Plans for 1994

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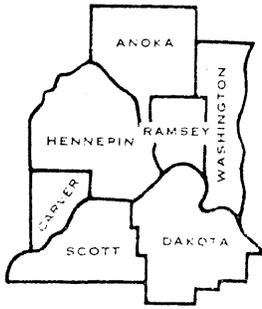
### EDITORIAL STAFF

Daniel Bennek, Administrative Assistant  
Diann M. Crane, Assistant Entomologist  
Susan M. Palchick, Ph.D., *Aedes* Program Manager

### ACKNOWLEDGEMENTS

The Co-Editors would like to thank Martyn Kirkman who provided the artwork for the report cover; Sandra Brogren, Bill Caesar, Paul Heller, Ross Green, Laurene Lozoski, Dave Neitzel, Scott Ranta, Nancy Read, Kelly Sharkey, Dr. Ken Simmons, Mark Smith, John Thompson, Theresa Upchurch, and all MMCD staff for their contributions and time spent in producing this report. Their input has improved the quality and presentation of the 1994 Annual Operations Report.

February 1994



## **METROPOLITAN MOSQUITO CONTROL DISTRICT**

2099 UNIVERSITY AVENUE WEST ■ ST. PAUL, MINNESOTA 55104-3431  
612-645-9149 ■ FAX 612-645-3246 TDD use Minnesota Relay Service

JOSEPH F. SANZONE  
*Director*

W.J. CAESAR  
*Business Admin.*

July 5, 1994

Dear Reader;

The following is the Metropolitan Mosquito Control District's (MMCD) 1993 Operational Review and Plans for 1994. MMCD staff prepared this report to outline the program operations based on the goals set forth by the MMCD Board of County Commissioner's.

This report has been reviewed by the Metropolitan Mosquito Control Commission's Technical Advisory Board (TAB). The charge of the TAB is to make recommendations for improvements in the District's operation on an annual basis. The minutes and recommendations from their February 25, 1994 meeting is enclosed.

The TAB recommendations and report were accepted by the MMCD Board of Commissioner's at it June 22, 1994 Commission Meeting. The MMCD Board has instructed staff to consider the recommendations of the TAB, and report to the Executive Committee of the Commission.

If we can provide further information on the District please contact us.

Sincerely,

Joseph F. Sanzone  
Director

AFFIRMATIVE ACTION EMPLOYER





## Minnesota Department of Agriculture

June 3, 1994

612-296-8448

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

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Dear Commissioner Loeding:

Some of the members of the Technical Advisory Board (TAB) met on January 21, 1994, with Bill Caesar, Bob Sjogren and Susan Palchick of the Metropolitan Mosquito Control Staff. This meeting was called to discuss possible changes in the structure of the TAB. The topics discussed at this meeting to be presented to the full TAB at their next regular meeting. The minutes of this meeting are included in the 1994 Annual Operations Report.

The full TAB met on February 25, 1994, detailed minutes are also included in the 1994 Annual Operations Report. I urge you refer to the minutes for information rather than my going into duplicative details of the meeting in this letter. Please focus attention on the motions and recommendations in the minutes of the meeting as they are the TAB's report to the Commission. I will repeat two that are specifically directed to the Commission:

- The MMCD staff and the Commission is commended for their diligence in following up the TAB's recommendations.
- The MMCD Commission consider having the District conduct an improved public opinion survey. The next survey should ask more difficult questions that would assess the respondent's knowledge of insecticides.

Sincerely,

Arthur H. Mason, Director  
Plant Protection Division  
Technical Advisory Board Rotating Chair



**METROPOLITAN MOSQUITO CONTROL DISTRICT  
MMCD**

**Minutes —1994 Technical Advisory Board Meeting**

Art Mason, Chair	Minnesota Department of Agriculture
Dave Noetzel, Vice-Chair	University of Minnesota-Entomology Dept.
Robert Sherman	Hennepin County -Planning/Development
Larry Gillette	Hennepin Parks
Howard Krosch	Minnesota Dept. of Natural Resources
Mary Knudsen	Minnesota Pollution Control Agency
Richard Anderson	U.S. Environmental Protection Agency
Stan Smith	U.S. Fish and Wildlife Service

**Staff:**

Susan Palchick, *Aedes* Program Manager  
Dan Bennek, Administrative Assistant  
Sandy Brogren, Entomology Laboratory  
Diann Crane, Entomology Laboratory  
Dave Crews, Black Fly Program Leader  
Daniel Dobbert, Data Analyst  
Ross Green, Public Information Program  
Dave Neitzel, LaCrosse-Lyme Program Leader  
Scott Ranta, Cattail Program Leader  
Nancy Read, Program Development  
Kelly Sharkey, Quality Assurance Program  
John Thompson, Data Processing Manager  
Brian Zeigler, Ramsey-Washington Foreman

**Visitors:**

Peggy Burkman, Minnesota Valley National Wildlife Refuge  
Harriet Lykken, Sierra Club  
Gary Montz, Minnesota Department of Natural Resources

- I.** The February 25, 1994, the meeting of the Technical Advisory Board (TAB) was called to order at 9:00 a.m. at the Metropolitan Mosquito Control Headquarters in St. Paul by Art Mason, meeting chair.

An annual operations report containing the results from 1993 and plans for the 1994 program was distributed to TAB members prior to the meeting. Discussion of this report formed the basis of the meeting.

An introduction overview was presented by Ross Green for interested members prior to the regular TAB meeting.

**II.** A subcommittee of the TAB met in January to review the Boards' policies and structure. From that meeting, changes in the structure of the TAB were proposed. These proposals were mailed as an insert to the MMCD Annual Operations Report (amended version is attached).

Discussion regarding the changes resulted in the following changes.

Bob Sherman moved to adopt changes in the TAB structure as outlined with the following modifications:

- 1) Adding of a Fall TAB meeting to discuss preliminary results from the summers activities.
- 2) Adding the Minnesota Department of Transportation to the bottom of the chairperson rotation.
- 3) Alternating the chair position between environmental agencies and non-environmental agencies. MMCD staff will submit an updated list of chair rotation to the chair.
- 4) Adding a vice-chair position to the TAB who would then become the next years' chair. It was determined the Dave Noetzel would be the vice-chair for 1994.

Howard Krosch seconded the motion and the resolution was passed.

**III.** Program updates were presented by the various program leaders and a question and answer period followed each presentation. The open discussion resulted in the following motions and recommendations.

#### **Motions**

- Larry Gillette moved to have the MMCD continue to determine public opinions as to the effectiveness of the program. Dave Noetzel seconded the motion and the resolution was passed.
- Larry Gillette moved to urge the District to increase and consider expansion of Lyme tick surveillance since it is a valuable component of the program. Stan Smith seconded the motion and the resolution was passed.
- Larry Gillette moved to commend the MMCD staff and the Commission in their diligence in following up the TAB's recommendations. Howard Krosch seconded the motion and the resolution was passed.
- Dave Noetzel moved to have the TAB chair draft a response on behalf of the TAB to clarify the misinformation presented in the editorial in the November 1994 edition of the Star Tribune. The response should be directed to the editor as well as the author. Howard Krosch seconded the motion and the resolution was passed.

## **Recommendations**

- That the MMCD Commission consider having the District conduct an improved public opinion survey. This next survey should ask more difficult questions that would assess the respondents knowledge of insecticides.
- That the District continue resistance testing with control materials presently in use.
- That the District develop and implement a standard operating procedure for determining that control materials, as delivered, meet standards.
- The MMCD arrange a field day in 1995 for TAB members and interested parties to see actual field activities. The field day plan will be presented to the TAB at its Fall 1994 meeting.
- That the MMCD consider investigating the non-target impacts of its aduenticiding program.
- After a final report on the research contracted by the SPRP is completed, the District arrange for a joint meeting to discuss the results with the TAB
- That the current TAB chair work with the MMCD to find new TAB members to represent the Industry Group and the Environmentalist Group.

## **ADJOURNMENT**

A motion to adjourn was made by Dick Anderson with Mary Knudsen seconding the motion. The motion passed.

**DISCUSSION OF STRUCTURE OF TECHNICAL ADVISORY BOARD (TAB)  
AND RECOMMENDATIONS TO BE PRESENTED AT 1994 TAB MEETING.**

**Metropolitan Mosquito Control Staff (Bill Caesar, Bob Sjogren, Susan Palchick) met with Technical Advisory Board members (Larry Gillette, Howard Krosch, Dave Noetzel, Art Mason) on January 21, 1994 to discuss possible changes in structure of the Technical Advisory Board. These topics were discussed at the February 25, 1994 meeting.**

1. **Chairperson:** The term of chairperson will be 1 year with a vice-chair also serving one year. The vice-chair will become the chair, after the chair's 1 year term. This should enhance continuity. The chairperson chairs the meeting and is responsible for the meeting minutes. If a regular member is not present at his/her turn to be chairperson, then the vice-chair should substitute.

In 1994, the TAB decided that the TAB chair will be alternated between environmental and regulatory agencies in the order of the following list:

Minnesota Department of Agriculture  
University of Minnesota-Department of Entomology  
U.S. Environmental Protection Agency  
Hennepin Parks  
Industry Representative  
U.S. Fish and Wildlife Service  
Hennepin County Planning and Development  
Minnesota Department of Natural Resources  
Minnesota Pollution Control Agency  
University of Minnesota-Department of Fisheries and Wildlife  
Minnesota Department of Health  
Environmental Group Representative  
Minnesota Department of Transportation

2. **Meetings:** The TAB should meet 2 times per year, rather than just once. A meeting in the autumn would review the previous season's activities and would not be accompanied by a final report. This would be an opportunity to discuss and suggest options for the next season based on the experiences from the recent field season. The spring meeting would concentrate on plans for the upcoming season and would include the presentation of the annual operations report.
3. **Report to the Commission:** The report from the TAB would include formal recommendations that were approved by majority vote of the members plus a listing of minority options for the Commissions consideration.
4. **Composition of TAB:** The TAB is presently composed of representatives from Minnesota Department of Agriculture, Minnesota Department of Health, Minnesota Department of Natural Resources, Minnesota Pollution Control Agency, University of Minnesota, United States Environmental Protection Agency, United States Fish and Wildlife Service, Hennepin County, Hennepin Parks, Industry and Environmental groups.

Minnesota Department of Transportation should be invited to attend as they are listed as an advisory group in the statutes. No other groups were identified as possibilities for inclusion. Since minority opinions are sent to the Commission, it should not be necessary to try to balance competing interests on TAB.

5. Additional comments:

- Sending the Director's report to all TAB members would help keep members up to date.
- Metropolitan Mosquito Control District staff may want to offer another Field Day demonstration to TAB members. One was held in 1981 that members found very useful and informative.
- Expand notification of TAB meetings. Possibilities include Environmental Quality Board *Monitor*, MDNR newsletter, MDA newsletter.
- Commission may want to consider having a commissioner sit in on the TAB meeting.
- MMCD staff should not be excluded from TAB discussion of MMCD program. If TAB goes into closed session, all non-TAB members should be excluded.
- A short session (1-2 hours) could be offered to new representatives before the TAB meeting to provide background information about MMCD programs. In this way, the TAB meeting could focus on changes and new developments in the program.

**STATEMENT OF PURPOSE AND FUNCTION:**

The Technical Advisory Board was formed in 1981. The MMCD Director recognized that the Commission would profit from outside opinions on technical aspects of field operations. In addition, Minnesota Statutes specify that listed state agencies act in an advisory capacity to the Commission. These state agencies were contacted and invited to participate in a Technical Advisory Board which would report directly to the Chair of the Commission.

The TAB is composed of representatives from Minnesota Department of Agriculture, Minnesota Department of Health, Minnesota Department of Natural Resources, Minnesota Pollution Control Agency, Minnesota Department of Transportation, University of Minnesota, United States Environmental Protection Agency, United States Fish and Wildlife Service, Hennepin County, Hennepin Parks, industry and environmentalist groups.

These representatives meet one time per year before the MMCD field season begins. TAB members receive the Draft Annual Operations Report prior to that meeting. MMCD staff provide updates of MMCD programs at the annual meeting and address questions from the TAB. The TAB is to evaluate the technical merits of the MMCD programs as described in the Annual report and oral presentations. Opinions from organizations or individuals not represented on TAB are welcome for consideration by the TAB. The TAB chairperson submits recommendations to the Metropolitan Mosquito Control Commission regarding the program along with the minutes from the meeting.

Once reviewed by the Commission, the TAB recommendations and minutes are included in the Annual Operations Report which is made available to the public.

**TECHNICAL ADVISORY BOARD (TAB)  
CHAIRS (1981-1994)**

MINNESOTA DEPT. OF AGRICULTURE	1994	1981	
UNIVERSITY OF MN-DEPT. OF ENTOMOLOGY			
U.S. ENVIRONMENTAL PROTECTION AGENCY	1987	1986	
HENNEPIN COUNTY PARKS			
INDUSTRY REPRESENTATIVE			
U.S. FISH & WILDLIFE SERVICE	1985	1983	
HENNEPIN COUNTY PLANNING & DEVELOPMENT	1989	1988	
MINNESOTA DEPT. OF NATURAL RESOURCES	1990	1984	
MINNESOTA POLLUTION CONTROL AGENCY	1992		
UNIVERSITY OF MN-DEPT. FISHERIES & WILDLIFE			
MINNESOTA DEPARTMENT OF HEALTH	1993	1982	
ENVIRONMENTALIST GROUP REPRESENTATIVE	1991		
MINNESOTA DEPT. OF TRANSPORTATION			

**Metropolitan Mosquito Control District Response  
to 1993 Technical Advisory Board Recommendations**

**1. Greater efforts to notify people of treatments. Expand communication efforts.**

- MMCD revised its entry in the telephone directory to provide better access for general questions as well as adulticide treatment information. The listings are cross referenced, as much as possible, to make it easier for citizens to find the phone numbers. The adult mosquito control hotline phone number is included on postings, press releases, business cards and wherever other opportunities arise.
- Signs are posted in parks while adult mosquito control treatments are being performed.
- Organizations requesting treatment will be asked to notify their participants that adult mosquito control was performed in the area.

**2. Gather evidence to identify the prevalence of hypersensitive people in our population. Explore additional studies to address the concerns of self identified "chemically hypersensitive" people.**

- Staff agree that the concerns of self-identified "chemically hypersensitive" people need to be addressed. This is out of the area of expertise of staff, however, and would be better executed by Minnesota Department of Health (MDH). Staff recommend that the matter be referred to the MDH.

**3. MMCD should review Minnesota Department of Agriculture data to identify the volume of adulticiding that is done in the Twin Cities outside of MMCD activities.**

- The Minnesota Department of Agriculture (MDA) does not accumulate information about adult mosquito control in the Twin Cities outside of MMCD activities. Staff have obtained a list of applicators licensed for mosquito control in Minnesota. Art Mason, TAB representative from MDA, recommended that a survey be sent to these applicators inquiring about their adult mosquito control activities. Staff have surveyed other applicators and met with reluctance to provide information. As the information does not seem obtainable, this question will not be pursued.

**4. Tabulate the area of land currently off limits to treatment activities.**

- See summary for tabulation of area of land currently off limits to treatment activities due to agency policy, management prerogative or citizen request.

**5. Strive for 95% effectiveness in mosquito control, to avoid the excessive application of material required for 100% control.**

- Using the most cost effective and legal dosage of control materials is a routine part of MMCD activities. When evaluating new products or application rates, control rates in excess of 95% may occur. The correct dosage would then be implemented in the control

## Refused Entry Acres

Owner/Agency	Wetland Acres Untreated	Total Wetland Acres
Private Ownership	25,417	
Hennepin Parks	6,269	
Minnesota Department Natural Resources	16,374	
MN Valley National Wildlife Refuge	8,314	
University of Minnesota	1,075	
Communities	479	
<hr/>		
Totals* -	57,928	252,366

\* Wetland Acres not treated represents acres of wetlands which may produce mosquitoes. Many refused entry acres cannot be adequately checked at the time they are breeding mosquitoes because the labor needed at this time is used to control mosquitoes in sites which can be treated.

Total wetland acres represents the total acres of wetlands the MMCD has identified as having the potential of breeding mosquitoes.

## **I. BACKGROUND AND OVERVIEW**

- Metropolitan Mosquito Control Commissioners
- Program Overview
- MMCD Staff and Technical Advisory Board Members
- Regulatory and Advisory Review
- Mission Statement and Goals
- Program Summaries
- Mosquito Control Materials



**METROPOLITAN MOSQUITO CONTROL DISTRICT**  
**ANNUAL REPORT**  
**SUBMITTED TO THE TECHNICAL ADVISORY BOARD**  
**FEBRUARY 25, 1994**

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# METROPOLITAN MOSQUITO CONTROL DISTRICT

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The Metropolitan Mosquito Control District, established in 1958, controls mosquitoes and gnats (black flies) 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 1 9 9 4

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<b>Steve Loeding, Chairman</b>	<b>Dakota County</b>
<b>Dennis Hegberg, Vice Chairman</b>	<b>Washington County</b>
<b>Dick Wedell, Secretary</b>	<b>Ramsey County</b>
<b>Robert C. Burman</b>	<b>Anoka County</b>
<b>Margaret Langfeld</b>	<b>Anoka County</b>
<b>Dave McCauley</b>	<b>Anoka County</b>
<b>John Siegfried</b>	<b>Carver County</b>
<b>Bob Jensen</b>	<b>Dakota County</b>
<b>Dee Richards</b>	<b>Dakota County</b>
<b>Randy Johnson</b>	<b>Hennepin County</b>
<b>Mike Opat</b>	<b>Hennepin County</b>
<b>Sandra Hillary</b>	<b>Hennepin County</b>
<b>John Finley</b>	<b>Ramsey County</b>
<b>Hal Norgard</b>	<b>Ramsey County</b>
<b>Ray Foslid</b>	<b>Scott County</b>
<b>Dick Underferth</b>	<b>Scott County</b>
<b>Dave Engstrom</b>	<b>Washington County</b>



## PROGRAM OVERVIEW

The mission of the Metropolitan Mosquito Control District (MMCD) is to suppress mosquito and tick transmitted diseases and to reduce annoyance levels of mosquitoes and gnats below that which interferes with outdoor activities. MMCD is a seven-county, cooperative governmental agency, including the counties of Anoka, Dakota, Hennepin, Ramsey, Scott, Washington and the eastern half of Carver.

The District is managed by a Director and a Business Administrator. MMCD encompasses a number of programs, the largest being the floodwater *Aedes* mosquito control program. Other MMCD programs are Cattail Mosquito Control, LaCrosse Encephalitis Prevention, Lyme Disease Surveillance, and Black Fly Control. Support is provided by Quality Assurance, Program Development and the Entomology laboratory.

**The District's emphasis is on the control of mosquito larvae, while they are in the water.** Sites are mapped, sampled and prioritized according to mosquito productivity. The most productive sites are treated using two types of biological control materials that affect immature mosquitoes in an environmentally sensitive approach. A natural soil bacteria (*Bacillus thuringiensis* var. *israelensis* or *Bti*) and an insect growth regulator (methoprene or brand name Altosid®) are used in dry, granulated or briquet forms.

Localized adult mosquito control is done to reduce mosquito annoyance for public events on request. MMCD primarily treats in and around park and recreation areas and for civic events. Adult mosquito control materials are permethrin and resmethrin products. These materials are synthetic pyrethroids and are similar in chemical structure to pyrethrum, a natural botanical insecticide that is the extract of a chrysanthemum flower.

An independent Scientific Peer Review Panel (SPRP) directs contract environmental research to assess potential adverse environmental impacts. No adverse environmental effects have been found in five years of research on larval control materials to date.

MMCD has chosen to use the most environmentally compatible control materials available. Staff remain current in advances in mosquito control technology. They continue to evaluate alternative control methods and solicit input from toxicologists about control materials.

To accomplish the above work, the MMCD operations budget for 1994 is \$9,979,707. This represent a increase of less than 1% from the 1993 budget. The MMCD levy on an \$80,000 home was less than \$4.00 in 1993. Ninety three percent (93%) of MMCD's budget goes into the field for the control of mosquitoes, biting gnats, Lyme tick surveillance, program development, quality control and environmental studies.

As public service agency, MMCD is very sensitive to the questions and concerns of citizens of the metropolitan area. Our public information program provides speakers for schools and groups such as Kiwanis and Lions clubs. Several brochures and write-ups are sent to callers with questions and are available for distribution. In 1993, information booths were located at the State and county fairs. In addition, a video overview of MMCD is available for presentations to citizen groups. A list of additional readings about mosquito control and toxicology is in the Appendix.

**METROPOLITAN MOSQUITO CONTROL DISTRICT  
STAFF & QUALIFICATIONS**

**Joseph Sanzone**, Director, (March 1994) M.S. Biology/Entomology, B.S. Entomology  
**Robert Sjogren**, Director, Ph.D. Entomology - Biological Control/Medical Entomology  
**Susan Palchick**, *Aedes* Program Manager, Ph.D. Entomology, Masters Public Health-  
 Epidemiology, M.S. Entomology

**Daniel Bennek**, Administrative Assistant, B.S. Business/Marketing  
**Sandy Brogren**, Entomology Laboratory, B.S. Entomology  
**William Caesar**, Business Administrator, Masters Business Administration, B.S. Business  
**Dave Clark**, Personnel Manager, J.D., B.B.A.  
**Diann Crane**, Entomology Laboratory, B.S. Biology, M.S. candidate Entomology  
**Dave Crews**, Black Fly Program Leader, B.S. Biology  
**Daniel Dobbert**, Data Analyst, Ed.D.  
**Rosemary Golias**, Admin. Secretary, B.Ed Chemistry/Biology, M.A.Theology  
**Ross Green**, Public Information Officer, B.S. Biology Education  
**Dave Neitzel**, LaCrosse-Lyme Program Leader, B.S. Wildlife Management, M.S.  
 Environmental Health-Public Health Biology  
**Scott Ranta**, Cattail Program Leader  
**Nancy Read**, Program Development, B.S. Biology, M.S. Entomology, Ph.D. candidate  
 Entomology,  
**Kelly Sharkey**, Quality Assurance Program Leader, B.S. Wildlife Management, M.S.  
 Entomology  
**John Thompson**, Data Processing Manager, Computer Science Brown Institute, Management  
 Information Systems - Metro State College (in progress)

**METROPOLITAN MOSQUITO CONTROL DISTRICT  
TECHNICAL ADVISORY BOARD  
1994**

<u>Member Agency</u>	<u>Representative</u>
<b>Environmental Groups</b>	<b>Scott Wasiluk</b> 1747 Frank Street Maplewood, MN 55109
<b>Hennepin County Office of Planning and Development</b>	<b>Robert Sherman</b> A-2308 Government Center Minneapolis, MN 55487
<b>Hennepin Parks</b>	<b>Laurence Gillette</b> 3800 County Road 24 Maple Plaine, MN 55359
<b>McLaughlin Gormley King Company</b>	<b>Frederick J. Preiss</b> 8810 10th Avenue No. Minneapolis, MN 55427

**MN Dept. of Agriculture**

**Art Mason**  
90 W. Plato Boulevard  
St. Paul, MN 55107

**MN Dept. of Health**

**Craig Hedberg**  
717 SE Delaware Street  
Minneapolis, MN 55440

**MN Dept. of Natural Resources**

**Howard F. Krosch**  
Box 25 DNR Building  
500 Lafayette Road  
St. Paul, MN 55155

**MN Pollution Control Agency**

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**University of Minnesota**  
**Entomology Department**

**Dave Noetzel**  
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**Fisheries and Wildlife Department**

**Jim Cooper**  
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St. Paul, MN 55108

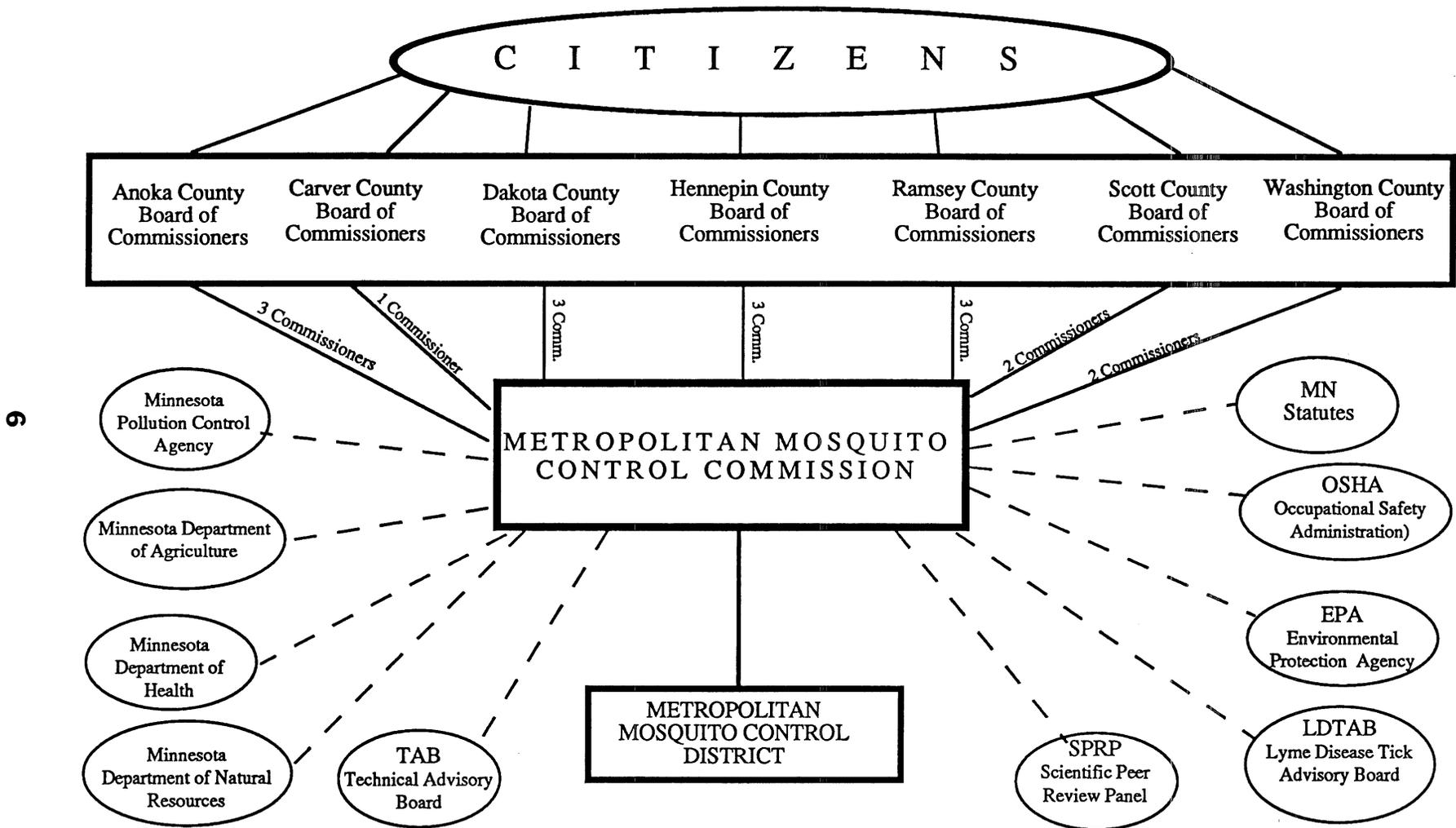
**US Environmental Protection Agency**

**Richard Anderson**  
Environmental Research Laboratory  
6201 Congdon Boulevard  
Duluth, MN 55804

**US Fish and Wildlife Service**

**Stan Smith**  
Twin Cities Field Office  
4101 E. 80th Street  
Bloomington, MN 55425

# METROPOLITAN MOSQUITO CONTROL DISTRICT ADVISORY AND REGULATORY REVIEW



9

TAB (Technical Advisory Board) — Representation from: Mn Department of Health; Mn Department of Agriculture; Mn Department of Natural Resources; Environmental Organizations; MN Pollution Control Agency; Departments of Entomology and Fisheries and Wildlife, University of Minnesota; U.S. Environmental Protection Agency; U.S. Fish and Wildlife Service; Industry

SPRP (Scientific Peer Review Panel) — Members from North America who are specialists in toxicology, wildlife biology, aquatic biology, ornithology, statistics, and entomology.

# METROPOLITAN MOSQUITO CONTROL DISTRICT

## MISSION STATEMENT

THE MISSION OF THE METROPOLITAN MOSQUITO CONTROL DISTRICT IS TO SUPPRESS MOSQUITO AND TICK TRANSMITTED DISEASE AND TO REDUCE ANNOYANCE LEVELS OF MOSQUITOES AND BLACK FLIES BELOW THAT WHICH INTERFERES WITH OUTDOOR ACTIVITIES.

## GOALS

- GOAL 1: To develop and publicize the District's long range and annual plans.
- GOAL 2: To use environmentally sensitive control materials that assure dependable and cost effective control under varying field conditions.
- GOAL 3: To develop and maintain consistency in program procedures throughout the district.
- GOAL 4: To develop and maintain effective quality assurance on all program procedures.
- GOAL 5: To maintain a library of current mosquito control knowledge and technology.
- GOAL 6: To conduct program development research to guide control programs.
- GOAL 7: To develop and maintain effective communication, cooperation, and sharing of resources between the district's field offices and programs.
- GOAL 8: To develop and maintain monitoring programs for immature and adult mosquito, black fly (biting gnat), deer tick populations, and district rainfall.
- GOAL 9: To improve and monitor accuracy in administrative and field operational data bases.
- GOAL 10: To have clear lines of communication between the district and the public
- GOAL 11: To promote employee professional development, enhance personal productivity, work satisfaction, and ensure safe working conditions.
- GOAL 12: To cooperate with other agencies, within the limits of available resources, to maximize public benefit.



## METROPOLITAN MOSQUITO CONTROL DISTRICT PROGRAMS & SUPPORT

### ADMINISTRATION

To work with the public to identify and define the District's overall mission and long range goals, and then establish and implement the procedures necessary to achieve them (p.13).

### PUBLIC INFORMATION

To coordinate and communicate District activities to citizen groups, schools, government agencies, the news media, and the general public (p.15).

### FLOODWATER *Aedes* MOSQUITO PROGRAM

To control the long lived spring *Aedes* species and the prominent summer pest *Aedes vexans* to reduce the nuisance levels from them, and to monitor the vector *Culex tarsalis* to respond to any increased risk of western equine encephalitis transmission (p.19).

### CATTAIL PROGRAM

To control the District's most aggressive mosquito, the cattail mosquito, *Coquillettidia perturbans*, which develop in cattail marshes (p.23).

### LACROSSE ENCEPHALITIS PREVENTION PROGRAM

To prevent the serious childhood viral disease of LaCrosse encephalitis from occurring within the District by controlling the vector mosquito, *Aedes triseriatus* (p.25).

### ENTOMOLOGY LABORATORIES

To provide support that monitors and identifies larval and adult mosquito populations (p.29).

### QUALITY ASSURANCE PROGRAM

To increase the District's effectiveness by striving for consistent improvement in the quality of all aspects of the various control operations (p.37).

### BLACK FLY (Biting Gnat) PROGRAM

To control biting gnats, both the species that breed in small streams during the spring and those that breed in large rivers during the spring and summer (p.45).

### LYME TICK SURVEILLANCE PROGRAM

To determine the distribution within the District of the Lyme disease vector the deer tick *Ixodes dammini*, and the distribution within that tick population of the Lyme disease infectious agent - the spirochete *Borrelia burgdorferi* (p.49).

### PROGRAM DEVELOPMENT

To provide biological information needed to evaluate and improve the control strategies used by the *Aedes* mosquito program, to assist in similar work for other programs, and to develop methods and tools to facilitate and support treatment decisions for specific *Aedes* breeding sites (p.51).

### LONG-TERM STUDIES/SCIENTIFIC PEER REVIEW PANEL (SPRP)

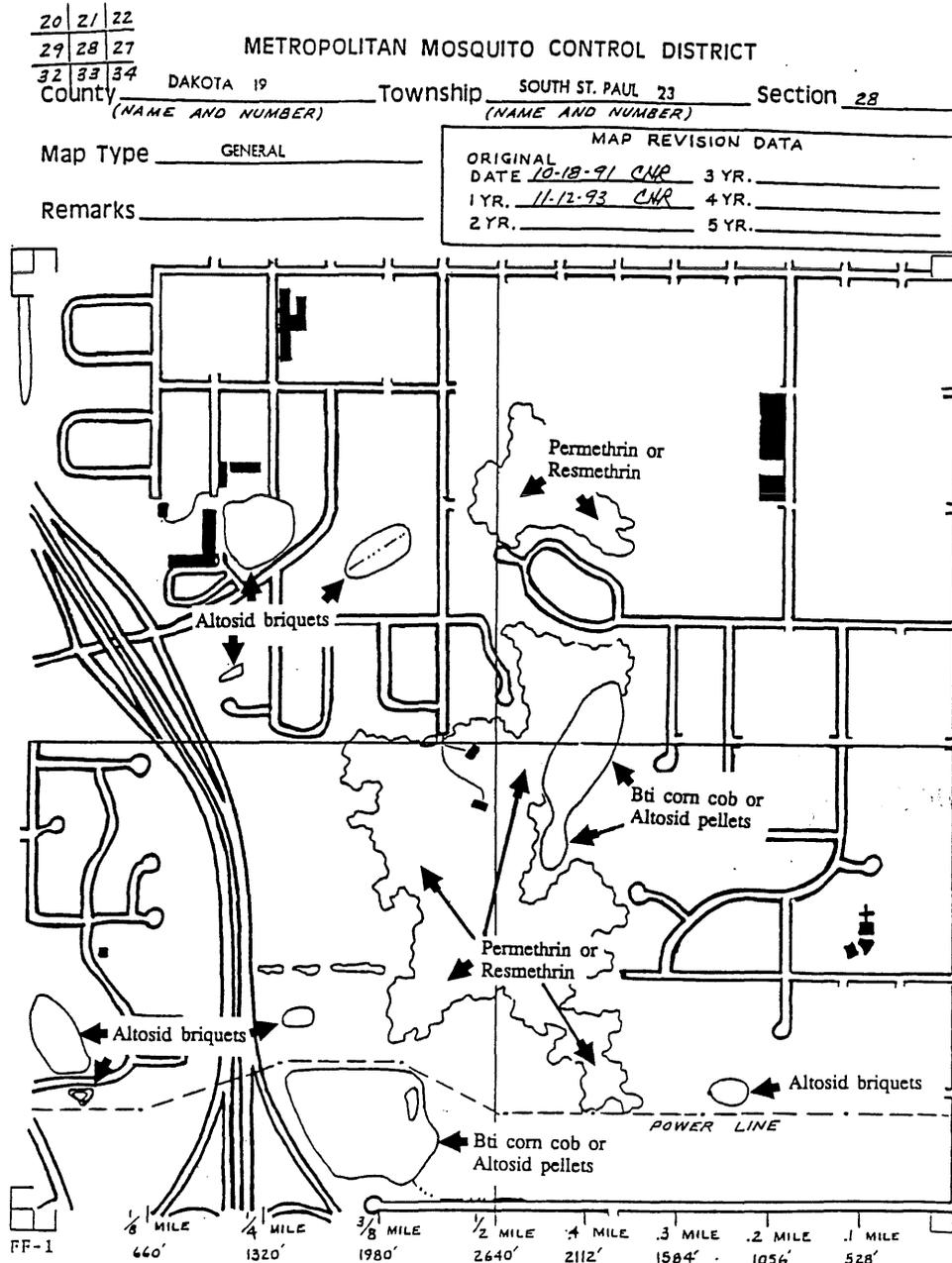
To fund studies on the long-term environmental impacts of the control materials used by the District (p.55).

## MOSQUITO CONTROL MATERIALS

The following is a description of a mosquito breeding site and an explanation of the mosquito control materials currently in use by MMCD. The specific names of products used in 1993 are given. The generic products will not change in 1994, although the specific formulator may. Copies of labels are located in the Appendix.

### **Mosquito Breeding Site -**

A mosquito breeding site is just about any place which will hold water for a week or more after a rain. The typical summer *Aedes* species mosquito breeding site generally occurs in sites which are less than 4 feet deep and in areas which may contain many grasses. The MMCD has mapped breeding sites in the entire metropolitan area as well as sites in Wright, western Carver and southeastern Sherburne counties. There are over 60,000 breeding sites in the metropolitan area. Breeding site maps are updated on a five year schedule. Below is a example of a breeding site map with typical mosquito applications.



## **ALTOSID® 150 DAY BRIQUETS**

(Sandoz Agro-Zoecon Corporation-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 Altosid® briquets due to spotty control achieved in the uneven drawdown of the site.

Cattail mosquito breeding sites are treated at 330 or 440 briquets per acre. Applications are made in the winter and early spring.

Altosid® briquets are not applied to known fish breeding habitats as defined by the MN Department of Natural Resources (DNR).

## **ALTOSID® LIQUID**

(Sandoz Agro-Zoecon Corporation - 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 normally completed by June 1st of each season. Site conditions during the remainder of the season do not allow for successful treatment with a liquid larvicide as the material does not penetrate the vegetation.

## **ALTOSID® PELLETS**

(Sandoz Agro-Zoecon Corporation - 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 the *Aedes* control program and 4-5 lbs. per acre for the Cattail mosquito control program. Applications are also done by helicopter in sites which are greater than 3 acres in size at the same rate as ground sites.

## ***Bacillus thuringiensis israelensis* (Bti) CORN COB**

(Abbott Laboratories Vectobac® G; Novo Nordisk Bioindustrial Bactimos™)

*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.

## **PERMETHRIN**

(Clarke Mosquito Control Products - Permethrin 57% OS)

Permethrin is used by the District to treat adult mosquitoes in known daytime resting or harborage areas. Harborage areas are defined as wooded areas with good ground cover to provide a shaded, moist area for 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. 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 back-pack mister at a rate of 17 oz. of mixed material per acre.

## **RESMETHRIN (Roussel Bio Corporation - 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 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 mixed with other oils and is applied at a rate of 1.5 ounces of mixed material per acre.

## II. PROGRAMS

1. Administration
2. Public Information
3. *Aedes* Control Program
4. Cattail Mosquito Program
5. LaCrosse Encephalitis Prevention
6. Mosquito Surveillance
7. Quality Assurance
8. Black Fly Program
9. Lyme Disease Tick Surveillance
10. Program Development
11. Scientific Peer Review Panel / Long-term Studies



## **ADMINISTRATION**

### **1. Background**

Administration serves each of the field programs by providing overall leadership and support for control operations by coordinating resources for Program Leaders and front-line staff. This function works with the Commission to identify program needs, maintains a link with the public, and works to implement Commission established mission and policies. Long and short range goals are developed to achieve the strategies of the mission and policies.

### **2. 1993 Program**

Normal activities involved with implementation of programs were of importance as well as continuing an emphasis on compliance with Affirmative Action goals and Targeted Group Business purchasing goals. The District also continued to focus on environmental sensitivity and encouraged growth in technical competence for all staff.

The District's Capital Improvement plan continued in 1993 with the commencement of construction of the Dakota Division headquarters and acquisition of buildings to house the Hennepin North and South Divisions. The MMCD administration headquarters, designed as a multiple use facility, was used as a central meeting place for several local governmental agencies during the year.

One of the goals during the year was to empower, inspire, and encourage staff to continue making advances in program quality. In 1993, MMCD began a change in management theory that we call continuous quality improvement (CQI). This journey was begun because we realized that other organizations were using new and better management methods and in many cases, were achieving outstanding improvements in quality, productivity, employee morale and competitive position. We wanted to benefit from these new methods.

The first step was to form a cross functional volunteer CQI steering committee. The committee studied various approaches to quality improvement such as TQM, ISO-9000, Zero Defects and others. After learning the basics of these theories, W. Edwards Deming's 14 point Theory of management was chosen as the basis for quality improvement at the MMCD. Mr. Bob Killeen a speaker from the Minnesota Council for Quality addressed all the employees about the benefits of this method. Committee members made presentations on the 14 points at each of our field headquarters.

Advanced Quality Engineering was selected to teach the concepts and techniques necessary to make further progress. Two organization wide education sessions on continuous improvement were presented followed by a quality audit consisting of employee interviews.

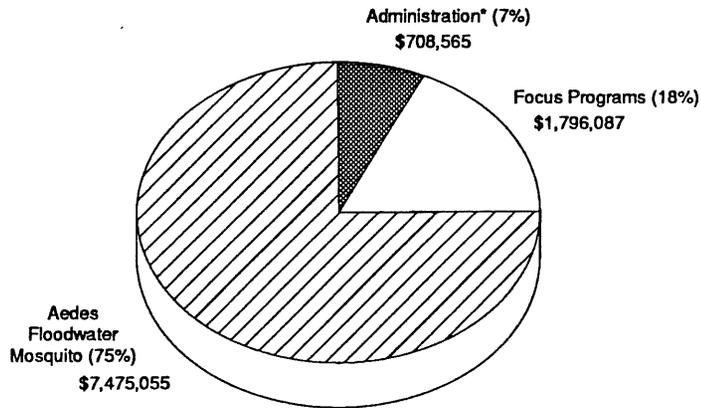
### **3. 1994 Plans**

We expect the completion of the Capital Improvement program and a review of District structure as we welcome a new Director to the MMCD. The CQI program will develop a strategic quality plan to help direct us on the next steps down the quality improvement road. A goal is to improve and maintain our informational link to the public and interested stakeholders.

The MMCD's operations budget of \$9,979,707 for 1994 is a slight increase from the 1993 budget of \$9,917,685. Figure 1.1 shows the allocations of the Metropolitan Mosquito Control District's budget for specific programs in 1994.

# 1994 MMCD BUDGET & PROGRAM BREAKOUTS

## 1994 MMCD Budget Total Budget - \$9,979,707



\*includes \$8,600 for Commission

## 1994 Focus Program Breakouts Total \$1,796,087 (18%)

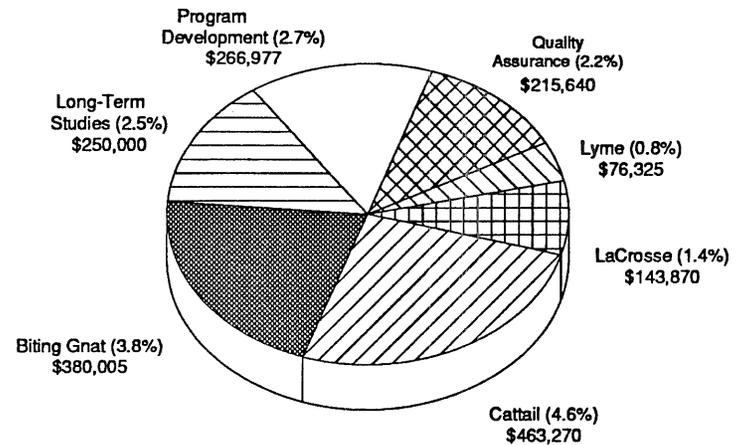


Figure 1.1

## PUBLIC INFORMATION

### 1. Background

The Public Information (PI) program communicates District field activities to citizen groups, government agencies, the news media, and the general public. Response to citizen inquiries is done clearly, concisely, and promptly.

District staff conduct Public Information/Education programs for citizen groups, civic organizations, and school districts within the MMCD. Press releases and filmed interviews provide the public with information about program activities. In addition, PI literature is developed and updated as MMCD programs and public needs change.

### 2. Telephone Response to Citizen Inquiry

As a public agency, the MMCD is responsible to citizen questions and concerns. In 1993 the District received over 1,000 telephone calls inquiring about the District operations (Table 2.1). The staff answer questions, provide information, and obtain information about the caller and their request. Caller information is forwarded daily to the appropriate Supervisor or Program Leader for follow-up. Information requested by the caller is mailed that day or the next morning. The category of calls received and the path of service for each are as follows:

***Citizen concerns.*** Citizens call with a variety of questions or concerns including control material information, notification before treatment, objection to treatment on private property, helicopter use, and chemical sensitivity, among others.

Callers are reassured that their concerns are being heard and that prompt action will be taken. A simple exchange of information is usually sufficient. However, many times callers are angry or upset and such calls are forwarded directly to the PI coordinator. An investigation is initiated with follow-up that includes contact by letter, additional phone call(s), or personal visit. If the concern demands immediate attention, the Supervisor/Program Leader is located and apprised of the situation. Follow-up and response are completed within two working days. Follow-up for general questions or concerns is completed within five days. District information is sent to the caller in addition to any specific follow-up to their request.

***Report of a breeding site.*** Callers want to know if we are aware of a breeding site on their property or in their neighborhood and whether or not it has been treated.

The information taken from the caller is given to the appropriate Supervisor or Program Leader for follow-up. Maps and records are checked to make sure the site is listed. More than 95% of these calls refer to sites that are already mapped. If the field staff is unfamiliar with or unclear about the site, the citizen is contacted and the area is field-checked. A citizen response sheet is completed and returned to the main office within 7 to 10 days. We suggest that the citizen call back after that time for an update.

The caller is also sent information regarding breeding site identification and materials that we use. Brochures about the entire MMCD program, LaCrosse Encephalitis Prevention, Black Fly Program, and other related information are also available.

**Mosquito annoyance complaints.** A caller registers a general complaint (e.g. "The mosquitoes are terrible! Please help!") with no reference to a breeding site nearby. Many times these calls come from areas in the District where larval control is minimal resulting in higher mosquito annoyance. Black fly annoyance is also recorded in this category. Caller information is recorded and sent to the appropriate Division. In addition, telephone staff explain our adult mosquito surveillance methods and control operations and information is sent to the caller. The information obtained from the caller is valuable and helps direct control operations in that Division.

**Public property treatments.** Representatives from civic organizations or government agencies call to request adult mosquito control for park and recreational areas and for civic events (i.e., graduations, sporting events, and local fairs and celebrations). Most public functions are held annually and treatment requests need to be submitted yearly. Information is recorded and sent to the appropriate Division. Treatments are done once the priority work has been completed and weather conditions permit. Field staff document treatments and return information to the main office.

Table 2.1

### TELEPHONE SUMMARY 1993

The following shows the number of telephone calls by category, received by the MMCD.

TYPE OF CALL*	1990	1991	1992	1993
CITIZEN ISSUES & CONCERNS	239	234	292	233
MOSQUITO BREEDING SITE LOCATIONS	274	347	273	359
MOSQUITO/BLACK FLY (GNAT) ANNOYANCE LEVELS	211	112	161	173
PUBLIC TREATMENT REQUESTS	171	161	137	171
GENERAL INFORMATION	236	194	210	387
CALLS TOTAL -	1,131	1,048	1,073	1,323

\* Caller may have voiced more than one concern or issue.

### 3. Adult Mosquito Control Information Line - 643-8383

To inform citizens concerned about the time and location of mosquito adulticiding operations, the MMCD expanded its adulticiding information line. The information line enables citizens to hear a daily recorded message on where adulticiding activities will be taking place. This provides a greater service to the citizens since they do not have to be at home to receive our call. Staff will call citizens who still desire advanced notice of adult mosquito control treatments.

The MMCD uses its voice mail system to update daily information on this line. District field staff input information to staff at the end of work shifts which then allows staff to update the line by 4:00 P.M. weekdays.

Callers to the information line are first given a general greeting, followed by instructions for specific counties within the Metropolitan area. By pressing the corresponding number to the county requested, the caller receives specific back pack and cold fogging information for each community within the county involved.

Citizen who have expressed concern over adulticiding activities receive a letter with instructions on the use of the system at the beginning of the season. A person who chooses not to use this system can request the MMCD contact them if treatments were to happen in their area.

Results from the number of calls received were tallied, and broken out at the end of the season. (Table 2.2)

Table 2.2

<b>ADULT MOSQUITO CONTROL INFORMATION LINE 1993</b>		
	<b>Number of Phone Calls Received</b>	<b>Percent by County</b>
<b>Anoka</b>	<b>151</b>	<b>18.3%</b>
<b>Carver</b>	<b>52</b>	<b>6.3%</b>
<b>Dakota</b>	<b>35</b>	<b>4.2%</b>
<b>North Hennepin</b>	<b>87</b>	<b>10.5%</b>
<b>South Hennepin</b>	<b>286</b>	<b>34.6%</b>
<b>Ramsey</b>	<b>98</b>	<b>11.9%</b>
<b>Scott</b>	<b>63</b>	<b>7.6%</b>
<b>Washington</b>	<b>54</b>	<b>6.5%</b>
<b>Total -</b>	<b>826</b>	<b>100.0%</b>

May-October 1993

#### 4. Metropolitan Mosquito Control District Video

A 10 minute video on MMCD operations was completed in 1993. The video provides an overview of all District programs. This video is used in presentations by staff as an introduction to the program. Additional copies of the video are available for presentations.

#### 5. State & County Fairs Booth Presentations

This summer, for the first time ever, information booths were set up at State and County fairs. The booths featured examples of mosquito and black fly larvae; deer and wood ticks; information on Lyme disease; and dog heartworm displays. We also distributed information brochures on all of the programs. An estimated 33,000 visitors stopped to inquire and staff reported that the public response to the displays and the program was over 95% positive.

Following is a tabulation of the number of people who visited our booth (Table 2.3):

Table 2.3

**Metropolitan Mosquito Control District  
1993 Estimated Visitors to Informational Booths  
County and State Fairs**

<b>DATE</b>	<b>FAIR</b>	<b>ESTIMATED # PEOPLE VISITED</b>
August 3 - 8	Anoka County Fair	1,850
August 11 - 15	Carver County Fair	2,550
August 9 - 15	Dakota County Fair	2,500
July 22 - 25	Hennepin County Fair	700
July 21 - 25	Ramsey County Fair	1,400
July 29 - August 1	Scott County Fair	1,850
August 5 - 8	Washington County Fair	3,000
August 26 - September 6	Minnesota State Fair	20,007
	<b>Total Estimated Visitors -</b>	<b>33,857</b>

## **AEDES CONTROL PROGRAM**

### **1. Background**

The *Aedes* Control Program targets the principal summer pest mosquito, *Aedes vexans*, and several species of spring *Aedes*. Larval control is the main focus of the program but is augmented by adult mosquito control when necessary.

*Aedes* 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 of the area. The rolling topography provides an unusually high number of highly productive breeding sites for the 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 resting adult mosquitoes.

### **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. The *Aedes* Control Program targets the most prolific mosquito breeding locations. An insect growth regulator (Altosid® or methoprene) and a soil bacteria (*Bti*) are the larval control materials.

Adult mosquito control is a minor part of the MMCD program. Control is done upon request in high use park and recreation areas and for public events. Two synthetic pyrethroids (resmethrin and permethrin) are used for adult mosquito control.

### **3. 1993 *Aedes* Control**

#### ***Larval Control***

As in the past, ground sites (less than 3 acres) were treated primarily with Altosid® briquets. This formulation provides season long mosquito control. In 1993, 9,775 acres were treated with briquets compared to 9,836 in 1992. Approximately 4870 acres were treated with pellets, a 30 day Altosid® formulation, in 1993.

Air sites (3 acres or more) were treated with *Bti* corn cob granules by helicopter. Approximately 123,766 acres were treated in 1993, which is 1.2% increase over the 101,877 acres treated in 1992. This increase is primarily due to the above average rainfall in 1993. The treatment threshold was set at 2 larvae per dip in the inner zone of the District. 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.

The Quality Assurance report discusses the relative effectiveness of *Bti* granules from different vendors. Lack of interest by field personnel restricted the trials of Altosid® Liquid Larvicide concentrate applications by helicopter.

#### ***Adult Mosquito Control***

Permethrin usage (8,312 acres) was less than usage in 1992 (12,812 acres). Resmethrin usage (53,634 acres) was greater than in 1992 (48,712) probably due to increased mosquito numbers, decreased use of permethrin and increased use of resmethrin from a hand held fogger.

#### **4. Supporting Research**

The following studies were conducted to evaluate present and possible future control methods. More detailed reports are available in the MMCD library.

##### ***Briquet Carryover***

With the yearly application of briquets to breeding sites, we have been concerned about possible carryover effects of these treatments. Three years of study are now complete. Briquets will totally degrade if they are under water for 355 to 515 days. At 150 days under water they will be 81% degraded. Although there may be briquet mass remaining, the percent methoprene available is below that which provides mosquito control. Neither the number of times the water level fluctuated around the briquet nor the site type influenced the effect on degradation.

##### ***Park study***

This study was conducted to determine how an MMCD perimeter backpack treatment using permethrin impacted the mosquito annoyance levels in treated parks. Treated parks were compared with similar untreated parks in the same area. Whole person bag samplers (WPBS) and CO<sub>2</sub> traps were used to sample mosquitoes in the evening.

Nine weeks of sampling were successfully completed over the summer and the samples were identified, counted, and stored during the fall. It was shown that treatments significantly decreased mosquito populations (as measured by the WPBS) in the parks. Further analysis will show how long the treatment lasts in the parks.

##### ***Resistance testing***

We are still experiencing problems with resistance testing, and we will be working with toxicologists at University of California to refine the techniques in 1994.

#### **5. 1994 Plans for *Aedes* Control**

##### ***Larval Control***

Several years of data which indicated more consistent control rates from Altosid<sup>®</sup> pellets than from Altosid<sup>®</sup> briquets led to a decision to reduce the amount of ground site acres treated by briquets to 8,100 in 1994. Most operating divisions have reduced their planned briquet use by 20%, and will use pellets on the remaining acres.

For air sites, we plan to use 5 helicopters for the majority of the operational program with a sixth helicopter available during district wide broods and for widespread mosquito production. This procedure worked very well in 1993, as most sites appropriate for treatment were reached during each brood.

The primary control material will again be *Bti* corn cob granules. The amount of material budgeted this year is similar to that budgeted in 1993. Treatment thresholds, the minimum number of larvae in a sample to warrant treatment, have not yet been set for this year. Thresholds are intended to maximize the limited time available to fly each brood.

Use of pellets applied by helicopter have been hampered as a result of difficulties in applying the low dose uniformly. We hope to attain the proper level of precision for application with the cooperation of the pilots, the manufacturer of the helicopter delivery system, the supplier of pellets, and the expertise of the University of Minnesota calibration specialist. This calibration work started last fall and will continue in April, 1994.

### ***Adult Mosquito Control***

Both permethrin and resmethrin applications are planned to be lower in 1994 than in 1993. In 1994, adult mosquito control treatments will again be targeted primarily at high use park and recreation areas. Field supervisors met with park and recreation directors to confirm that mosquito control applications were being made to those areas desired by park directors. Cold fogging will be reduced to a back-up for these treatments and for public events where control is requested.

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. This provides a greater service to the citizens because they do not have to be at home to receive our call. However, staff will continue to call citizens who still want advance notice of MMCD adult mosquito control treatments.



# CATTAIL MOSQUITO PROGRAM

## 1. Background

The Cattail Program controls the District's most aggressive biting mosquito, *Coquillettidia perturbans*. Larvae of this mosquito develop in cattail marshes over twelve months and emerge as adult mosquitoes during June and July. The goal of the Cattail Mosquito Program is to inspect and treat all potential cattail breeding sites in the area served by the *Aedes* Control Program.

## 2. 1993 Program

Crews inspected approximately 1,500 *Cq. perturbans* breeding sites from mid-August through November, 1992. Larviciding began in February 1993 using Altosid® XR 150-day briquets applied on the ice and snow. Deep sites were treated first and applications continued through April when the small, shallow sites were treated after the spring thaw. A total of 782 acres were treated with Altosid® briquets and 686 acres with Altosid® 30-day pellets applied by helicopter in late May.

### *Efficacy Studies*

Cattail Mosquito Program staff conducted operational studies on the efficacy of Altosid® 30-day pellets applied by helicopter. Six emergence cages were placed in each of 9 sites treated with the pellets and in 7 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 May 27 through August 27, 1993. Altosid® pellets markedly reduced the number of *Cq. perturbans* emerging from treated sites compared to untreated sites throughout the study period (Fig. 4.1).

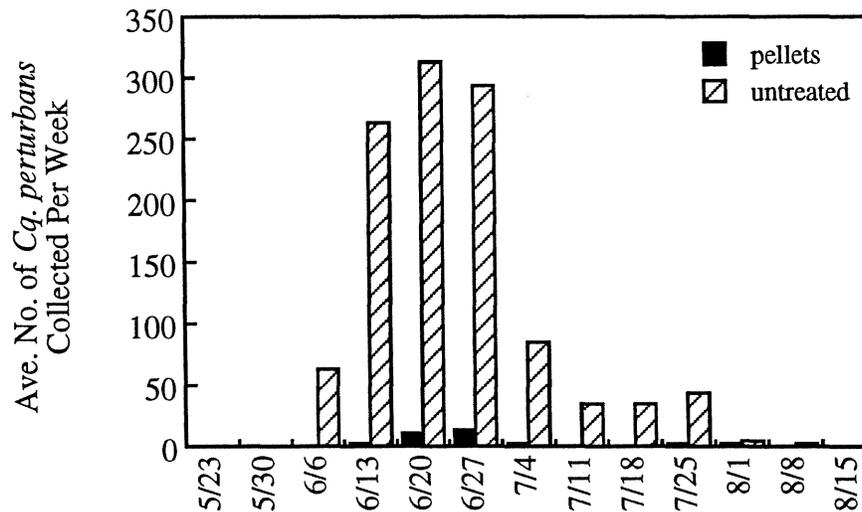


Fig. 4.1 Average number of *Cq. perturbans* collected per week in emergence cages in 1993.

Overall, pelleted sites had a 96% reduction in mosquito emergence compared to the untreated reference sites (Fig. 4.2).

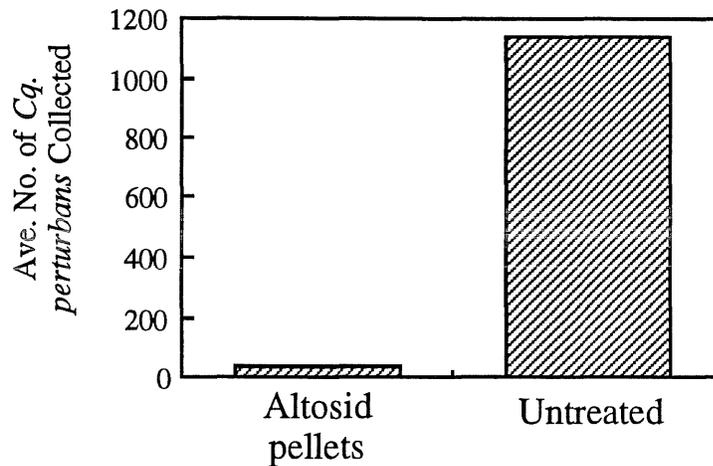


Fig. 4.2 Average numbers of *Cq. perturbans* collected per study site receiving either Altosid pellet treatments or no treatments in 1993.

We also used 8 CO<sub>2</sub> baited light traps to monitor adult *Cq. perturbans* populations in Ramsey County. Counts of *Cq. perturbans* decreased in 1993 compared to 1992. We believe the reduction was due to the increased use of the 30-day pellets which allowed us to treat more acres.

### 3. 1994 Plans

Because *Cq. perturbans* has a limited flight range of 5 miles, the program will focus control activities on the most productive marshes near human population centers. Regular applications of Altosid® 150-day briquets will begin in February 1994. We anticipate being able to treat more acres this year because of the shift from briquets to pellets. Altosid® pellets will be applied by helicopter to large cattail marshes late in May at a rate of 4 lb/ac. During the summer months we will monitor the efficacy of these treatments. We will also increase the adult monitoring by setting up more CO<sub>2</sub> traps throughout the District.

## LACROSSE ENCEPHALITIS PREVENTION PROGRAM

### 1. Background

The LaCrosse Encephalitis Prevention Program was initiated in 1987 to identify areas of significant risk of LaCrosse encephalitis case occurrence 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 and mosquito breeding site removal. In addition, surveillance and control procedures are conducted at confirmed LaCrosse encephalitis case sites. We have also initiated an *Ae. albopictus* (Asian tiger mosquito) surveillance program to detect this potential LaCrosse encephalitis vector before it becomes established within the District.

### 2. 1993 Program

#### *Aedes triseriatus* Surveillance

Studies are done in areas that have been identified as high risk for LaCrosse encephalitis. High risk areas were identified based on past confirmed cases and suitable *Ae. triseriatus* habitat. This year, intensive sampling was conducted in western Dakota and eastern Scott counties at 80 randomly chosen woodlots. Adult mosquitoes were collected from each site using a large aspirator. Locations that yielded a season average of 2 or more *Ae. triseriatus*/5 minute sample in 1993 will be priority areas for control in 1994.

The majority of past LaCrosse encephalitis cases occurred in the Lake Minnetonka region of Hennepin County. High risk neighborhoods within this region were identified during our 1988 and 1989 surveys. Levels of *Ae. triseriatus* at those high risk sites continued to be monitored, and several locations that will require additional control efforts in 1994 have been identified. Surveillance efforts were also continued at all past confirmed LaCrosse encephalitis case locations to prevent further cases in those areas.

#### *Aedes triseriatus* Control

We distributed several thousand copies of the program's educational leaflet. Leaflets were supplied for distribution to every city hall and public library in the high risk LaCrosse encephalitis areas--southern Hennepin County, northern Dakota County, and eastern Carver County. Citizens of southern Hennepin and eastern Carver counties living in high risk neighborhoods (identified by our surveillance) were also given leaflets.

The program provided two press releases on LaCrosse encephalitis which were sent to over 50 local media sources. In addition, interpretive posters and other information were presented at each county fair and the State Fair. The presentations outlined LaCrosse encephalitis, and stressed water-holding container removal.

In 1993, our staff removed 40,838 waste tires from high risk areas of the District (Fig. 5.1). The waste tire agreement with the Minnesota Pollution Control Agency (MPCA) was continued. The MPCA renewed a grant to the MMCD to cover a portion of the waste tire disposal costs incurred by our staff while removing tires from the field. Most tire piles with over 100 tires were reported to the MPCA for their abatement action.

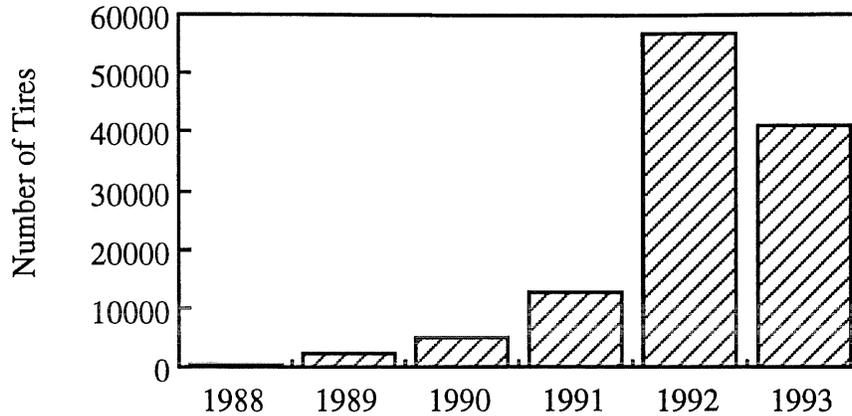


Fig. 5.1 Waste tires removed by MMCD staff between 1988 and 1993.  
Total tires removed to date=118,374

Program staff removed artificial containers and modified wet tree holes in several areas including the Lake Minnetonka area (Hennepin County). No confirmed cases of LaCrosse encephalitis have been reported in the District from 1989 through 1993 (Fig. 5.2). However, cases have occurred each year in southeastern Minnesota, outside our control District.

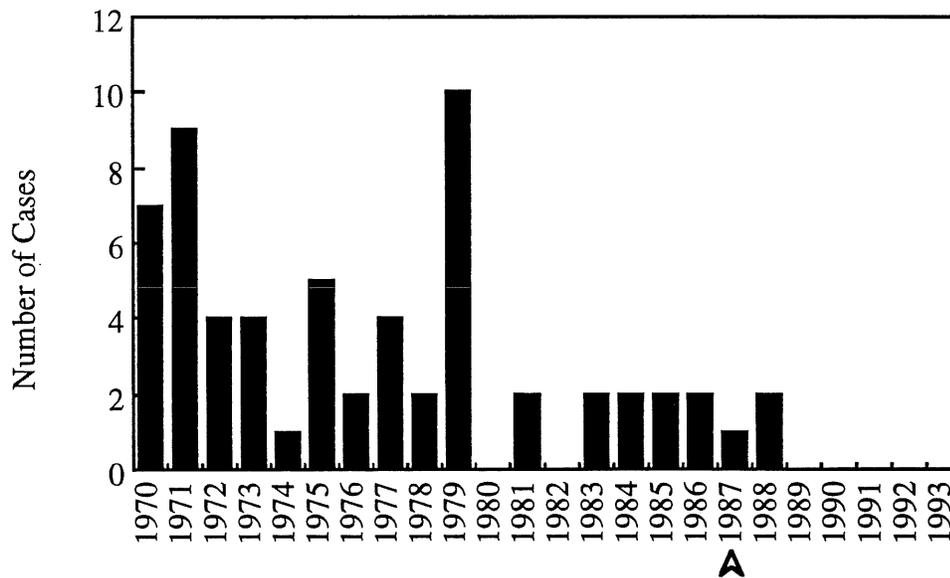


Fig. 5.2 Number of LaCrosse encephalitis cases between 1970 and 1993 in the seven county metropolitan area. LaCrosse Encephalitis Prevention Program began in 1987.

***Aedes albopictus* (Asian tiger mosquito) Surveillance**

We found no evidence of *Ae. albopictus* within the District in 1993. The infestation discovered at a Scott County tire recycling facility in 1991 has been eradicated. In addition, no *Ae. albopictus* were found during regular monitoring at several other tire businesses.

### 3. 1994 Plans

The LaCrosse Program will continue the current surveillance and control programs in 1994. *Aedes triseriatus* surveillance will be conducted in the next identified risk areas of western Hennepin and northern Carver counties. In addition, surveillance will also be continued in the Lake Minnetonka area to monitor the long term need for additional control efforts.

Waste tire removal will continue to be a priority in 1994. 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. Water-holding container removal will also be conducted as these areas are found.



# MOSQUITO SURVEILLANCE

## 1. Background

The MMCD Entomology Lab coordinates and processes larval and adult mosquito collections. Mosquitoes from all collections are identified to the species level of classification. Larval collections are taken from breeding sites prior to treatment to determine whether human-biting species are present in sufficient numbers to treat the site. Light traps monitor disease vector species and provide historical data of mosquito populations. Sweep net collections are taken during the day in wooded areas which are located every 8 square miles throughout the District.

## 2. 1993 Summaries

### *Rainfall*

The Entomology Lab maintains a network of 85 rain gauges located throughout the District to monitor rainfall amounts. Rainfall amounts greater than 1 inch can produce a brood of mosquitoes. Gauges are read immediately after a rainfall and control efforts are concentrated on areas that received rainfall sufficient to produce a brood.

Average rainfall per gauge in the District in 1993 was 27.84 inches. This was 40% above the 35-year average (Table 6.1). The rain was distributed evenly over the district, with slightly more in Scott County than in other counties (Fig. 6.1).

MMCD rain gauge readings are also reported to the MDNR State Climatology office to supplement their network.

### *Larval Collections*

Larval samples are promptly identified and the location of sites that meet treatment threshold are quickly conveyed to field personnel for treatment. Priority is given to larval samples which require helicopter treatment rather than ground treated sites.

Weekly summaries of species and number of collections for each county are produced and distributed to personnel. In 1993, 21,795 larval collections were identified. This number is above average for the past 10 years (see appendix).

Above average rainfall in 1993 produced 12 broods of mosquitoes which is twice the normal 6 broods per season. Flooding produced many new breeding sites, resulting in more areas to sample for larvae.

### *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. Light trap sample processing is still in progress.

### *Adult Collections—Sweep Net*

Twice a week MMCD field personnel take 2-minute sweep net collections from 104 locations (Fig. 6.2). Field personnel kick the brush and sweep the air as they walk through the area to collect resting mosquitoes.

Table 6.1. Rainfall totals for May 1 - September 30.

YEAR	Anoka	Carver	Dakota	N. Henn.	Hennepin	S. Henn.	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	18.51	19.13	19.51	20.55	16.00	24.34		19.92
1981	17.13		19.36	17.72	18.01	18.37	19.35	21.40	20.01		19.08
1982	16.84		16.21	15.88	15.46	14.87	14.32	16.71	14.62		15.59
1983	18.17	24.53	19.99	19.74	20.14	20.67	19.55	23.32	19.09		20.31
1984	20.18	27.31	17.35	20.52	21.63	23.10	22.58	22.09	20.75		21.45
1985	24.42	18.29	17.38	20.55	20.47	20.38	21.74	18.02	21.37	26.26	20.73
1986	22.81	21.90	24.87	20.94	21.55	22.31	24.56	24.85	25.59	24.28	23.39
1987	17.10	20.17	20.17	20.63	22.21	23.62	19.72	17.11	17.11	15.70	19.48
1988	13.50	10.50	12.46	11.07	11.69	12.07	14.33	11.90	14.42	9.35	12.31
1989	14.94	16.62	16.16	16.81	16.83	16.85	15.92	18.50	17.66	18.08	16.64
1990	25.23	23.38	22.73	23.04	23.54	24.08	24.61	24.89	22.97	22.49	23.95
1991	27.49	27.14	22.06	29.97	28.19	26.42	27.31	23.15	25.65	27.26	26.88
1992	15.40	18.29	21.67	20.63	19.33	18.13	20.72	25.13	19.37	17.02	19.10
1993	27.81	28.00	26.99	26.79	27.40	28.14	28.73	31.04	27.42	25.46	27.84
Thirty-five year average	19.02		19.39		19.70		19.87	19.17	20.10		19.44

Fig. 6.1. Rainfall in each county in 1993 compared to District 35-year average.

### Rainfall May-Sept. 1993

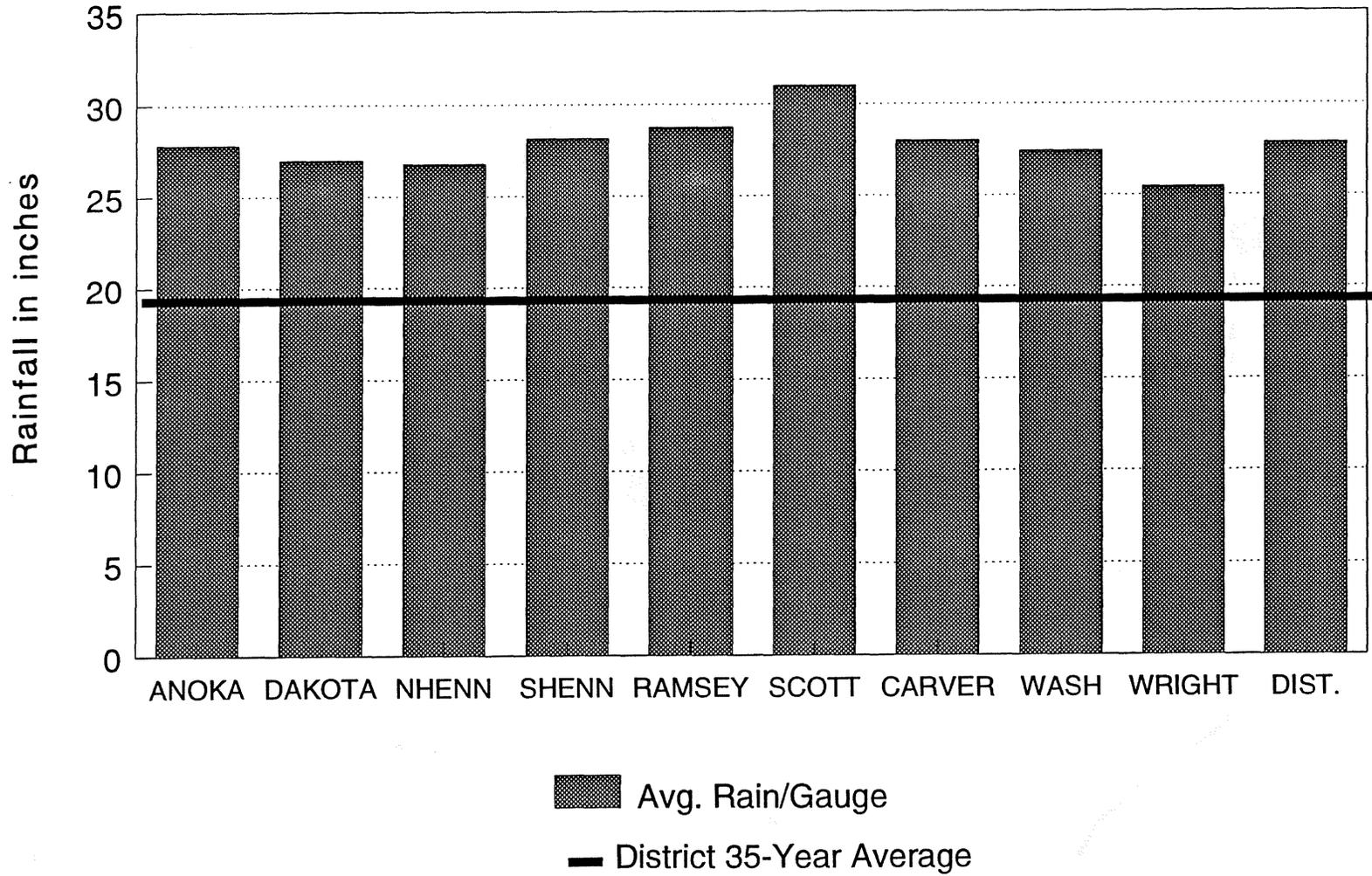
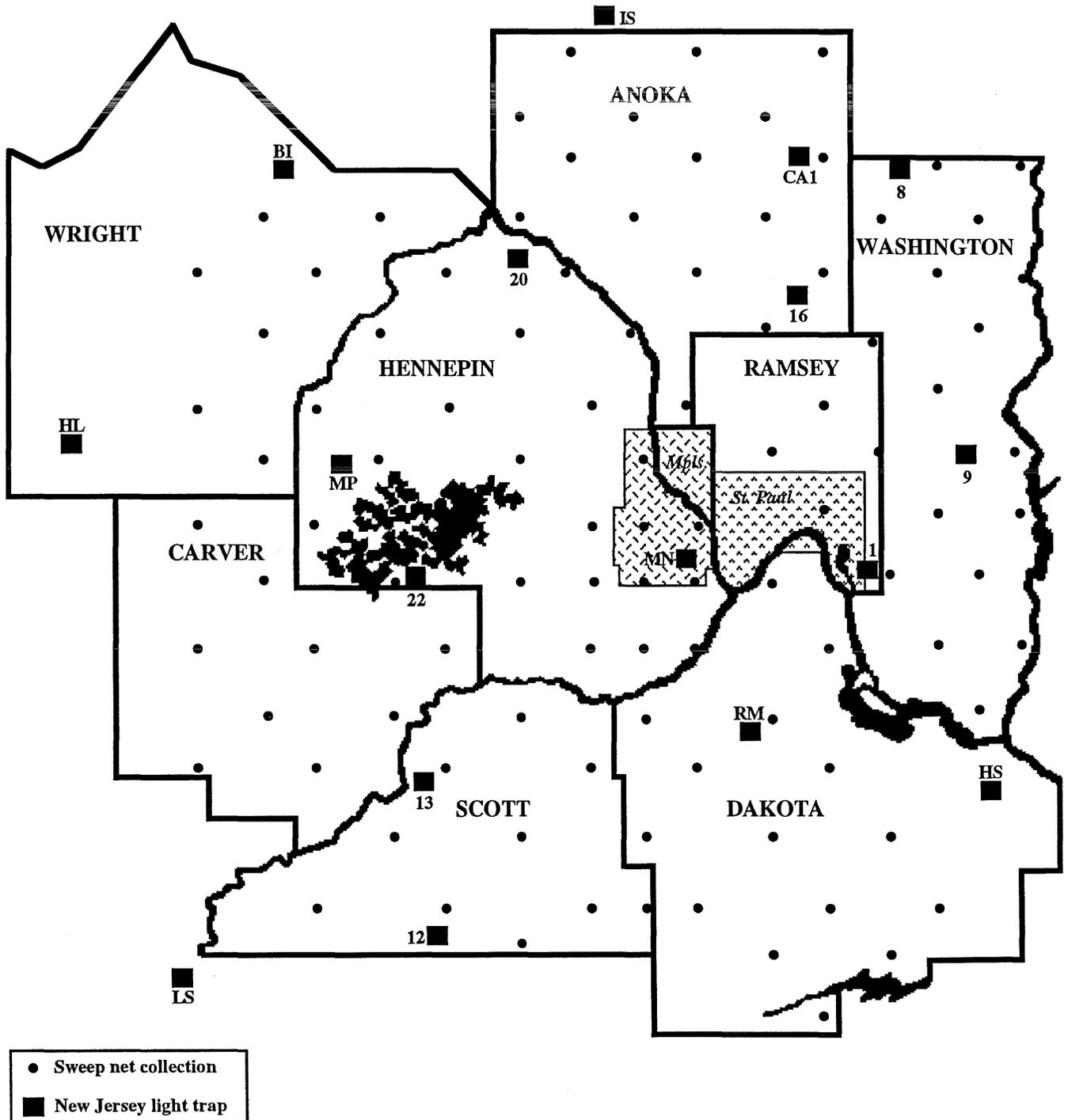


Fig. 6.2. Sweep net and New Jersey light trap collection locations.



*Aedes vexans* was the predominant species collected in sweep net collections in 1993, accounting for 57% of all mosquitoes collected (Table 6.2). The spring *Aedes* and *Cq. perturbans* were the next most abundant species detected; each comprised 4% of the total mosquitoes collected, and *Ae. cinereus* accounted for 3% of all mosquitoes sweep netted.

*Aedes vexans* has consistently been the most abundant mosquito collected; it has comprised over 50% of the sweep net samples in each of the past 4 years (Table 6.2). Spring *Aedes* levels, though low, have been static over the past 4 years. *Coquillettidia perturbans* populations have increased from 1990 levels, probably due to wetland (i.e. cattail marsh) recovery from drought conditions experienced in the late 1980's. *Aedes cinereus* levels have declined significantly over the last three years. In 1990, *Ae. cinereus* was quite abundant accounting for 21% of all mosquitoes collected, it decreased to 11% in 1991, and in 1993 it accounted for only 3% of mosquitoes collected.

In 1992, *Ae vexans* populations went from almost zero in May and June to extremely high levels in early July while *Ae. vexans* was more numerous all season long in 1993 (Fig. 6.3). Peak abundance of *Ae. vexans* was in July for both years.

Unlike 1990 and 1991, which had above average numbers of mosquitoes in sweep net collections with above average rainfall, 1993 had 40% above average rainfall and mosquito totals 9% below the 1990-1993 average (Fig. 6.4).

There was some concern about the floods producing high populations of *Culex tarsalis*, the vector of western equine encephalitis. However, the weather and breeding site conditions needed to produce large populations did not occur and levels of *Cx. tarsalis* remained low (Table 6.2).

### **3. 1994 Plans**

Adult mosquito sampling is needed to measure program effectiveness, measure annoyance, direct control measures, monitor disease vectors and collect historical data. Our current methods using New Jersey light traps and sweep net collections do not adequately measure all these parameters. Along with the MMCD Research Review Committee, we are working to identify the adult mosquito collection method or combination of methods to meet these needs. Studies will be conducted in 1994 to begin to answer questions about adult mosquito surveillance.

Table 6.2. Numbers of mosquitoes collected in sweep nets 1990 - 1993.

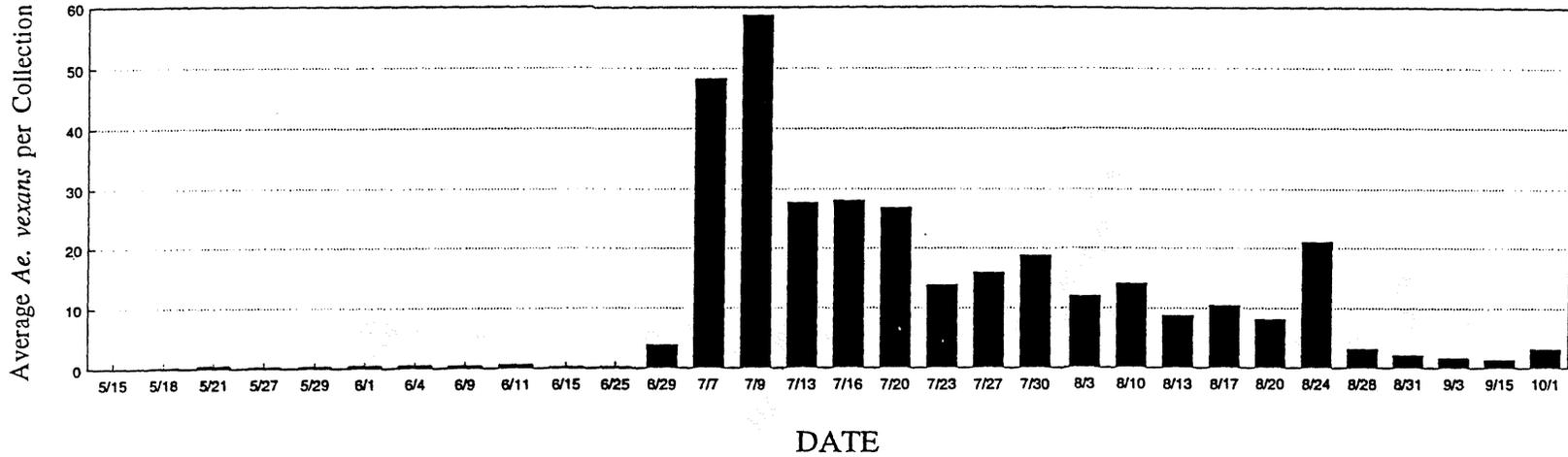
	*1990			**1991			**1992			**1993		
	Number Collected	% of Total	Avg./ Coll.	Number Collected	% of Total	Avg./ Coll.	Number Collected	% of Total	Avg./ Coll.	Number Collected	% of Total	Avg./ Coll.
<i>Aedes vexans</i>	107734	56	14.2	68397	62	19.1	32603	65	10.7	42939	57	12.6
<i>Aedes cinereus</i>	40228	21	5.3	11728	11	3.3	665	1	0.2	2168	3	0.6
<i>Spring Aedes</i>	11487	6	1.5	7765	7	2.2	2941	6	1.0	3260	4	1.0
<i>Coq. perturbans</i>	75	<1	<0.1	175	<1	<0.1	1905	4	0.6	3147	4	1.0
<i>Culex tarsalis</i>	143	<1	<0.1	27	<1	<0.1	17	<1	<0.1	37	<1	<0.1
<i>Others</i>	33458	17	4.4	21926	20	6.1	11916	24	3.9	24346	32	7.1
<b>Total</b>	<b>193125</b>	<b>100</b>	<b>25.5</b>	<b>110018</b>	<b>100</b>	<b>30.8</b>	<b>50047</b>	<b>100</b>	<b>16.4</b>	<b>75897</b>	<b>100</b>	<b>22.2</b>
	No. Collection Days	38		No. Collection Days	37		No. Collection Days	31		No. Collection Days	33	
	No. of Collections	7575		No. of Collections	3575		No. of Collections	3052		No. of Collections	3416	

\*202 Collection locations

\*\*104 Collection locations

Figure 6.3. Seasonal occurrence of *Aedes vexans* measured by sweep nets in 1992 and 1993.

### SWEEP NET COLLECTIONS 1992



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### SWEEP NET COLLECTIONS 1993

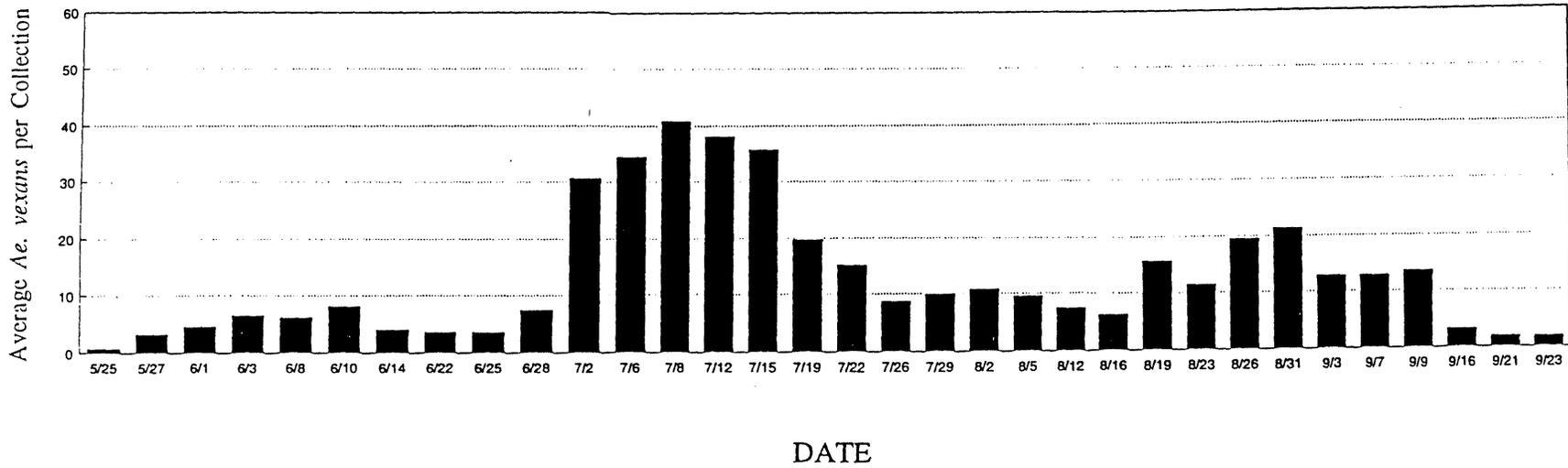
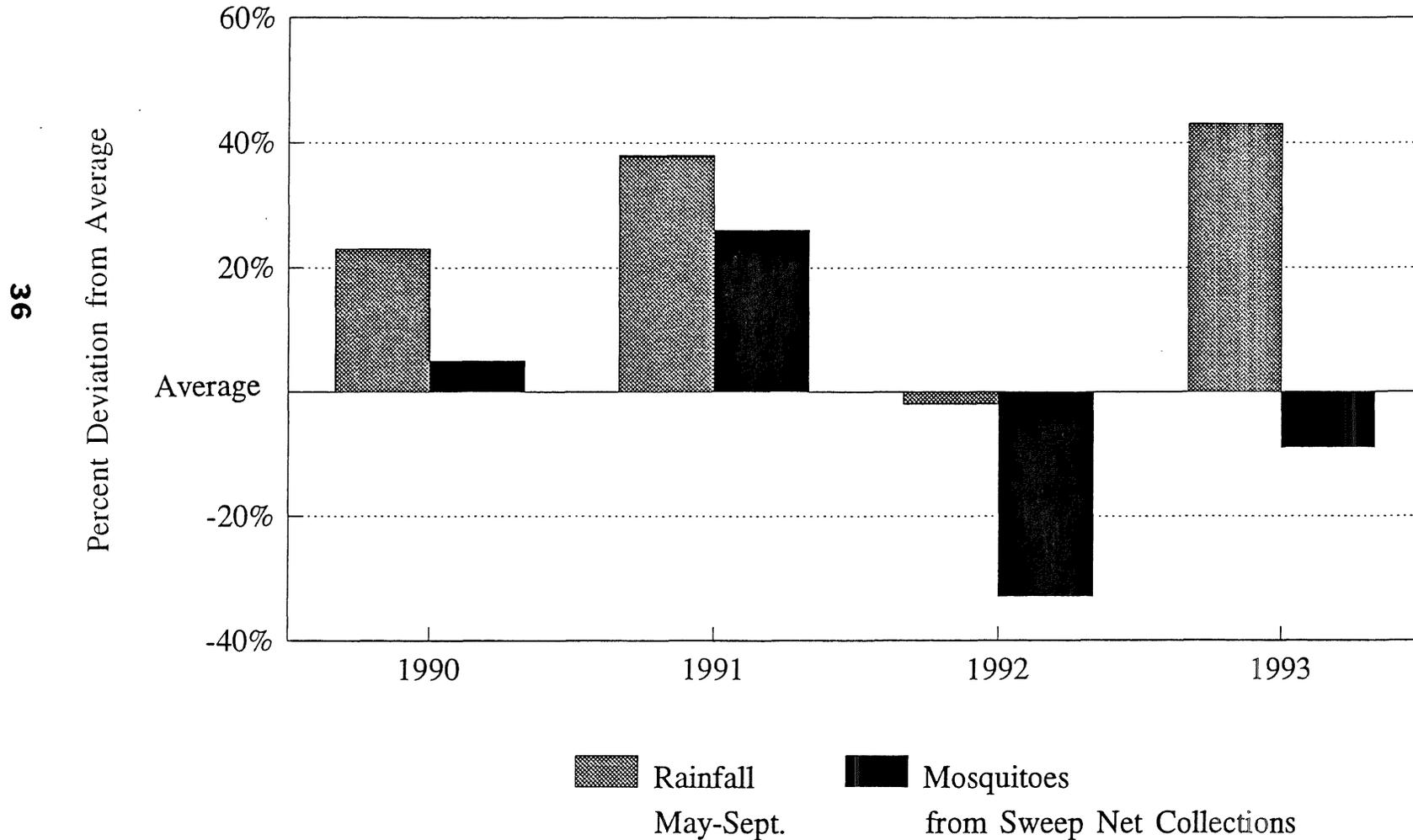


Fig. 6.4. Mosquito totals from sweep net collections in 1993 were below average even though rainfall was above average.

### Rainfall and Mosquitoes Percent Deviation from Average



# QUALITY ASSURANCE

## 1. Background

The Quality Assurance (QA) Program provides technical support and field assistance in quality related areas for all operational programs of MMCD. In 1993, the QA program sampled incoming larval mosquito control products for active ingredient levels, measured efficacy of these products during field operations, assessed the accuracy of briquet placement, and coordinated the redrawing and updating of MMCD section maps.

## 2. 1993 Program

### Average Control Rates

During the 1993 mosquito season, the District experienced rainfall that was 40% above normal (MMCD records) and cool temperatures, which resulted in 12 broods of mosquitoes. In this environment, 3 of 4 larval control materials showed declines in efficacy against *Aedes* mosquitoes compared to last year (Fig. 7.1). Only the 5 lb/ac *Bti* (Vectobac® G), which was used in spring before heavy rains came, showed an increase in efficacy. Average control of the 5 lb/ac *Bti* treatments (n=395) measured was 80% compared to 72% last year. Last year's best performer, 2.5 lb/ac Altosid® pellets, declined significantly from 95% to 78% (n=300), and Altosid® briquets declined from 77% to 70% (n=271). Average control with 8 lb/ac *Bti* (Vectobac® G) was 86% (n=526) compared to 89% last year. Last year's official summer *Bti* rate was 7.5 lb/ac, this year the rate was changed to 8 lb/ac for ease of calculations.

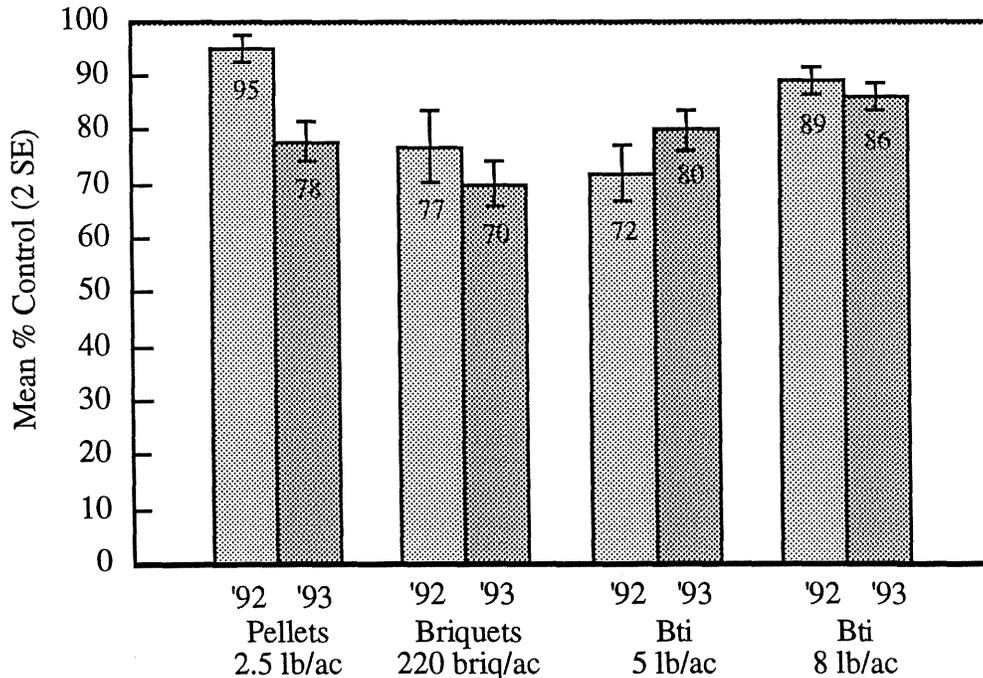


Figure 7.1. Average control of *Aedes* mosquitoes with the larvicides used by MMCD in 1992 and 1993.

Control rates with all larval control products must be improved substantially if MMCD is to meet its target rate of at least 95% control. This target rate has recently been adopted by MMCD because it is the EPA suggested performance standard for pest control products (Schneider 1982). In the judgment of the QA program, at least 95% average larval control is necessary for acceptable mosquito annoyance relief.

#### ***Efficacy of 2 Application Rates of Bti Corncob***

*Bti* corncob (Vectobac® G, 5/8 mesh) was applied at two different rates throughout the summer to account for the shielding effect of vegetative canopies in breeding sites. The 5 lb/ac rate was used early in the season when the vegetation in breeding sites was sparse. Later in the summer, the 8 lb/ac rate was used because it was assumed a higher rate would better penetrate the vegetation. Efficacy of these two rates was determined from pre-treatment and post-treatment counts taken by foremen and inspectors at randomly selected sites. Counts were recorded on an airwork treatment form (FF-10, see appendix) and control percentages were calculated as a percent reduction based on the difference between the pre-treatment and post-treatment counts.

Of ca 4,200 helicopter applications, control rates were calculated from 921 sites that were checked after treatment. Highest mean control was achieved at the 8 lb/ac rate (86%, sd=27.7) and the 5 lb/ac rate had a mean control of 80% (sd=34.5). See next section for additional discussion.

#### ***Evaluation of Vectobac® v. Bactimos® Bti Corncob***

Because MMCD has experienced poor control with new products in the past, we implemented a certification program for new products. New products are tested before we rely on them in full scale use. In 1993 Novo Nordisk Bioindustrial, maker of Bactimos®, underbid Abbott Laboratories to supply MMCD with *Bti* corncob. Over the last several years Vectobac® from Abbott Laboratories has been the standard *Bti* corncob product used by the MMCD. A study was designed to compare the efficacy of these two products as they are used operationally in the field and to identify seasonal differences in efficacy. Additionally, we compared QA sampling results to operational collections taken by *Aedes* program personnel to identify if a difference existed between the two monitoring techniques.

After a significant rainfall, 12 large sites, which varied in size from 5 to 300 acres, were selected within a county for study. Sites were divided into 4 groups of 3 sites close in proximity to each other. Each group randomly received one of four treatments: Vectobac® 5 lb/ac, Vectobac® 8 lb/ac, Bactimos® 5 lb/ac, and Bactimos® 8 lb/ac.

Prior to treatment, a minimum of 50 larval samples were taken to select a region which contained mosquito densities estimated to be representative of the entire site. This study region was strategically located within the site to assure an unobstructed helicopter flight path. Pre-treatment counts were recorded and post-treatment counts were taken 48 h after treatment.

One site was selected from each treatment group to observe the application and to record water temperatures. In the study region of the site, minimum and maximum water temperatures were monitored in ca 6 in of water for 48 h after treatment. Five 1 ft diameter plastic pans were placed within the study area to collect *Bti* granules to confirm treatment.

*Aedes* program staff collected pre-treatment and post-treatment information from sites in a routine manner and recorded the information on an FF-10. QA staff obtained this information to compare the intensive sampling of the above study and regular operational monitoring.

Results of this study showed control rates were similar for both brands of *Bti*. Vectobac® and Bactimos® had a comparable effectiveness range from 75% to 96% (Fig. 7.2).

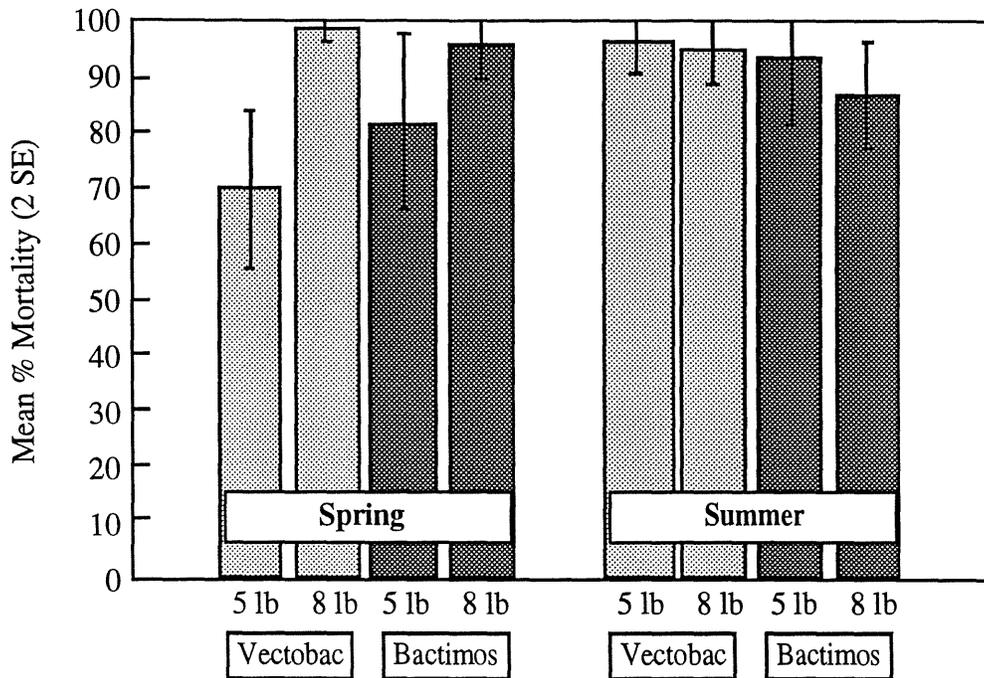


Figure 7.2. Seasonal comparison of commercial brands and application rates of air sites monitored by Quality Assurance.

Seasonal differences occurred for both materials. In the spring, the control rate for Vectobac® 8 lb/ac was 28% greater than the Vectobac® 5 lb/ac rate, and the Bactimos® 8 lb/ac was 14% greater than the Bactimos® 5 lb/ac. Results of summer comparisons showed no difference between brands or rates. Mean maximum and minimum water temperatures during the summer were 9° F and 15° F warmer, respectively, than in the spring (Table 7.1)

Table 7.1. Mean water temperatures of Quality Assurance study sites during the spring and summer, 1993.

	spring mean temperatures	summer mean temperatures
Maximum	63° F	72° F
Minimum	48° F	61° F

While both materials performed equally well, there were seasonal differences in efficacy for both brands of *Bti*. In the spring, the 8 lb/ac rate worked better than the 5 lb/ac rate. Becker et al. (1992) found that in water temperatures between 40-50° F a higher rate of *Bti* was more effective in controlling mosquitoes than a lower treatment rate. Our limited testing of temperature's effect on control supports this conclusion. Additionally, Becker et al. (1992) and Walker (1993) identified a positive correlation between feeding activity and water temperature.

Limited summer testing showed both brands at both rates performed equally well, which may be attributed to increased feeding by mosquitoes in warmer water. An increased feeding rate results in a rapid ingestion of a lethal dose of *Bti*. In the 5-10 sites where we observed the *Bti* application, the 5 lb/ac rate did penetrate the dense summer vegetation and achieved control comparable to the 8 lb/ac rate.

Currently, MMCD treatment strategies call for using the 5 lb/ac rate in the spring and the 8 lb/ac rate in the summer. Converse to this strategy, these results suggest that the 8 lb/ac rate should be used early in the season and the 5 lb/ac rate should be used when water temperatures rise above 50 F. More extensive summer testing should be done to evaluate the 5 lb/ac rate. The MMCD could save a substantial amount of material and money if the lower rate proves to be as effective as the higher rate in the summer.

Comparisons of QA sampling results and *Aedes* program collections showed similar results. Both Vectobac® and Bactimos® 8 lb/ac had approximately 14% greater control than the 5 lb/ac rate. In the summer the 5 lb/ac rate was not used operationally so no evaluation could be made.

#### ***Efficacy of Altosid® Briquet and Pellet Applications***

The Altosid® XR briquet was applied by hand at a rate of 220 briquets per acre to 29,776 breeding sites totaling 9,776 acres. Altosid® pellets were applied at 2.5 lb/ac by helicopter, seeder or hand to 8,779 sites totaling 4,876 acres.

To determine efficacy of briquet and pellet applications, we used the method recommended by Zoecon Inc., the manufacturer of Altosid®. This method assesses mortality of pupae, the life stage most impacted by Altosid®\*. Mosquito pupae were collected from arbitrarily chosen, treated and untreated breeding sites. After collection, pupae were transported to the laboratory and transferred into half gallon ice cream rounds lined with 10 by 18 inch, 1.5 mil clear poly bags. Approximately 8 oz. of water from each breeding site was poured in the container and ca 100 pupae were placed into each bag. A screened lid was placed on the container and several raisins were placed on the screen to provide a carbohydrate source for the emerging adults. Successfully emerged adults were counted and removed from the container daily. This process continued until all mosquitoes either emerged or died. Using results from both treated and untreated or reference sites, control rates for individual sites were calculated using Mulla's Formula II (Mulla et al. 1971).

For the 271 sites treated with briquets and evaluated within the 150 day label claim of effectiveness, average control was 70% (sd=35.2), a decline of 7% from 1992. This reduction in control rate may have been due to high water levels caused by rainfall that was 40% above normal. For the 300 sites treated with pellets and evaluated within the 30 day effectiveness claim of the label, average control was 78% (sd=33.0). This decline of nearly 20% from last year's average may also be attributed to dilution of active ingredient caused by the high water levels.

**\* Note:** This assay assesses pupal mortality and may not reflect the total level of control achieved. Altosid® may cause varying levels of mortality up to pupation. Also, Altosid® aberrations in adult mosquito morphology, physiology, fecundity and life span are reported (Busvine et al. 1976, Arias and Mulla 1975, and Klowden pers. comm.). The implications of these post-emergence phenomena on the overall control effect of Altosid® have not been determined under MMCD conditions, hence they are excluded from our evaluation of Altosid® products.

### ***Accuracy of Briquet Placement***

In 1993, 29,776 sites were treated with briquets and 1,285 were later inspected for quality of treatment (Table 7.2). Treatments were made primarily by seasonal employees and checkbacks were made by foremen, supervisors, and QA staff. The number of sites treated was about 1,400 more than in 1992, and the percentage of sites inspected dropped to 4% of treatments.

Table 7.2. Sites Treated with Briquets and Sites Inspected during the 1993 Season.

Division	Sites treated	Sites inspected for treatment quality	Percent of sites inspected
Anoka	3,792	196	5 %
Dakota	2,624	220	8 %
North Hennepin	3,695	110	3 %
South Hennepin	4,035	179	4 %
Ramsey/Washington	9,076	144	2 %
Scott/Carver	5,232	353	7 %
Western	1,322	83	6 %
Total	29,776	1,285	4 %

A worksheet containing treatment information on up to 20 sites (FF2, see appendix) was filled out daily by each applicator of briquets. One site from each FF2 was selected at random by QA staff and assigned for checkback to the foreman responsible for the work completed that day. Supervisors received one site from all work completed in their division that day to check. QA staff also inspected some sites. Briquet placement was evaluated and categorized as follows:

- 1) spacing correct, low areas hit;
- 2) spacing correct, low areas missed;
- 3) spacing too close, <12 ft apart;
- 4) spacing too far apart, > 18 ft;
- 5) erratic placement;
- 6) briquets absent.

Inspection results showed that 80% of the sites were treated correctly (Fig. 7.3), which is the same correct treatment rate as last year. However, briquets were absent (considered missed treatments) in 8% of the sites, a 2% increase from 1992. These missed treatments are of concern because they allow mosquitoes to survive and presumably contribute to annoyance in the MMCD area of coverage. Missed treatments may result from confusion about the location of sites, data recording errors, or other reasons. MMCD needs to understand these causes and improve the accuracy of treatments.

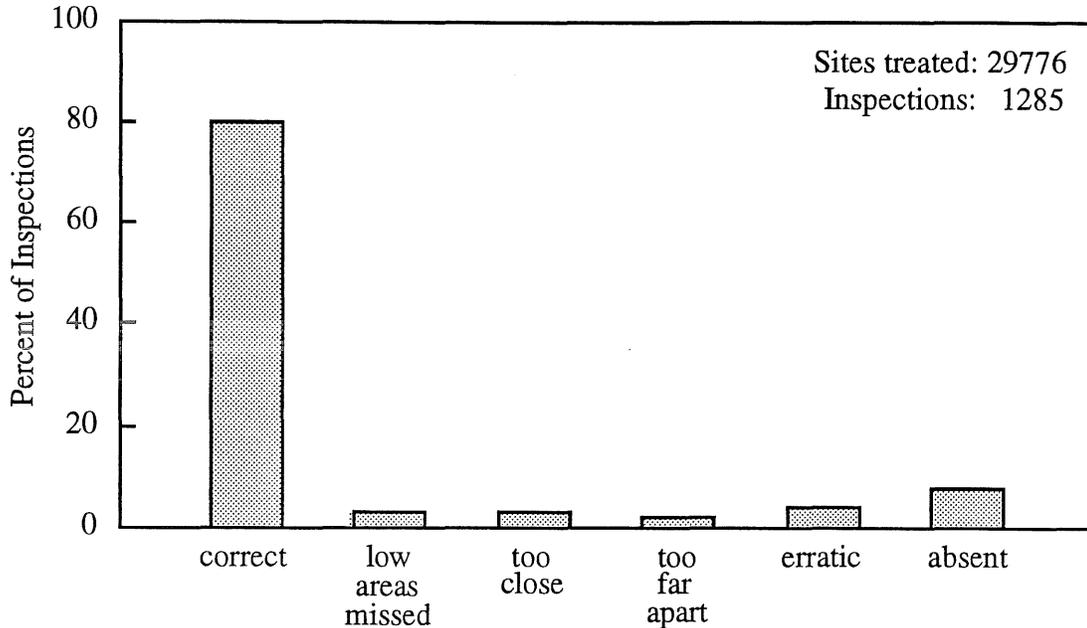


Figure 7.3. Placement accuracy of briquet treatments in 1993.

### *Section Map Reviews*

Section maps are the primary means of locating breeding sites for treatment. Most ground larviciding is done by seasonal staff with varying levels of experience so it is essential that section maps are easily navigated and accurately portray site locations. Each fall over 20% of our ca 2500 section maps are redrawn or revised to reflect changes which have occurred within the sections. The methods for review of section maps are included in the 1991 report to the TAB. The mapping season concludes in mid-February and results will be available in March, 1994. We have more than 99% of our maps less than 5 years old, as per our goal.

### *Helicopter Calibration*

The purpose of helicopter calibration is to establish a flow rate in pounds per acre, application swath width in feet, and uniformity of pattern over the swath width for the control materials that we apply by helicopter to mosquito breeding sites.

Our former calibration system, discussed in the 1990 report to the TAB, gave us limited information about helicopter applications. In 1993, we investigated, purchased and began to use a state-of-the-art system designed by WRK, Inc. This system consists of a series of small concave "trampolines" which collect and concentrate granules that land on them. The granules from each trampoline are then weighed, analyzed by computer, and a report is generated which depicts the rate, swath width, and pattern of application. This procedure is done for each helicopter, and adjustments are made to the delivery system as guided by the computer output for all control materials and rates that we use.

### 3. 1994 Plans

We will continue to measure efficacy of larval control materials, determine accuracy of briquet placement, coordinate the mapping project, and assist in helicopter calibration. In addition, we plan to expand the field comparison of the 5 lb v. 8 lb/ac *Bti* rate in spring and summer. If results in 1994 confirm those from 1993, we may suggest operational changes to the *Aedes* program. Also, we plan to continue investigating adult mosquito control questions concerning calibration, application, formulation, and employee safety.

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# BLACK FLY PROGRAM

## 1. Background

The Black Fly Program began in 1984 with the small stream treatment program. Between 1987 and 1989, the MMCD conducted *Bti* efficacy and acute toxicity studies on the large rivers. Results from those studies showed that *Bti* is highly effective for black flies in the large rivers and it had no major acute toxic impacts on non-target organisms. Based on these positive results the MMCD began to phase in an operational control program on the large rivers in 1990. Currently the Black Fly Program monitors adult and larval black fly populations that develop in the small streams and large rivers during spring and summer within the MMCD. Sites that reach larval population thresholds are then treated with liquid *Bti*.

## 2. 1993 Program

### *Simulium venustum* Control Program

*Simulium venustum* is a human biting black fly with one, early spring generation in the MMCD region. Larvae breed in small streams throughout the District. The MMCD began using *Bti* to control *S. venustum* larvae in 1984.

More than 500 potential breeding sites were sampled in mid-April to determine the density of *S. venustum* larvae using the standard grab sampling technique developed by the MMCD in 1990. Treatment decisions were based on a threshold of 40 *S. venustum* per sample. Ninety six sites met the threshold and were treated once with *Bti* (Vectobac® AS 12) at a dosage rate of 10 ppm. A total of 21.3 gallons of *Bti* were used for the treatments (Table 8.1).

Table 8.1 Summary of *Bti* treatments for black fly control by the MMCD in 1993.

Water body	Number of application sites	Total number of treatments	Gallons of <i>Bti</i> used
Small streams	96	96	21.3
Mississippi River	3	21	1895.0
Crow River	5	15	402.0
Minnesota River	7	23	2646.0
Rum River	2	17	127.0
Total	113	172	5091.3

### *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 mainly in the Crow and Minnesota rivers. These species are most abundant in May and June, although *S. meridionale* populations will remain high throughout the summer if stream flow is also high.

Between 1987 and 1989, the MMCD conducted *Bti* efficacy and acute toxicity studies on black flies and non-target organisms at limited sites on the large rivers. Results from those studies

showed that *Bti* is highly effective against black fly larvae in the large rivers and that there are no major acute toxic impacts on non-target organisms.

In 1990, the District began operational treatments, at a restricted number of breeding sites, on the large rivers with *Bti*. On the Mississippi River, operational treatments were linked to a 3-year non-target insect production and community structure study. This study, requested by the DNR, will identify any indirect effects of black fly control such as alteration of the invertebrate community and food web structure.

The black fly population density at each treatment location was measured every 7 days using artificial substrates. The treatment thresholds used in 1993 were the same as those used since 1990.

A total of 5,070 gallons of *Bti* were used to treat the large rivers in 1993 (Table 8.1). This is compared to 4,534 gallons used in 1992. More *Bti* was used in 1993 than in 1992 because of flooding on the major rivers caused by record summer rains. The heaviest flooding was on the Minnesota River, where discharge averaged 29,146 cfs (cubic feet per second) in the months of May-September. This was compared to an average discharge of 6,956 cfs for the same months in the previous 9 years of the program. Due to the extraordinarily high discharge on the Minnesota River, *Bti* treatments were suspended on this river from mid-June until late July. Discharge on the Rum, Crow and Mississippi rivers also was abnormally high for all of the 1993 treatment season, but *Bti* treatments were done when the larval thresholds were exceeded. Control of black fly larvae on the larger rivers averaged between 91% and 95% in 1993, which is comparable to the results obtained in previous years.

### **Adult Population Sampling**

The adult black fly population was monitored in 1993 at 99 locations using the over-head net sweep technique. This is the same technique that has been used since the start of the program. Samples were taken twice weekly from mid-May to September.

The average number of all species of adult black flies captured in 1993 was 3.32 (Table 8.2). Except during the drought in 1988, this was the second lowest population level since the program began. The lowest level was in 1992, which was the second year of the *Bti* treatments downstream of Dayton. The slight increase over the 1992 average was due to the increase in the

Table 8.2 Annual mean number of black fly adults captured in over-head net sweeps in bi-weekly samples taken at standard sampling locations throughout the MMCD between mid-May and mid-September.

Year	All species <sup>1</sup>	<i>Simulium luggeri</i>	<i>Simulium johansenni</i>	<i>Simulium meridionale</i>
1984	16.02	14.06	0.04	1.77
1985	11.62	10.71	0.02	0.83
1986	11.38	8.26	1.30	1.61
1987	5.92	5.70	0.02	0.13
1988	1.87	1.77	0.09	0.00
1989	5.79	4.89	0.50	0.19
1990	6.02	5.44	0.02	0.53
1991	4.04	3.06	0.14	0.77
1992	2.40	1.93	0.12	0.26
1993	3.32	1.71	0.04	1.55

<sup>1</sup> All species includes *S. luggeri*, *S. johansenni*, *S. meridionale*, *S. vittatum*, and *S. venustum*

*S. meridionale* population. The average number of *S. meridionale* captured in 1993 was 1.55, the largest number captured since the flood years of 1984 and 1986, which was before control began. The *S. luggeri* counts averaged 1.71, which is the lowest level recorded to date. The average number of adult black flies captured has dropped each year since the start of the large river control program in 1990 (Table 8.2). Prior to the start of the large river control program, the average number of all black fly species captured in the net sweeps has been as high as 16 (Table 8.2).

The average number of adult *S. venustum* captured in 1993 was 0.013 (n = 3,566), which is similar to the results of the previous 9 years of the program. The number of *S. venustum* captured in the net-sweep samples always is quite low and not representative of the actual populations. 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 density between years. Beginning in 1995, studies will be initiated to develop a more accurate assessment of adult *S. venustum* populations.

The seasonal distributions of *S. luggeri* and *S. meridionale*, the two dominant species attracted to humans within the MMCD in 1993, are shown in Figure 8.1. There were four population peaks of *S. luggeri* in 1993, with the highest occurring in early August and early September. *Simulium meridionale* was abundant throughout the summer due to the flooding of the Minnesota River, its primary breeding site. Control for *S. meridionale* was suspended from mid-June through late July due to the high cost of the massive volumes of *Bti* that would have been required to obtain adequate control when the river discharge was in excess of 90,000 cfs. This lack of control resulted in a sharp rise in the population of *S. meridionale* (Table 8.2 and Fig. 8.1), especially in July.

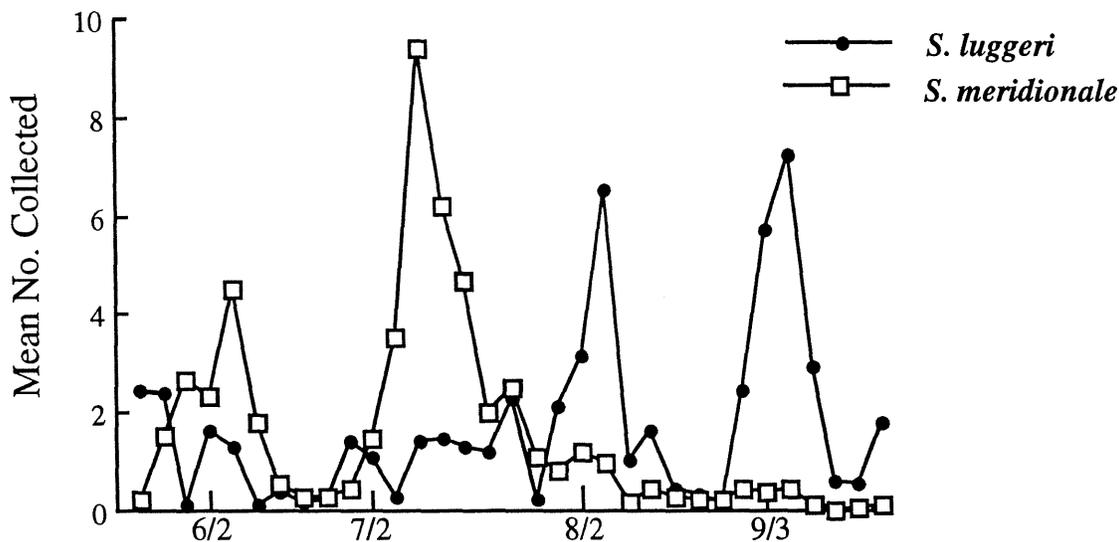


Figure. 8.1 Mean number of black fly adults captured in each bi-weekly net-sweep sample for the 99 sampling sites in the MMCD in 1993

Among the 7 counties within the MMCD, *S. luggeri* was most abundant in Anoka County (Fig. 8.2). This was due to the close proximity of the major *S. luggeri* breeding sites on the Rum and Mississippi rivers. The average number of *S. luggeri* captured in Anoka County in 1993 was 5.53, which is the lowest number captured since the program began in 1984. Prior to the start of the control program on the large rivers, the average annual collections of *S. luggeri* in Anoka County

have been as high as 80. Wright County, where the net-sweep count of *S. luggeri* averaged 4.24 in 1993, is just outside the black fly program treatment area (Fig. 8.2).

The highest population of *S. meridionale* adults was observed in Scott and Carver counties, reflecting the proximity of these counties to the primary breeding sites of *S. meridionale* on the Minnesota River (Fig. 8.2).

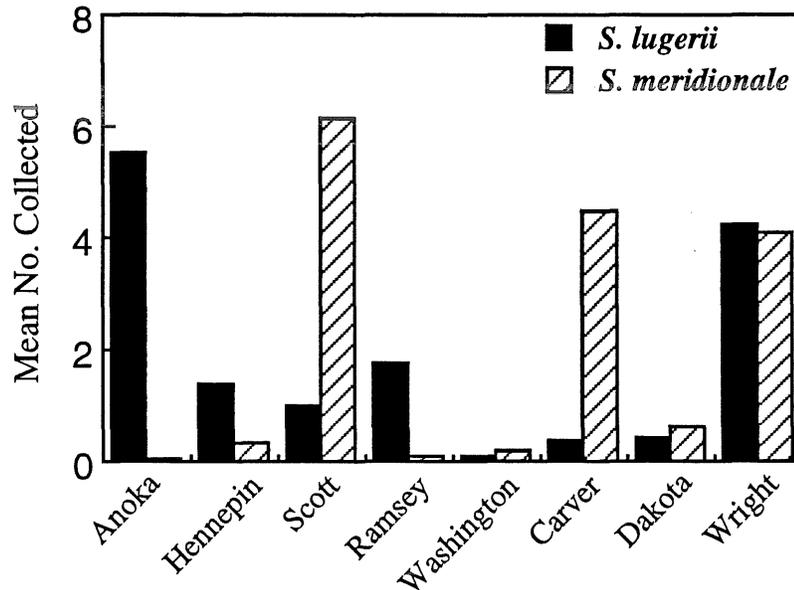


Fig. 8.2 Mean number of adult black flies captured in bi-weekly net sweeps from each county within the MMCD in 1993. The Wright County sample sites are outside the Black Fly Program's control area.

### *Non-target Studies*

The field work on the three-year insect community structure and production study on the Mississippi River, that was required by the MDNR, was completed in 1992. Laboratory sample processing and data analysis will be completed by March 1994. The final report is scheduled for completion in June, 1994.

Preliminary results from the production study indicated that too few predacious stoneflies were captured to obtain sufficient data to make production or standing crop estimates. The MMCD reached an agreement with the MDNR to conduct a follow-up study to address stonefly concerns on the Rum River between 1993 and 1994. The Rum River was chosen as the study site because of the availability of untreated *Bti* stations, high stonefly densities and the relative ease of sampling. The goal of this study is to measure production of a predacious stonefly species, and the standing crop and community structure of all stonefly species in untreated and *Bti*-treated reaches of river. Quantitative stonefly samples were collected at the designated study stations throughout the 1993 growing season. Samples currently are being processed.

### 3. 1994 Plans

The 1994 goals of the Black Fly Program are to: 1) continue effective control of small stream and large river black flies, 2) complete the final report for the Mississippi River insect community structure and production study, 3) complete field sampling for the Rum River stonefly production study, and 4) begin to process the Rum River stonefly samples and analyze the preliminary data.

## LYME DISEASE TICK SURVEILLANCE PROGRAM

### 1. Background

In 1990, the MMCD initiated a Lyme Disease Tick Surveillance Program to determine the range and abundance of the deer tick (*Ixodes scapularis*, formerly *I. dammini*) and the Lyme disease spirochete (*Borrelia burgdorferi*) within the District. To date, the current distribution of deer ticks in the metropolitan area has been mapped, and cooperative Lyme spirochete studies with the University of Minnesota have been initiated. All of the 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 program only; no deer tick control program is planned in the District.

### 2. 1993 Program

Sampling was continued in the 100 site network, set up in 1991-1992, to look for changes in deer tick distribution over several years. As in previous years, our main sampling method involved capturing small mammals from each site, and removing all attached ticks from them. Over 1500 mammals were inspected this year, and deer ticks were found at 37 of the sampling locations. We continue to find most *I. scapularis* in the northeastern counties of the District (Fig. 9.1).

Cooperative studies with Dr. Russell Johnson of the University of Minnesota continued in order 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 exposure situation in a metropolitan area suburb. Small mammal infection rates varied from 0-30%. Lyme disease spirochetes appear to be quite localized in the eastern woodlots of North Oaks.

Interpretive posters and other information were presented at each county fair and the State Fair. Deer tick distributions, tick identification, and personal protection measures were featured .

### 3. 1994 Plans

The deer tick distribution study at the 100 repeated sampling locations will continue this summer, to identify any changes in the known tick distribution. No new sampling areas will be examined, because baseline deer tick distribution data for the entire metropolitan area has already been established by the District. Cooperative spirochete studies with the University of Minnesota will also be continued in addition to increased Lyme disease public education efforts (e.g. tick distribution information, personal protection measures).

A Lyme Disease Tick Advisory Board (LDTAB), made up of local scientists and agency representatives with Lyme disease expertise, meets annually to independently review our surveillance work and provide input for future studies. The program's 1993 report, and 1994 sampling plans will be reviewed by the LDTAB in early March (1994). The 1993 report, will be available upon request after review by the LDTAB.

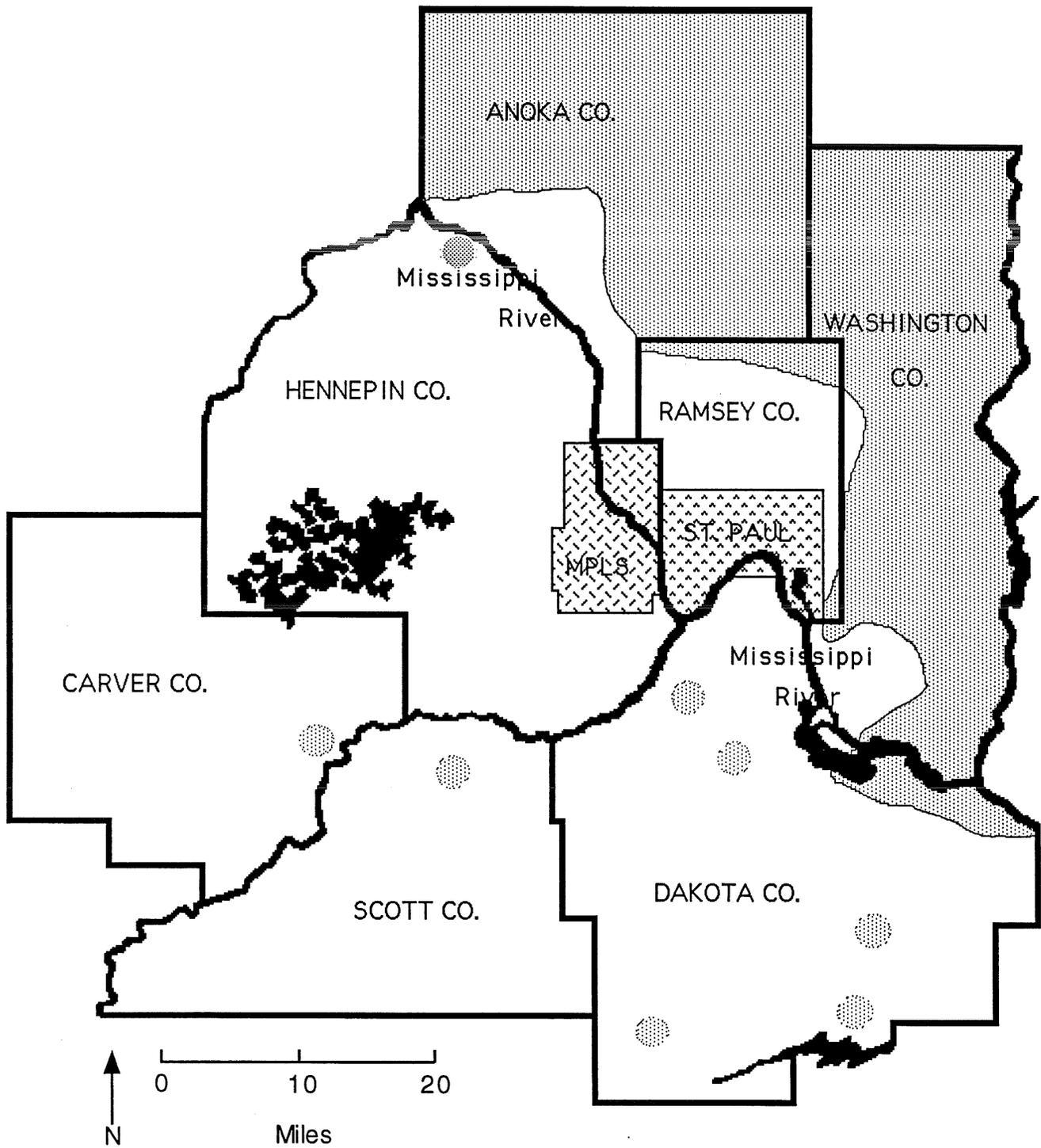


Fig. 9.1. *Ixodes scapularis* distribution within MMCD boundaries as of December, 1993. Shaded area is present distribution and shaded circles are isolated records.

## PROGRAM DEVELOPMENT

### 1. Background

Measuring the effectiveness of the District's nuisance mosquito control program was Program Development's main research focus in 1993. Data demonstrating the positive effect of the District's LaCrosse Encephalitis Prevention Program and Black Fly (gnat) Control Program are already available, but data supporting the effectiveness of the nuisance mosquito control portion of the program is only available for larvae. This year's research was targeted at demonstrating effectiveness as expressed by adult mosquito populations. Additionally, at the Commission's initiative, a public opinion survey evaluating citizen's opinions about mosquitoes and the MMCD was conducted by an independent contractor.

### 2. 1993 Program

#### *Effect of Control Efforts: Before/After Study*

To compare mosquito populations before and after the start of the MMCD, the average daily catch from 4 New Jersey light traps was compared with trap counts from 1938 at the same locations (Lake Nokomis, University of Minnesota St. Paul campus, Cedar Lake, and Orono). Data from 1957-1962 from the University location was also compared with current counts.

Comparisons of the mean number of mosquitoes collected per night showed that counts were much higher in 1938 than in 1993 at Orono and Cedar Lake, were somewhat higher at the University, and were lower in 1938 than in 1993 at Lake Nokomis (Fig. 10.1). Both years had high amounts of rainfall in the summer, but total rainfall was higher in 1993. Counts from high rainfall years, 1957-1962, were higher than counts in 1993 at the University, but were somewhat lower than in 1938. The results of this research suggest that there were fewer mosquitoes in the metropolitan area in 1993 than there were in 1938, and that the difference was probably not due to a difference in rainfall.

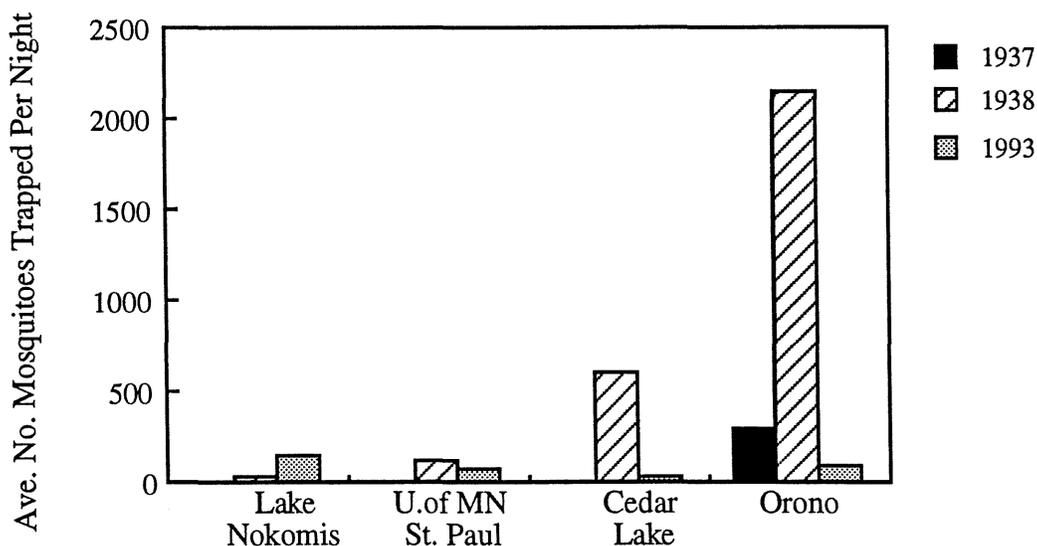


Fig. 10.1 Average number of mosquitoes collected per night in New Jersey light traps at 4 locations in the Minneapolis/St. Paul area before (1937, 1938) and after (1993) the start of the MMCD.

Linking the difference in mosquito counts between years and the activity of the MMCD is problematic because the sites that have probably changed most due to development (Orono, Cedar Lake) also showed the greatest difference in mosquito counts. Sites that have probably not changed greatly (University, Lake Nokomis) had a smaller difference or an increase. It should be noted that there was extensive flooding around Lake Nokomis in 1993, but breeding sites were not treated as requested by the Minneapolis Park Board. Historical land use records could help determine impacts of development on mosquito production.

### ***Effect of Control Efforts: Inside/Outside Study***

A preliminary study was done to investigate possible methods to use to compare mosquito levels from inside and outside the treated area of the District. Dusk sweep and CO<sub>2</sub> trap collections of host-seeking mosquitoes were taken at 5 pairs of sites located inside and outside the District. Paired sites had similar mosquito breeding acreage, harborage acreage, topography, and soil composition. The pairs were Eagan/Northfield, Shakopee/LeSueur, Plymouth/Howard Lake, Champlin/Monticello, and Circle Pines/Isanti.

Each site had three collection locations: grassy field, woods edge, and interior of the woods. Sweep net collections were taken at each location at 35 and 15 minutes before and 5 minutes after the end of twilight. CO<sub>2</sub> traps were placed in the grassy field and inside the woods and ran at 20 minute intervals bracketing the sweep net sampling times. Collections were taken twice weekly from June 21 to August 26.

Initial analysis only on the sweep net collections without associated factors showed that for *Coquillettidia perturbans*, *Aedes cinereus*, *Ae. dorsalis*, *Ae. nigromaculis*, *Ae. sticticus*, *Ae. trivittatus*, and the spring *Aedes*, counts were lower inside than outside the District. *Aedes vexans* counts were often higher inside, especially in sites north and west of the District.

Although the sites were paired to try to limit the effect of other factors besides treatment, some differences were apparent (e.g. differences in rainfall, breeding site area, others). Total mosquito breeding site area for the 9 sections surrounding and including each collection site was similar for 3 of the pairs of sites. One pair had higher amounts of breeding sites for the outside location than for the inside location, and one pair had greater amounts of breeding sites for the inside location than for the outside location. Frequency and amount of rainfall was somewhat higher inside the District, especially in August, which is also when *Ae. vexans* counts inside were highest. Larval mosquito counts, treatment history, harborage area and adult treatments may also be examined.

Although the study was not designed to measure black fly annoyance, black flies captured in the sweep nets and CO<sub>2</sub> traps were also analyzed. Black fly counts were generally higher at sites outside than inside the District, especially for *Simulium meridionale*.

### ***Sampling Methods Studies***

Several small tests were run to check the methods used in the Inside/Outside study and explore possible future surveillance methods:

- 1) A test of various sweeping patterns found no significant difference in the quantity of mosquitoes collected;
- 2) Sweep net counts from collectors with and without repellent showed repellent use decreased numbers of mosquitoes collected;
- 3) Sweep net counts were compared with Whole Person Bag Sampler counts, and preliminary analysis identified a significant correlation ( $R^2=0.65$ );
- 4) Results from the CO<sub>2</sub> trap collections done in conjunction with the Inside/Outside study and the Parks Study (see *Aedes* Control Program) will be compared with sweep net or WPBS counts to examine the possible use of CO<sub>2</sub> traps in future adult surveillance.

### ***Public Opinion Survey***

A telephone survey of 378 metropolitan area residents was conducted by the Atlantis Group for the District. This survey will provide guidance to District commissioners and staff by assessing public awareness, satisfaction, and concerns about the District. A majority of respondents strongly agreed that MMCD provides an important service to the community. About one in four respondents had environmental or health concerns and many were uncertain on these issues, suggesting MMCD should consider more broadly publicizing evidence of control material safety.

Most metro area respondents were aware of MMCD, but their understanding of what the District does was often limited to "controls mosquitoes." Many respondents listed "employees working in area" as their source of information about MMCD. Respondents outside the MMCD control area were more likely to use personal protection measures such as repellents or sprays than those respondents within the control area. This information will be used by the District to help develop better programs and materials to meet the public's needs.

### ***Publications***

Two manuscripts on our 1990 work, "Public perception of mosquito annoyance measured by a survey and simultaneous mosquito sampling" and "A whole-person sampler for assessing numbers of host seeking adult mosquitoes," will be published in the March 1994 issue of the Journal of the American Mosquito Control Association.

### **3. 1994 Plans**

Meetings with MMCD staff identified possible research topics. The Research Review Committee is currently reviewing these topics. Proposals for research will be developed after priorities are established.



# METROPOLITAN MOSQUITO CONTROL DISTRICT SCIENTIFIC PEER REVIEW PANEL

## 1. Background

The Scientific Peer Review Panel (SPRP) is an independent panel of specialists in entomology, ornithology, wildlife biology, aquatic biology, statistics, and toxicology. The SPRP was formed in 1985 to direct research by independent contractors which assesses environmental impacts of mosquito control materials used by the MMCD. The research is funded through the MMCD's budget and is approximately 2.5% of its annual budget.

The SPRP research is relevant to the MMCD program because it helps address current environmental questions about the effects of long-term exposure of wetlands to MMCD control materials. Laboratory and field experiments were undertaken to provide data necessary to address these environmental questions.

The SPRP research projects investigate the impact of MMCD control activities on non-target species in wetlands treated for mosquitoes by the MMCD. Research emphasizes three areas of impact:

- 1) Indirect effects of the control agents on non-target species associated with wetlands,
- 2) Direct impacts of chronic exposure of methoprene on invertebrates and amphibians that inhabit wetlands
- 3) Direct effects of acute and chronic *Bti* exposure on wetland invertebrates.

## 2. 1993 SPRP Results

In May 1993, an interim report presenting results of research completed to date were submitted to the Minnesota Environmental Quality Board. So far indications are that dosage rates used by MMCD are below that which have a significant adverse impact on non-target aquatic invertebrate and vertebrate organisms in the region.

## 3. 1994 Research Plans

- Natural Resource Research Institute (NRRI)  
The field sampling portion of the project is completed. Remaining samples from 1993 will be processed in 1994. Analysis and a draft final report will be submitted to the SPRP November 1, 1994.
- Field Effects of *Bti* on Chironomids (investigator to be determined)  
The potential effect of field applications of *Bti* on chironomids in mosquito breeding sites will be further investigated. Request for Proposals were solicited in February 1994 and a contractor will be selected in the spring. With the help of the U.S. Fish and Wildlife Service, the first year of the study will concentrate on study site selection and preliminary sampling of chironomids. Treatments and field sampling will begin during the second study year and a final report will then be submitted.

## SCIENTIFIC PEER REVIEW PANEL MEMBERS

- Dr. Richard Anderson - Research Entomologist, U.S. Environmental Research Laboratory, United States Environmental Protection Agency - Duluth, MN
- Dr. Judy Helgen - Minnesota Pollution Control Agency, St. Paul
- Dr. Stuart Hurlburt - Department of Biology, San Diego State University, San Diego, CA
- Dr. Roger Moon - Department of Entomology, University of Minnesota, St. Paul, MN
- Dr. Robert Naiman - Center for Streamside Studies, University of Washington, Seattle, WA
- Dr. William Schmid - Department of Ecology and Behavioral Biology, University of Minnesota, Minneapolis, MN
- Dr. Ken Simmons - Massachusetts Division of Fish and Wildlife, Field Headquarters, Westboro, MA
- Dr. Keith Solomon - Director, Canadian Centre for Toxicology, Guelph, Ontario
- Dr. Harrison Tordoff - Department of Ecology and Behavioral Biology, University of Minnesota, Minneapolis
- Dr. Michael Zicus - Waterfowl Research Group, Minnesota Department of Natural Resources, Bemidji, MN

## APPENDIX

Additional Readings about Mosquito Control

Summary of Control Materials

Acres Treated 1986-1993

1993 Acres Treated by County

1993 Sites Treated by County

1993 Amounts Treated by County

1993 Treated Ground Acres

1993 District Airsite Acres

Adulticides Used 1984-1993

1994 *Aedes* Program Treatment Schedule

Number of Larval Collections Taken 1958-1993

Light Trap Collection Totals 1992

Field Forms (FF-2, FF-3, FF-10)

FF-2 - Larval Ground Treatment

FF-3 - Adult Control Treatment

FF-10 - Aerial Control Treatments

Product Labels



## ADDITIONAL READINGS ABOUT MOSQUITO CONTROL

The following articles are available at the MMCD's library and provide additional information about control materials, mosquito control, toxicology, repellents and alternative mosquito control.

### MOSQUITO CONTROL

Olkowski, H. "On the Research Front - Demonstrating Successful Mosquito Control;" *Common Sense Pest Control Quarterly* Spring 1987, 111(2), II-1 - II-2.

Describes an Integrated Pest Management approach for mosquito control.

Olkowski, W. "Mosquitos: The Water Connection;" *Common Sense Pest Control Quarterly* Spring 1987, 111(2), 1-12.

Describes mosquito biology and components of safe and effective mosquito management.

Benzon, G.L. "Controlling Mosquitos and Other Flying Insects Within Municipalities;" *Public Works* 1988, 119, 46-49.

An overview of municipal mosquito control agencies, explaining larval control, adult control and public information.

Challet, G.L. "Problem-Solving at the Local Level;" *Journal of Environmental Health* 1988, 51(2), 79-80.

An overview of organization and management of mosquito control districts across the United States.

### HUMAN HEALTH

Minnesota Department of Health. *Risk Assessment on Scourge® and Punt™ 57-OS Materials used by the Metropolitan Mosquito Control District for the Control of Adult Mosquitoes*, [Report of evaluation requested by the Metropolitan Mosquito Control District] MN Department of Health Division of Environmental Health Section of Health Risk Assessment: Minneapolis, MN, [1993].

Evaluation by Elizabeth V. Wattenberg, Ph.D., Environmental Toxicologist. Exposure to Scourge® or Punt™ through ingestion or skin contact should not pose a health risk to humans under the scenarios described in the document. Brief inhalation exposure to the pesticides should not pose a health risk.

Minnesota Department of Health. *Evaluation of the Human Health Hazards of Resmethrin/Piperonyl Butoxide Insecticide*, [Report of evaluation requested by Metropolitan Mosquito Control District] MN Department of Health: Minneapolis, MN, [1984].

This evaluation includes a review of the scientific literature as well as discussions with scientists and physicians. The literature review indicates that the acute and chronic toxicity of both resmethrin and piperonyl butoxide is very low. There were not studies indicating these compounds were either allergens or toxic irritants.

## ANIMAL HEALTH

Adams, A. W., Jackson, M. E., and Pitts, C. W. "A Feed Additive to Control Flies in Poultry Manure;" *Poultry Science* 1976, 55(5), 2001-2003.

Methoprene was fed to poultry to control flies emerging from poultry manure. Neither egg production nor egg quality was affected by the additive.

Beadles, M. L., Miller, J. A., Chamberlain, W. F., Eschle, J. L., and Harris, R. L. "The Horn Fly: Methoprene in Drinking Water of Cattle for Control;" *Journal of Economic Entomology* 1975, 68(6), 781-785.

Describes the advantages of feeding methoprene to cattle for control of Horn Fly on cattle. The cattle treated exhibited no toxic effects from the treatment.

Harris, R. L., Frazer, E. D., and Younger, R. L. "Horn Flies, Stable Flies, and House Flies: Development in Feces of Bovines Treated Orally with Juvenile Hormone Analogues;" *Journal of Economic Entomology* 1973, 66(5), 1099-1102.

Cattle were treated with methoprene to control stable flies, horn flies and house flies. No signs of clinical toxicity were observed in the cattle.

Terborgh, J. "Why American Songbirds are Vanishing;" *Scientific American* May 1992, 98-104.

Discusses possible reasons for the decline of some songbirds in North America.

## OTHER INSECTS

Creekmur, G. D., Russell, M. P., and Hazelrigg, J. E. "Field Evaluation of the Effects of Slow-Release Wettable Powder Formulation of Altosid® on Nontarget Organisms;" *CMCUA* 1981, 49, 95-97.

Altosid was used for midge control with no adverse effects on three families of beetles and two families of aquatic bugs, even at four times the recommended rate.

Hester, P. G., Rathburn, C. B. Jr, and Boike, A. H. Jr. "Effects of Methoprene on Non-Target Organisms When Applied as a Mosquito Larvicide;" *Proceedings: Florida Anti-Mosquito Association* 1980, 51, 16-20.

Evaluated the effects of two formulations of methoprene on non-target organisms: sheepshead minnow, longnose killfish, grass shrimp, blue crab, crayfish, mosquito fish and dragonfly naiads. No adverse effects were noted.

## CONTROL ALTERNATIVES

Faber, J. P. "Nature, Man Gang Up to Bring Down Bat Tower;" *Wing Beats* Summer 1992, 3(2), 18.

Describes a failed project to use bats to control mosquitoes in Florida.

Mitchell, L. "Mythical Mosquito Control;" *Wing Beats* Summer 1992, 3(2), 18-19.

Describes the ineffectiveness of "Bug Zappers", Citrosa plants, Purple Martins, and bats for controlling mosquitoes.

## CONTROL MATERIALS

### Bacillus thuringiensis israelensis

Ellis, R. *Insecticide Profiles: Bacillus thuringiensis israelensis* Prairie Pest Management 1992.

A comprehensive literature review on *Bti*.

Abbott Laboratories. A Biorational Alternative to Mosquito and Black Fly Control..*Vectobac: Biological Larvicide* 1990.

Product information provided by the manufacturer of *Bti*.

Anon. "Data Sheet on the Biological Control Agent: Bacillus thuringiensis serotype H-14 (de Bajac 1978)" World Health Organization 1982, [WHO/VBC/79.750 Rev.1 VBC/BCDS/79.01].

Information document produced by WHO details biological characteristics, effectiveness against target organisms, effect on non-target organisms and formulation of *Bti*.

Hudson, J. E. "The Development of Bacillus Thuringiensis H-14 for Vector Control: A Review of Recent Abstracts from Tropical Diseases Bulletin (1982, 79-1985, 82, No.6);" Tropical Diseases Bulletin 1985, 82(8), R1-R10.

Reviews mode of action, field trial results, effects on non-target organisms and application of *Bti*.

Lacey, L. A. "Bacillus thuringiensis Serotype H-14 for the Microbial Control of Mosquitoes;" *AMCA Bulletin*, 6, 132-158.

Review of *Bti* as a biological control agent.

Mulla, M. S., Federici, B.A., and Darwazeh, H. A. "Larvicidal Efficacy of *Bacillus thuringiensis* Serotype H-14 Against Stagnant Water Mosquitoes and Its Effect on Nontarget Organisms;" *Environ. Ent.* 1982, 11:788-795.

Margalit, J., Pascar-Gluzman, C., Bobroglio, H., Barak, Z., and Lahkim-Tsrer, L. "18: Biocontrol of Mosquitoes in Israel;" *Integrated Mosquito Control Methodologies* 1985, 2, 361-374.

Reviews the history, environmental safety and use of *Bti*.

### Pyrethroids

Ellis, R. *Insecticide Profiles: Permethrin* Prairie Pest Management 1992.

A comprehensive literature review on Permethrin.

*Environmental Health Criteria 92: Resmethrins-Resmethrin, Bioresmethrin, Cisresmethrin;* World Health Organization: Geneva, 1989.

An in depth profile of resmethrins including physical and chemical properties, environmental fate, metabolism and evaluation of human health risks.

*Environmental Health Criteria 94: Permethrin;* World Health Organization: Geneva, 1990.

An in depth profile of permethrin including physical and chemical properties, effects on the environment and effects on humans.

*Pyrethroid Insecticides*; Edited by John P. Leahey; Taylor & Francis: London & Philadelphia PA, 1985.

A compilation of research information on mode of action, uses and toxicology of the pyrethroids.

Elliott, M., Janes, N. F., and Potter, C. "The Future of Pyrethroids in Insect Control;" *Annual Review Entomology* 1978, 23, 443-69.

A review article includes physical properties of pyrethroids as well as metabolism and toxicology, resistance, and applications.

### Methoprene (Altosid)

Ellis, R. *Insecticide Profiles: Methoprene* Prairie Pest Management 1992.

A comprehensive literature review on Methoprene.

Solomon, K. R. *Methoprene, Environmental Fate* Guelph, Ontario, Canada, [1991, personal communication].

Discusses breakdown of methoprene by light, metabolism by plants and metabolism by aquatic organisms.

Zoecon Corporation. *Methoprene Re-registration Facts* Zoecon Corporation: Dallas, TX, 1991.

Update on results of methoprene non-target studies provided by the manufacturer.

Siddall, J. B. "Insect Growth Regulators and Insect Control: A Critical Appraisal;" *Environmental Health Perspectives* 1976, 14, 119-126.

Reviews basic properties of methoprene.

Arias, J. R. and Mulla, M. S. "Morphogenetic Aberrations Induced by a Juvenile Hormone Analogue in the Mosquito *Culex tarsalis* (Diptera: Culicidae);" *Journal of Medical Entomology* 1975, 12(3), 309-316.

Describes the developmental abnormalities sometimes found in mosquitoes after being treated with Altosid.

Miller, R. W. and Pickens, L. G. "Evaluation of Methoprene Formulations for Fly Control" *Journal of Economic Entomology* 1975, 68(6), 810-812.

No adverse effects were seen in cattle fed various formulations of methoprene for fly control.

### REPELLENTS

Anon. "Debugging Precautions;" *Prevention* 1990, 42, 22-23.

Cautions about possible adverse reactions to using DEET as an insect repellent and provides some safe use tips.

Curtis, C. F., "Are Insect Repellents Safe?;" *Lancet* II(8618), 1020.

Rao, S. S., and Rao, K. M. "Insect Repellent N, N-diethylphenylacetamide: an Update" (*Diptera: Culicidae*);" *Journal of Medical Entomology* 1991, 28, 303-306.

Robbins, P. J. and Cherniack, M. G. "Review of the Biodistribution and Toxicity of the Insect Repellent *N, N*-diethyl-*m*-toluamide (deet);" *Journal Toxicol. Environ. Health* 1986, 18(4), 503-525.

"Seizures Temporally Associated with Use of DEET Insect Repellent -- New York and Connecticut;" *Morbidity Mortality Weekly Report* 1989, 38(39), 678-680.

## GENERAL TOXICOLOGY AND RISK ASSESSMENT

Fisher, S. W. "Modes of Action of Pesticides Used in Mosquito Control;" *The Vector Control Bulletin of the North Central States* 1993, 1(2):30-36.

Reviews the mode of action for organophosphorus and carbamate insecticides, pyrethroids, *Bti* and methoprene.

Hayes, W. J. Jr. *How Toxic is Toxic?* Terra facts, Section I. Terra Society, Mount Prospect, IL, April 1973.

Discusses aspects of toxicity including toxic vs chronic, factors affecting toxicity, and Relevance of toxicologic information.

Hayes, W. J. Jr. *Pesticides Studied in Man*; Williams & Wilkins: Baltimore, MD, 1982.

This handbook discusses various classes of pesticides in terms of their use and chemistry, aspects of toxicity data that may be relevant to man, and effects of the compounds on man.

Hayes, W. J. Jr. *Toxicology of Pesticides*; Williams & Wilkins: Baltimore, MD, 1975.

Deals with the principles of toxicology such as general conditions of exposure, observed effects of this exposure on human health, problems of diagnosis and treatment, means of preventing injury and brief outlines of the impact of pesticides on animals.

Miyamoto, J. "Degradation, Metabolism and Toxicity of Synthetic Pyrethroids;" *EHP: Environmental Health Perspectives* 1976, 14, 15-28.

Reviews the toxicological information on synthetic pyrethroids available in 1976.

Robert, L. L., and Olson, J. K. "Effects of Sublethal Dosages of Insecticides on *Culex quinquefasciatus*;" *Journal of the American Mosquito Control Association* 1989, 5(2), 241-246.

Sublethal effects of methoprene include reduced egg production, egg raft size, egg hatching, wing length and adult longevity.

Sandman, P. M. *Explaining Environmental Risk*, Some Notes on Environmental Risk Communication; Office of Toxic Substances, U.S. Environmental Protection Agency: Washington DC, 1986.

Discusses some aspects of communication to consider when communicating risk to the public.

## INTERNAL MMCD PUBLICATIONS:

*Metropolitan Mosquito Control District Final Environmental Impact Statement: Options for Control to the Year 2000*; Metropolitan Mosquito Control District: St Paul, MN, 1977.

*Metropolitan Mosquito Control District Final Environmental Impact Statement: Options for Control to the Year 2000 - Appendix*; Metropolitan Mosquito Control District: St Paul, MN, 1977.

*Metropolitan Mosquito Control District Supplemental Environmental Impact Statement: Final*; Metropolitan Mosquito Control District: St Paul, MN, 1987.

*Metropolitan Mosquito Control District. Scientific Peer Review Panel. [Last 5 Years of Research - Report]*; Metropolitan Mosquito Control District: St Paul, MN, May 1993.

*Metropolitan Mosquito Control District's Annual Operations Report, Individual reports for years 1985, 86, 87, 88, 90, 91 and 1992*; Metropolitan Mosquito Control District: St Paul, MN, 1985-92.

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All articles listed in this bibliography are available to the public through the Metropolitan Mosquito Control District library. This library is open weekdays from 8:00 A.M. to 4:30 P.M.

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**CONTROL MATERIALS USED BY THE MMCD FOR MOSQUITO & BLACK FLY CONTROL  
NUMBER OF ACRES TREATED BY MATERIAL TYPE FOR 1986-1993**

**NUMBER ACRES TREATED**

<b>CONTROL MATERIAL</b>	<b>1986</b>	<b>1987</b>	<b>1988</b>	<b>1989</b>	<b>1990</b>	<b>1991</b>	<b>1992</b>	<b>1993</b>
ALTOSID BRIQUET 150	15,750	280	4,235	11,700	11,351	10,862	10,376	10,537
ALTOSID BRIQUET 100	0	5,880	2,258	2,815	1,270	0	0	0
ALTOSID SAND* GFM Sand ('92-'93)	3	0	706	13,900	84,286	12,079	625	630
ALTOSID PELLETS	0	0	0	0	0	75	5,689	5,562
ALTOSID SR-20 LIQUID	0	0	0	0	0	1	3,279	15
BTI CORN COB GRANULES	79,000	44,300	24,248	67,300	100,100	134,011	101,877	126,778
BTI LIQUID 1X ** BLACKFLY	0	84	85	174	1,645	336	0	0
BTI LIQUID 12AS ** BLACKFLY	0	36	15	40	364	3,238	3,343	5,090
ACROBE BTI LIQUID ** BLACKFLY	0	0	0	0	0	0	1,075	0
PERMETHRIN ADULTICIDE	19,900	11,483	8,771	9,225	37,015	22,062	12,812	8,261
RESMETHRIN ADULTICIDE	406,027	219,051	15,787	58,880	225,900	155,922	48,716	53,345
PERMANONE ADULTICIDE	0	0	0	640	1,772	0	0	0

\*\* Reported as total gallons used

**1993 Acres Treated by Material Type  
in MMCD Divisions**

<i>Control Material</i>	<i>Anoka</i>	<i>Carver</i>	<i>Dakota</i>	<i>No. Henn.</i>	<i>So. Henn.</i>	<i>Ramsey</i>	<i>Scott</i>	<i>Washington</i>	<i>Western*</i>	<b>District Totals</b>
<b>Altosid XR Briquet (150 Day)</b>	1,072.7	631.3	853.1	1,826.8	1,752.3	943.5	1,255.5	1,803.2	398.4	<b>10,536.8</b>
<b>Altosid Pellets (Ground Treatments)</b>	583.6	0.7	130.7	491.0	854.1	130.1	58.3	121.0	3.7	<b>2,373.2</b>
<b>Altosid Pellets (Aerial Treatments)</b>	408.0	0.0	434.0	742.0	97.0	88.0	645.0	775.0	0.0	<b>3,189.0</b>
<b>Altosid XR Dust</b>	0.0	0.0	2.9	5.1	3.0	0.6	3.3	0.0	0.0	<b>14.9</b>
<b>Altosid GFM Sand (Research Sites Only)</b>	0.0	0.0	0.0	9.4	5.4	0.0	0.0	0.0	630.0	<b>644.8</b>
<b>Altosid A.L.L. Liquid</b>	0.0	0.0	0.0	9.4	5.4	0.0	0.0	0.0	0.0	<b>14.8</b>
<b>Bti Granules (Ground Treatments)</b>	93.7	9.0	149.1	413.0	366.7	114.4	14.1	70.0	0.7	<b>1,230.7</b>
<b>Bti Granules (Aerial Treatments)</b>	18,811.0	2,411.0	6,251.0	27,085.0	29,025.0	18,315.0	16,394.0	4,902.0	2,353.0	<b>125,547.0</b>
<b>Permethrin</b>	829.7	338.8	1,552.6	1,415.6	1,609.5	1,339.9	825.4	342.3	7.4	<b>8,261.2</b>
<b>Resmethrin</b>	7,060.0	226.0	3,126.0	15,138.0	14,244.0	7,456.0	1,806.0	4,119.0	170.0	<b>53,345.0</b>
<b>Acres Division Totals -</b>	<b>28,858.7</b>	<b>3,616.8</b>	<b>12,499.4</b>	<b>47,135.3</b>	<b>47,962.4</b>	<b>28,387.5</b>	<b>21,001.6</b>	<b>12,132.5</b>	<b>3,563.2</b>	

\* includes eastern Carver, Wright, Sherburne Counties

**1993 Number of Sites Treated by Material Type  
in MMCD Divisions**

<i>Control Material</i>	<b>Anoka</b>	<b>Carver</b>	<b>Dakota</b>	<b>No. Henn.</b>	<b>So. Henn.</b>	<b>Ramsey</b>	<b>Scott</b>	<b>Washington</b>	<b>Western</b>	<b>Totals</b>
<b>Altosid XR Briquet (150 Day)</b>	3,837	1,394	2,652	3,784	4,103	3,256	3,879	5,918	1,322	30,145
<b>Altosid Pellets (Ground Treatments)</b>	1,658	8	320	1,400	3,073	1,341	76	779	12	8,667
<b>Altosid Pellets (Aerial Treatments)</b>	14	0	18	31	4	1	19	44	0	131
<b>Altosid XR Dust</b>	0	0	7	21	1	1	8	0	0	38
<b>Altosid GFM Sand (Research Sites Only)</b>	0	0	0	0	0	0	0	0	41	41
<b>Altosid A.L.L. Liquid</b>	0	0	49	13	3	0	0	0	0	65
<b>Bti Granules (Ground Treatments)</b>	477	5	539	1,447	2,039	621	41	154	7	5,330
<b>Bti Granules (Aerial Treatments)</b>	612	119	191	1,103	823	633	634	188	114	4,417
<b>Permethrin</b>	329	77	432	527	445	359	195	138	1	2,503
<b>Resmethrin</b>	130	28	76	420	172	193	29	90	1	1,139
<b>(#) Sites Division Totals -</b>	<b>7,057</b>	<b>1,631</b>	<b>4,284</b>	<b>8,746</b>	<b>10,663</b>	<b>6,405</b>	<b>4,881</b>	<b>7,311</b>	<b>1,498</b>	<b>52,476</b>

65

\* includes eastern Carver, Wright, Sherburne Counties

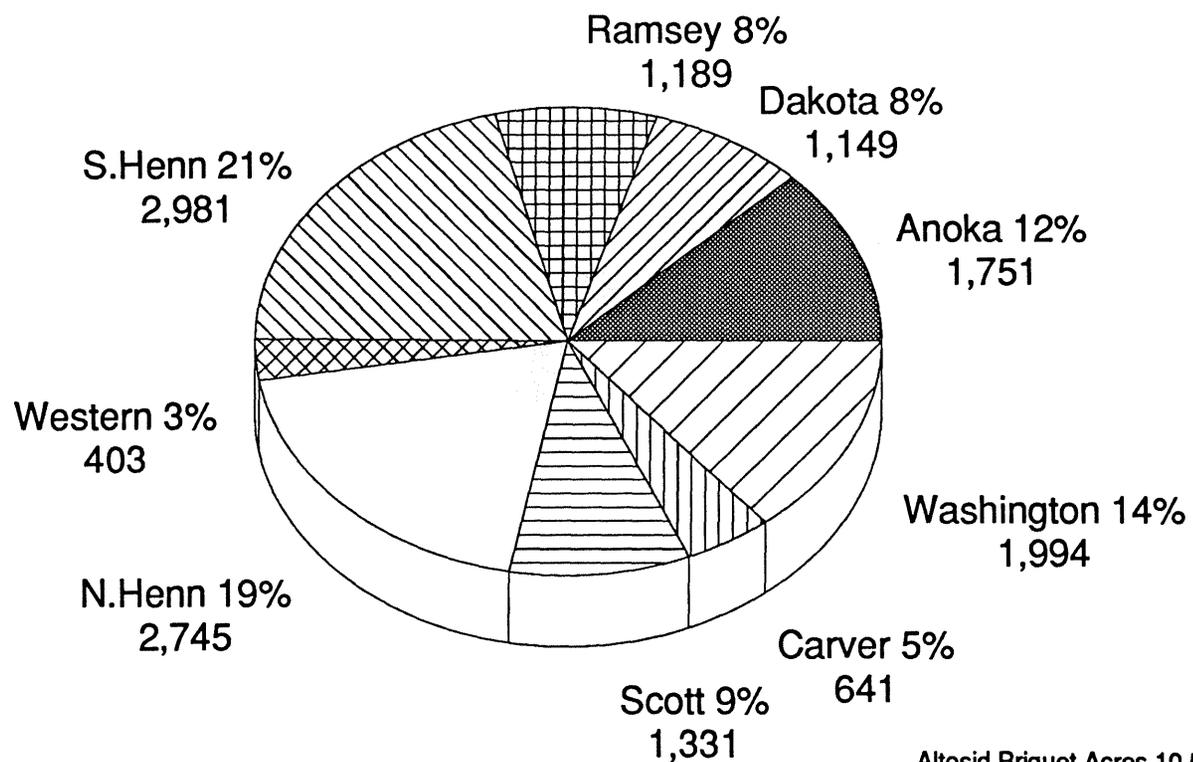
**1993 Amounts Used by Material Type  
in MMCD Divisions**

<i>Control Material</i>	Anoka	Carver	Dakota	No. Henn.	So. Henn.	Ramsey	Scott	Washington	Western	District Totals
<b>Altosid XR Briquet (150 Day)</b>	20,700.0	11,664.0	15,948.0	36,072.0	33,246.0	18,900.0	23,418.0	34,056.0	7,308.0	201,312.0
<b>Altosid Pellets (Ground Treatments)</b>	1,601.0	1.8	326.8	1,227.3	2,166.4	325.3	145.7	302.7	9.3	6,106.3
<b>Altosid Pellets (Aerial Treatments)</b>	1,738.0	0.0	1,179.0	3,036.0	261.0	440.0	1,613.0	2,178.0	0.0	10,445.0
<b>Altosid XR Dust</b>	0.0	0.0	58.0	102.0	60.0	12.0	66.0	0.0	0.0	298.0
<b>Altosid GFM Sand (Research Sites Only)</b>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3,700.0	3,700.0
<b>Altosid A.L.L. Liquid</b>	0.0	0.0	52.4	9.4	5.4	0.0	0.0	0.0	0.0	67.2
<b>Bti Granules (Ground Treatments)</b>	645.8	47.0	766.5	2,180.3	2,090.6	747.4	92.5	391.9	4.0	6,966.0
<b>Bti Granules (Aerial Treatments)</b>	125,208.0	17,109.0	39,434.0	186,225.0	193,106.0	130,760.0	113,425.0	33,310.0	14,080.0	852,657.0
<b>Permethrin</b>	162.0	66.2	303.2	276.5	314.3	261.5	161.2	66.8	1.4	1,613.3
<b>Resmethrin</b>	82.8	3.7	37.8	194.4	169.6	87.4	21.6	50.2	2.0	649.5
<b>Bti Liquid** (Black Fly Program)</b>	-	-	-	-	-	-	-	-	-	5,090.0

\* includes eastern Carver, Wright, Sherburne Counties

\*\* Total gallons used for black fly control

# 1993 Treated Ground Acres Larval Mosquito Treatments

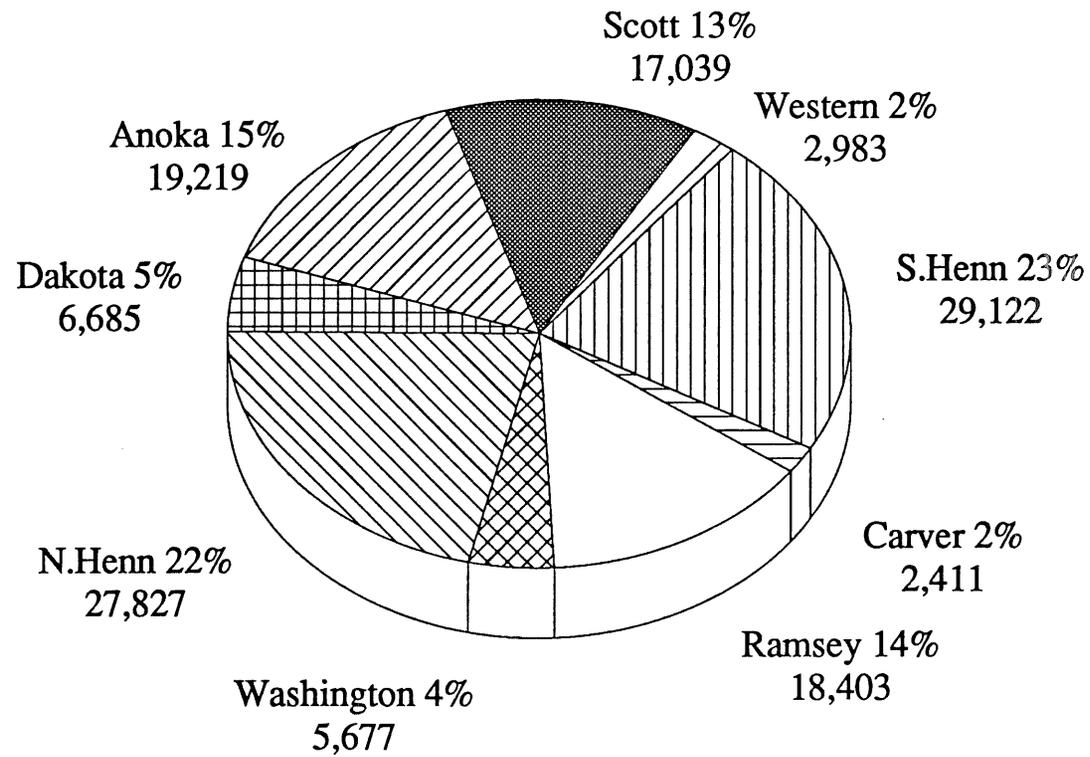


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Total Acres Treated 14,184

Altosid Briquet Acres 10,537  
 Altosid Pellet Acres 2,373  
 Altosid Liq. Acres 28  
 BTI Corn Cob Gran. 1,231

# 1993 District Airsite Acres

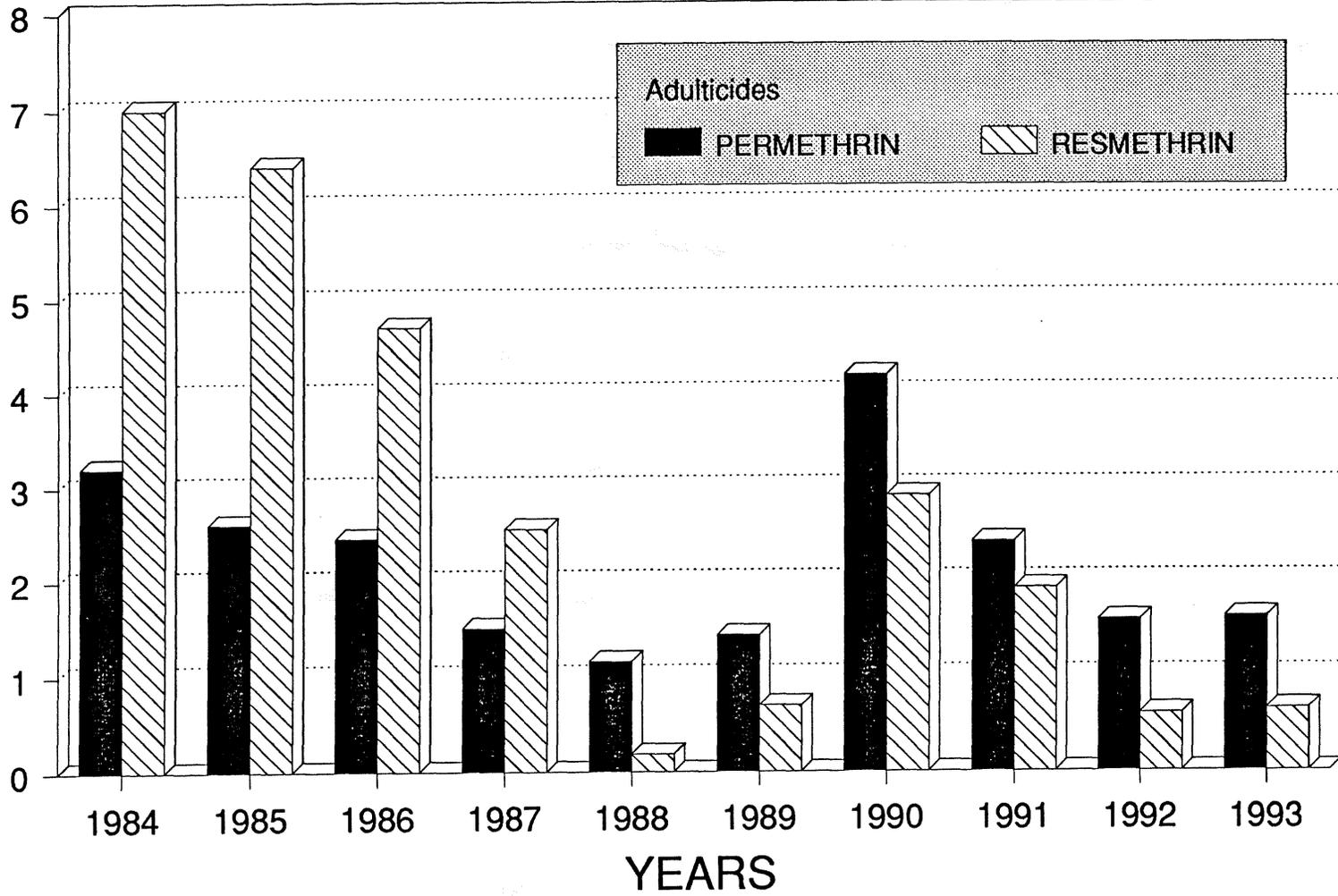


Altosid Pellet Acres 3,189  
BTI Granule Acres 125,547  
Altosid Sand Granule Acres 630

Total Airsite Acres Treated 129,366

# ADULTICIDES USED 1984-93

(Thousands of Gallons)

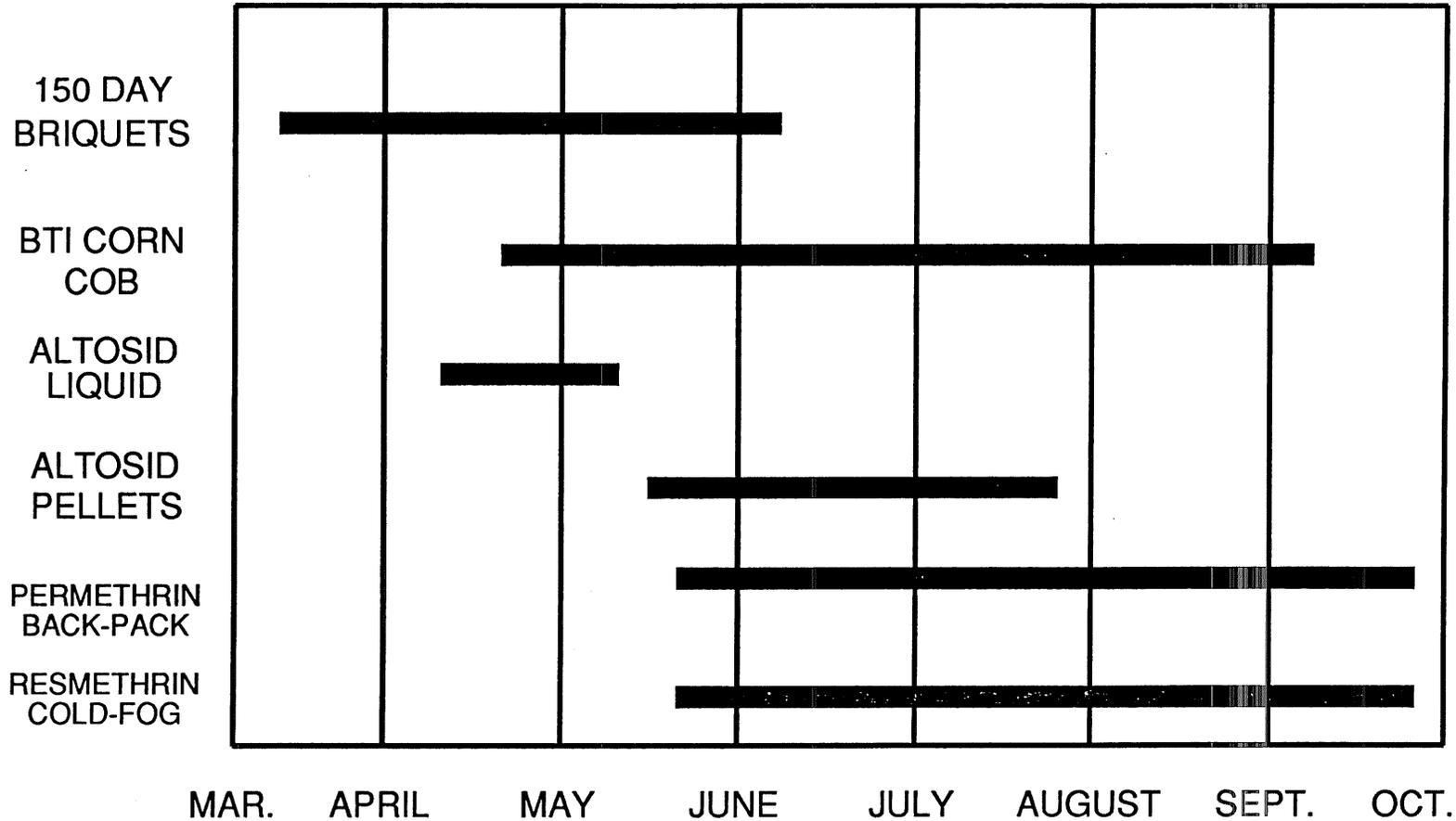


69

DRAFT, 1993

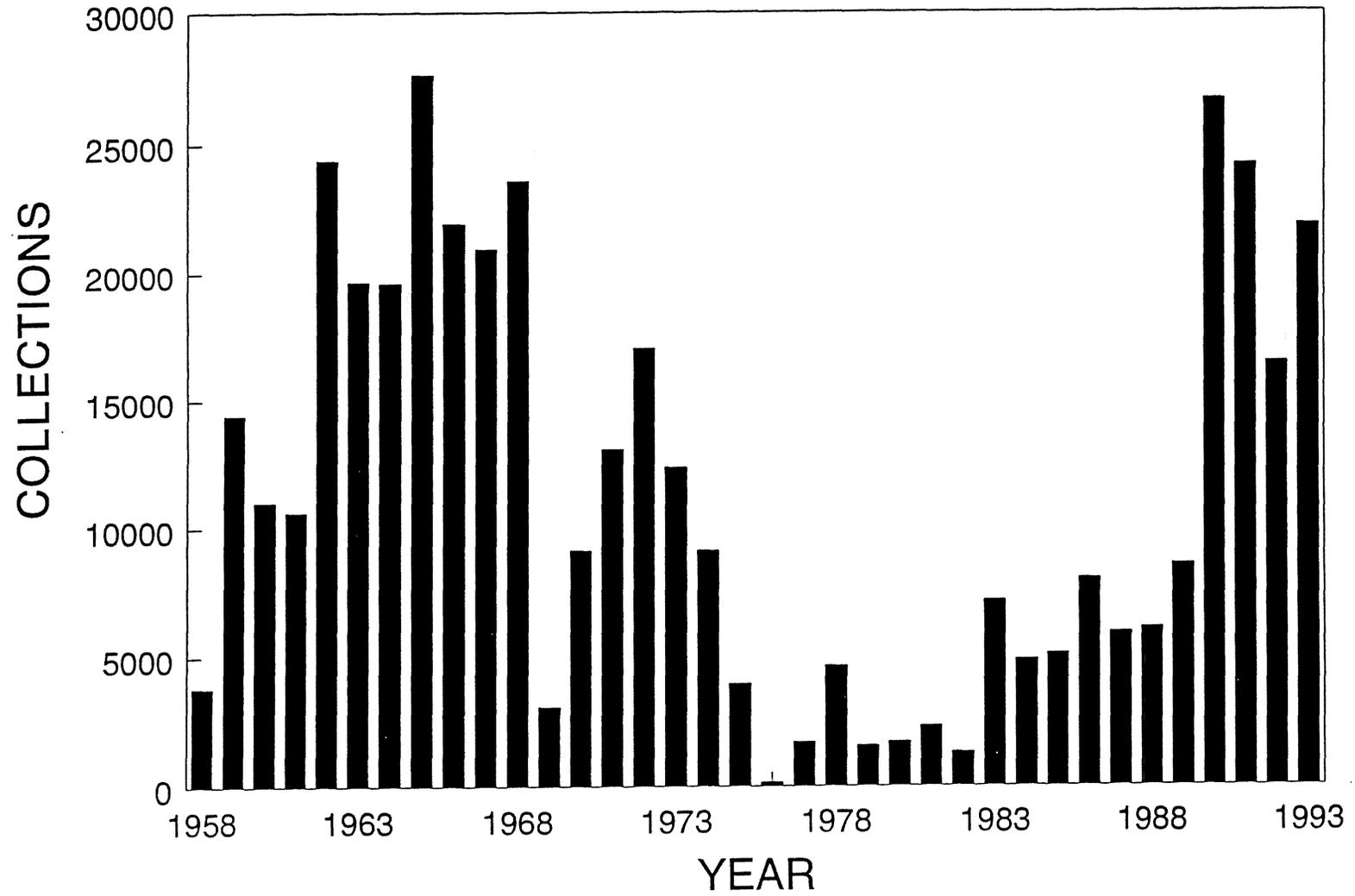
# AEDES MOSQUITO PROGRAM 1994 TREATMENT SCHEDULE LARVICIDE & ADULT MATERIALS

70



The bar chart above represents the time of the year the MMCD will typically apply materials.

Number of larval collections taken 1958 - 1993.







# METROPOLITAN MOSQUITO CONTROL DISTRICT

2099 University Avenue West, St. Paul MN 55104 (612)-645-9149

## AERIAL INSECTICIDE APPLICATION REPORT

OFFICE USE ONLY	
Flight No.	_____
Total Acres	_____
Price Per Acre	_____
Total Amount	_____
Applicator Name/Address	
Scott's Helicopter Service	
P.O. Box 92	
LeSueur, MN 56058	

Date: \_\_\_\_\_ Employee# \_\_\_\_\_ County # \_\_\_\_\_

Aircraft Type: Helicopter

FAA # \_\_\_\_\_

Pilot Name: \_\_\_\_\_

Applicator Lic. # \_\_\_\_\_

Material Code: \_\_\_\_\_

Time of Operation:

Start \_\_\_\_\_

Stop \_\_\_\_\_

Total \_\_\_\_\_

Weather:

Temp. \_\_\_\_\_

Wind Speed (mph)

start \_\_\_\_\_ finish \_\_\_\_\_

Wind Direction

start \_\_\_\_\_ finish \_\_\_\_\_

code	material	lb/ac	code	material	lb/ac
8	Altosid Pellets	2.5	25	Bti Bactimos	5.0
9	Altosid GFM	5.0	26	Bti Bactimos	8.0
10	Altosid Pellets	4.0	27	Bti Bactimos	10.0
19	Bti Vectobac	5.0	28	Bti Acrobe	5.0
20	Bti Vectobac	8.0	29	Bti Acrobe	8.0
21	Bti Vectobac	10.0	30	Bti Acrobe	10.0

Post Treatment Water Levels (enter one code)
1. higher
2. lower
3. same
Perimeter or Whole Site Treated enter P or W

Comment Codes	
1. good pattern	7. missed under trees or missed under power lines
2. light	8. material not found: explainable, physical factors
3. heavy	9. material not found: unexplainable (untreated?)
4. spotty	
5. can't determine	
6. missed edge	

Material Treatment Record							Inspection Record							
twp.	sec.	site	lot number	pounds	acres treated	P or W	average per dip		post date	post-treat water levels	1st comment	2nd comment	new brood	Y/N
							pre-treat	post-treat						
1														
2														
3														
4														
5														
6														
7														
8														
9														
10														
11														
12														
13														
14														
15														
16														
17														
18														
19														
20														

**FF-10  
RECORDKEEPING  
AERIAL APPLICATIONS**

Total Bags \_\_\_\_\_ Total Acres \_\_\_\_\_ Pilot Signature \_\_\_\_\_  
Remarks \_\_\_\_\_ Other Employees \_\_\_\_\_

EPA Registration #'s: Altosid Pellets #2724-448-50809; Altosid GFM EUP; Bti Vectobac "G" Granules #275-50; Bti Bactimos #58988-28; Bti Acrobe #62637-3-241

zoëcon



# Altosid<sup>®</sup> XR EXTENDED RESIDUAL BRIQUETS

**A SUSTAINED RELEASE PRODUCT TO PREVENT  
ADULT MOSQUITO EMERGENCE**

ACTIVE INGREDIENT: (S)-Methoprene [Isopropyl (2E, 4E, 7S)-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 ft<sup>2</sup>. 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 ft<sup>2</sup>.

*Coquillettidia* and *Mansonia* spp.: For application to cattail marshes, and water hyacinth beds. For control of these mosquitoes, place 1 Briquet per 100 ft<sup>2</sup>.

**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 bougainvillea, cesspools and septic tanks, waste treatment settling basins, flooded canals, transformer vaults, abandoned swimming pools, construction and other man-made depressions, cattail marshes, water hyacinth beds, pastures, meadows, rice fields, low water swamps and marshes, salt and tidal marshes, woods and 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 recycling or re-conditioning. 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.

Made in USA  
©1989 Zoecon  
Printed in USA  
EPA Est. No 39578-TX-1  
2724-TX-1

zoëcon<sup>®</sup>

Always read the label before using the product.

93-24-0047

# MATERIAL SAFETY DATA SHEET

May be used to comply with OSHA's Hazard Communication Standard, 29 CFR 1910.1200.  
Standard must be consulted for specific requirements.

## SECTION 1 – PRODUCT IDENTIFICATION

**PRODUCT NAME:** ALTOSID XR EXTENDED RESIDUAL BRIQUETS  
**EPA REG. NO.:** 2724-241-64833      **FDA NO.:**      **RF NO.:** 292  
**COMPANY NAME:** Zoecon Corporation      **EMERGENCY PHONE NO.:** 214-243-2321  
**ADDRESS:** 12200 Denton Drive  
**CITY, STATE, AND ZIP:** Dallas, Texas 75234  
**Date Prepared/Last Change:** 12/90

## SECTION 2 – HAZARDOUS/NON-HAZARDOUS INGREDIENTS

Regulated Components (Chemical and Common Name)	OSHA PEL	ACGIH TLV	OTHER EXPOSURE LIMITS	CAS NO
S-Methoprene: Isopropyl (2E, 4E, 7S)-11-Methoxy- 3,7,11-trimethyl-2,4- dodecadienoate	NE	NE	230 mg/m3 Zoecon recommended TWA	65733-16-6
Calcium Sulfate	15 mg/m3 Total Dust 5 mg/m3 Respirable Dust	10mg/m3 Total Dust	NE	7778-18-9

## SECTION 3 – PHYSICAL AND CHEMICAL CHARACTERISTICS

**Boiling Point:** N/A      **Specific Gravity (H2O=1):** 1.04g/cc      **Vapor Pressure (mm Hg):** N/A  
**Vapor Density (Air = 1):** N/A  
**Solubility in Water:** 1 ppm      **Evaporation Rate:** N/A      **% Volatile (volume):** None  
**Appearance and Odor:** Grey-black solid with a slight hydrocarbon order.

## SECTION 4 – FIRE & EXPLOSION DATA

**Flash Point:** N/A      **Method Used:**      **Flammable Limits in air - % by volume**  
 LEL lower: N/A      UEL upper: N/A  
**Auto Ignition Temperature:** Unknown      **Extinguisher Media:** Water, dry chemical, foam

### Special Fire Fighting Procedures:

Firefighters should wear protective clothing, eye protection, and self-contained breathing apparatus. Do not allow runoff to enter waterways inhabited by aquatic organisms.

### Unusual Fire and Explosion Hazards:

None

## SECTION 5 – PHYSICAL HAZARDS (REACTIVITY DATA)

**Stability:**      **Unstable**       **Conditions to Avoid:**  
    **Stable**

**Incompatibility (Materials to Avoid):** None

### Hazardous Decomposition Products:

**Hazardous Polymerization**      **may occur**       **Conditions to Avoid:**  
    **will not occur**

## SECTION 6 – HEALTH HAZARDS

### Signs and Symptoms of Exposure:

#### ACUTE:

Due to product form, use history, and toxicological safety of active ingredient, no adverse reactions have resulted from human exposure during the research or manufacture of this product. Adverse animal reactions to this product have not been shown. The acute oral LD 50 of the active ingredient is greater than 34,000 mg/kg to the rat. The dermal LD 50 to the rabbit is greater than 5,000 mg/kg.

#### CHRONIC:

No known effect from product.

**Emergency and First Aid Procedures:** Give symptomatic and supportive care. If ingested in large quantities, induce vomiting and get medical attention. Do not induce vomiting in an unconscious person. If in eyes, flush with gently flowing water for 15 minutes. If irritation persists, get medical attention. If on skin wash with soap and water.

### Primary Routes of Entry:

**Carcinogenic Status (NTP, IARC, ACGIH):** None known

## SECTION 7 – GENERAL PRECAUTIONS FOR SAFE HANDLING AND USE

**Work/Hygienic Practices:** Avoid contact with eyes or skin. Avoid breathing dust. Wash thoroughly with soap and water after handling.

### Precautions to be Taken in Handling and Storage:

Store in a cool, dry place. Do not remove briquets from container except for immediate use. Do not contaminate food or feed by storage or disposal. Keep away from children.

### Steps to be Taken in Case Material is Released/Spilled:

Do not allow spill to enter waterways inhabited by aquatic organisms. Sweep up material and place in container for proper disposal.

### Waste disposal Method (Consult federal, state, & local regulations):

Material is not a hazardous waste under current federal RCRA regulations. Consult applicable state and local regulations for proper disposal procedures. Do not contaminate water, food or feed by disposal.

## SECTION 8 – GENERAL CONTROL MEASURES

**Ventilation**  **Local Exhaust**       **Mechanical (General)**       **Special**       **Other**

**Respiratory Protection:** None required for ordinary use. Avoid breathing dust. If prolonged exposure, wear approved dust respirator.

**Protective Gloves:** Wear chemical resistant gloves to avoid prolonged skin exposure.

**Eye Protection:** None needed for normal use. Wear goggles when working in dusty or windy conditions to avoid product contact with eyes.

**Other Protective Clothing and Equipment:** Wear appropriate clothing to prevent skin contact.

## SECTION 9 – MATERIAL SHIPPING INFORMATION

**Article Name:** N/A      **Hazardous Class:** N/A

**Label Required:** N/A

**Packaging Required:** N/A

**Maximum Net Quantity Per Package Via Air**      **Passenger Only:** N/A      **Cargo Only:** N/A

### Bill of Lading Description:

Insecticides or Insect Repellents, OTA, Liquid or O/T Liquid, in boxes or drums. NMFC #102130 (1) Class 60.

**Shipper Certification Required**      **Yes**       **No**

The information herein is given in good faith, but no warranty, expressed or implied, is made.  
N/A = Not applicable

zoëcon.



# Altosid® PELLETS

## MOSQUITO GROWTH REGULATOR

### A GRANULAR PRODUCT TO PREVENT ADULT MOSQUITO EMERGENCE

ACTIVE INGREDIENT: (S)-Methoprene [Isopropyl (2E, 4E, 7S)-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, including *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)
<b>Floodwater sites</b> 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
<b>Permanent water sites</b> 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 flooding 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  
ALTOSID is a trademark of Sandoz Ltd.

Made in USA  
©1993 Zoecon  
Printed in USA  
EPA Est. No. 8329-IL-1

Always read the label before using the product.

zoëcon.  
92-24-0058

# MATERIAL SAFETY DATA SHEET

May be used to comply with OSHA's Hazard Communication Standard, 29 CFR 1910.1200.  
Standard must be consulted for specific requirements.

## SECTION 1 - PRODUCT IDENTIFICATION

PRODUCT NAME: ALTOSID PELLETS  
 EPA REG. NO.: 2724-448-50809      FDA NO.: \_\_\_\_\_      RF NO.: 330  
 COMPANY NAME: Zeecon Corporation  
 EMERGENCY PHONE NO: 214-243-2321  
 ADDRESS: 12200 Denton Drive  
 CITY, STATE, and ZIP: Dallas, Texas 75234

Date Prepared/Last Change: 7/90

## SECTION 2 - HAZARDOUS / NON HAZARDOUS INGREDIENTS

Regulated Components (Chemical and Common Name)	OSHA PEL	ACGIH TLV	OTHER EXPOSURE LIMITS	CAS NO
(S)-Methoprene: Isopropyl (2E,4E,7S) -11- Methoxy-3,7,11-trimethyl- 2,4-dodecadienoate	NE	NE	NE	65733-16-6
Calcium Sulfate	15 mg/m <sup>3</sup> Total Dust 5 mg/m <sup>3</sup> Respirable Dust	10 mg/m <sup>3</sup> Total Dust	NE	7778-18-9

## SECTION 3 - PHYSICAL and CHEMICAL CHARACTERISTICS

Boiling Point: N/A      Specific Gravity (H<sub>2</sub>O=1): 1.04      Vapor Pressure (mm Hg) N/A

Vapor Density (Air = 1): N/A

Solubility in Water: 1 ppm      Evaporation Rate: N/A      % Volatile (volume): None

Appearance And Odor: Dark grey to black pellets with a slight hydrocarbon odor.

## SECTION 4 - FIRE & EXPLOSION DATA

Flash Point: N/A      Method Used:      Flammable Limits in air - % by volume  
 LEL lower: N/A      UEL upper: N/A

Auto Ignition Temperature: Unknown      Extinguisher Media: Water, dry chemical, foam.

**Special Fire Fighting Procedures:** Firefighters should wear protective clothing, eye protection, and self-contained breathing apparatus. Do not allow runoff to enter waterways inhabited by aquatic organisms.

**Unusual Fire and Explosion Hazards:** None

## SECTION 5 - PHYSICAL HAZARDS (REACTIVITY DATA)

Stability: Unstable \_\_\_\_\_      Conditions To Avoid: \_\_\_\_\_  
 Stable X

Incompatibility (Materials to Avoid): None

Hazardous Decomposition Products: None

Hazardous Polymerization: may occur \_\_\_\_\_      Conditions to Avoid: \_\_\_\_\_  
 will not occur X

## SECTION 6 - HEALTH HAZARDS

Signs and Symptoms of Exposure: \*

**ACUTE:** Acute Oral LD<sub>50</sub> - Rat > 5,000 mg/kg (HDT)  
 Acute Dermal LD<sub>50</sub> - Rabbit > 2,000 mg/kg (HDT)  
 Eye Irritation - Rabbit: Practically non-irritating  
 Skin Irritation - Rabbit: Practically non-irritating  
 Skin Sensitization (Guinea Pig): non-sensitizing

**CHRONIC:** 90 day - sub-chronic - oral (RAT) - No effect at 1,000 ppm.  
 90 day - sub chronic - oral (DOG) - No effect at 500 ppm.

\* Data based on (s) Methoprene (Tech) or Methoprene (Tech)  
 \_\_\_\_\_HDT: Highest Dose Tested

**Emergency and First aid Procedures:** If in eyes- Immediately flush with gently running water for 15 min. See a doctor if irritation persists. If on Skin: Remove contaminated clothing. Wash thoroughly with water and soap. See a doctor if symptoms develop. If ingested: Give 1-2 glasses of water to drink and induce vomiting. Refer victim to medical personnel. In case of unconsciousness, don't induce vomiting or give anything by mouth. If Dust is inhaled: Remove victim to fresh air. Seek medical attention as needed.

Primary Routes of Entry: (Human) Oral - No ; Dermal - Yes; Inhalation - Yes

Carcinogenic Status (NTP, IARC, ACGIH): None known

## SECTION 7 - GENERAL PRECAUTIONS FOR SAFE HANDLING & USE

Work/Hygienic Practices: Avoid contact with eyes or skin. Avoid breathing dust. Wash thoroughly with soap and water after handling.

Precautions to be Taken in Handling and Storage: Store in a cool, dry place. Do not contaminate food, feed or water by storage.

Steps to be Taken in Case Material is Released/Spilled: Do not allow spill to enter waterways inhabited by aquatic organisms. Sweep up material. Place in container for disposal.

Waste Disposal Method (Consult federal, state, & local regulations): Material is not a hazardous waste under current federal RCRA regulations. Consult state and local regulations for proper disposal procedures. Do not contaminate water, food or feed by disposal. Empty containers may be disposed of in a sanitary landfill.

## SECTION 8 - GENERAL CONTROL MEASURES

Ventilation X      Local Exhaust \_\_\_\_\_      Mechanical (General) \_\_\_\_\_      Special \_\_\_\_\_      Other \_\_\_\_\_

Respiratory Protection: Avoid inhalation of Dust. If prolonged or excessive exposure is expected, wear dust respirator.

Protective Gloves: Avoid contact with skin. If prolonged or excessive exposure is expected, wear impervious gloves.

Eye Protection: Avoid contact with eyes. If dusty conditions occur, wear goggles.

Other Protective Clothing and Equipment: Wear appropriate clothing to prevent skin contact.

## SECTION 9 - MATERIAL SHIPPING INFORMATION

Article Name: N/A      Hazardous Class: N/A

Label Required: N/A      Packaging Required: N/A

Maximum Net Quantity Per Package Via Air      Passenger Only: N/A      Cargo only: N/A

Bill of Lading Description: Insecticides, NOI, other than poison NMFC 102120.

Shipper Certification Required: Yes \_\_\_\_\_      No X

The information herein is given in good faith, but no warranty, expressed or implied, is made.

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# Altosid® Liquid Larvicide CONCENTRATE

## PREVENTS EMERGENCE OF ADULT FLOODWATER MOSQUITOES

**ACTIVE INGREDIENT:** (S)-Methoprene [Isopropyl (2E, 4E, 7S)-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.

EPA Reg. No. 2724-446-64833  
Sold by

**Vector Management Division**  
A Division of Zoëcon Corporation

A Sandoz Company  
12200 Denton Drive, Dallas, Texas 75234  
For information call 1-800-248-7763

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Printed in USA  
EPA Est. No. 55947-CA-1

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92-24-0056

Always read the label before using the product.

# MATERIAL SAFETY DATA SHEET

May be used to comply with OSHA's Hazard Communication Standard, 29 CFR 1910.1200.  
Standard must be consulted for specific requirements.

## SECTION 1 - PRODUCT IDENTIFICATION

**PRODUCT NAME:** ALTOSID LIQUID LARVICIDE CONCENTRATE  
**EPA REG. NO.:** 2724-446-50809      **FDA NO.:**      **RF NO.:** 437N  
**COMPANY NAME:** Zoecon Corporation      **EMERGENCY PHONE NO.:** 214-243-2321  
**ADDRESS:** 12200 Denton Drive  
**CITY, STATE, AND ZIP:** Dallas, Texas 75234  
**Date Prepared/Last Change:** 7/90

## SECTION 2 - HAZARDOUS /NON HAZARDOUS INGREDIENTS

Components (Chemical and Common Name)	OSHA PEL	ACGIH TLV	OTHER EXPOSURE LIMITS	CAS NO
(S)-Methoprene: Isopropyl (2E,4E,7S)-11- Methoxy-3,7,11-trimethyl- 2,4-dodecadienoate	NE	NE	NE	65733-16-6
Sodium hydroxide	2 mg/m3	2 mg/m3	OSHA Ceiling 2 mg/m3	1310-73-2
Ethylenediamine	10 ppm 25 mg/m3	10 ppm 25 mg/m3	NE	107-15-3
Acetic acid	10 ppm 25 mg/m3	10 ppm 25 mg/m3	ACGIH STEL: 15 ppm 37 mg/m3	64-19-7
2,5-Di-tert-butyl-p- Cresol (BHT)	10 mg/m3	10 mg/m3	NE	128-37-0

## SECTION 3 - PHYSICAL AND CHEMICAL CHARACTERISTICS

**Boiling Point:** 100 degree C      **Specific Gravity (H<sub>2</sub>O = 1):** 1.0      **Vapor Pressure (mm Hg) (water phase):** 175

**Vapor Density (Air = 1):** 0.6 (water phase)

**Solubility in Water:** Disperses in water      **Evaporation Rate:** About 0.8      **% Volatile (volume):** N/A

**Appearance and Odor:** Creamy, yellow liquid with slight odor

## SECTION 4 - FIRE & EXPLOSION DATA

**Flash Point:** Non-Flammable      **Method Used:**      **Flammable Limits in air - % by volume**  
 LEL lower: None      UEL upper: None

**Auto Ignition Temperature:** None      **Extinguisher Media:** Water, foam, CO<sub>2</sub>

**Special Fire Fighting Procedures:**  
 Firefighters should wear protective clothing, eye protection, and self-contained breathing apparatus.  
 Unusual Fire and Explosion Hazards: None

## SECTION 5 - PHYSICAL HAZARDS (REACTIVITY DATA)

**Stability:** Unstable \_\_\_\_\_      **Conditions To Avoid:** Extreme Heat  
 Stable

**Incompatibility (Materials to Avoid):**  
 None

**Hazardous Decomposition Products:**  
 None

**Hazardous Polymerization:** may occur      **Conditions to Avoid:**  
 will not occur

## SECTION 6 - HEALTH HAZARDS

**Signs and Symptoms of Exposure:**  
 No adverse reactions have resulted from normal human exposure during research and testing.

**ACUTE:**  
 Acute oral LD50 - Rat: Greater than 5,000 mg/kg (highest - dose tested)  
 Acute dermal LD5 - Rabbit: Greater than 2,000 mg/kg (Hot)  
 Primary eye irritation - Rabbit: Practically non-irritating  
 Primary skin irritation - Rabbit: Slightly irritating  
 Acute inhalation LC50 Rat: Greater than 5.2 mg/L air (actual conc.)

**CHRONIC:**  
 Data not available, however no effect level for the active ingredient in 5,000 ppm in diet for rats.

**Emergency and First Aid Procedures:**  
 If ingested: Give 1 - 2 glasses of water and try to induce vomiting. Refer victim to medical personnel. Never give anything by mouth to unconscious person. If in eyes: Immediately flush with copious amount of water for at least 15 minutes. See a doctor if irritation persists. If on skin: Wash material off with copious amount of water and soap. Remove contaminated clothing and footwear. See a doctor if symptoms persist. If inhaled: Remove victim to fresh air. See a doctor if cough or other respiratory symptoms develop. Avoid ingestion, inhalation and contact with skin, eyes, or clothing. Notify Zoecon of any symptoms which may be related to exposure.

**Primary Routes of Entry:** Dermal contact  
 Carcinogenic Status (NTP, IARC, ACGIH): BHT/IARC Group 3: Not classifiable as a human carcinogen.

## SECTION 7 - GENERAL PRECAUTIONS FOR SAFE HANDLING AND USE

**Work/Hygienic Practices:**  
 Avoid contact with eyes or clothing. Wash thoroughly with soap and water after handling.

**Precautions to Be Taken in Handling and Storage:**  
 Store in a cool, dry place, away from other pesticides, food and feed.

**Steps to Be Taken in Case Material is Released/Spilled:**  
 In case of leakage or spill, soak up with absorbent material. Place in container for disposal.

**Waste Disposal Method (Consult federal, state, & local regulations):**  
 Material is not a hazardous waste under current federal RCRA regulations. Consult state and local regulations for proper disposal procedures. Do not contaminate water, food or feed by storage or disposal. Empty containers may be triple rinsed and disposed of in sanitary landfill.

## SECTION 8 - GENERAL CONTROL MEASURES

Ventilation	Local Exhaust	Mechanical (General)	Special	Other
<input checked="" type="checkbox"/>				

**Respiratory Protection:**  
 None required for ordinary use. If prolonged exposure is expected, wear a MSHA/NIOSH approved organic vapor/pesticide respirator.

**Protective Gloves:**  
 None for ordinary use. If prolonged exposure or excessive contact is expected, wear impervious gloves.

**Eye Protection:**  
 Avoid contact with eyes. Wear goggles or safety glasses with side shields.

**Other Protective Clothing and Equipment:**  
 Wear appropriate clothing to prevent skin contact.

## SECTION 9 - MATERIAL SHIPPING INFORMATION

**Article Name:** N/A      **Hazardous Class:** N/A

**Label Required:** N/A

**Packaging Required:** N/A

Maximum Net Quantity Per Package Via Air	Passenger Only:	Cargo Only:
	N/A	N/A

**Bill of Lading Description:**  
 Insecticides, or insect repellents, OTA, NOI, other than poison.

**Shipper Certification Required:** Yes \_\_\_\_\_  
 No \_\_\_\_\_

The information herein is given in good faith, but no warranty, expressed or implied, is made.



# Bactimos® Granules

FOR CONTROL OF MOSQUITO LARVAE

KEEP OUT OF REACH OF CHILDREN

## CAUTION

**ACTIVE INGREDIENT:** *Bacillus thuringiensis* subsp. *israelensis*  
 Dipteran Active Toxin ..... 0.2%  
**INERT INGREDIENTS** ..... 99.8%  
**TOTAL** ..... 100.0%

**POTENCY:** 200 International Toxic Units (ITU) per milligram of product or 0.091 billion International Toxic Units per pound of this product. Potency units should not be used to adjust use rates beyond those specified in the Directions For Use Section.

### PRECAUTIONARY STATEMENTS:

**HAZARDS TO HUMANS:** Avoid contact with eyes or open wounds.

**ENVIRONMENTAL HAZARDS:** Do not contaminate water when disposing of equipment washwaters. Do not apply directly to treated, finished drinking water reservoirs or drinking water receptacles.

### DIRECTIONS FOR USE:

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

Apply 2.5 to 20 pounds granules/acre with aircraft or ground equipment. Use the higher rates in heavily polluted water, when populations are high, when larvae are nearly grown or in fourth instar, and when aquatic or covering vegetation is dense. Most treatments require no more than 5 pounds/acre. Apply only when mosquitoes are larvae, not pupae.

### STORAGE AND DISPOSAL:

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

**Storage:** Tightly reclose containers of unused granules. Store in a cool, dry area.

**Pesticide Disposal:** Wastes resulting from the use of this product may be disposed of on site or at an approved waste disposal facility in accordance with federal and local regulations.

**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.

Bactimos® is a registered trademark of Novo Nordisk A/S

\*Active ingredient licensed from U.S. Navy under U.S. Patent No. 4,166,112.

EPA Reg. No. 58998-28  
 EPA Est. No. 50130-IL-001  
 EPA Est. No. 9198-OH-001

Manufactured For:  
**Novo Nordisk**  
 33 Turner Road  
 Danbury, CT 06813-1907

### CONDITIONS: RATES (lbs/acre)

Pools, ponds, flood water, pastures, ditches, ricefields, brackish water, light to moderate populations 2.5 - 7.5

Catch basins, tidal water, salt marshes, storm water retention areas, mangrove swamps, moderate pollution or organic content 7.5 - 10

Allow 24 hours for control. Under certain conditions such as sewage waste lagoons, high pollution or organic content, heavy vegetative cover, high populations, and catch basins the above application rates may be doubled.

### TREATMENT OF SCRAP TIRES

**Method of Application:** Bactimos® Granules can be scattered by hand to tire stockpiles or applied directly to individual tires.

**ALWAYS WEAR PROTECTIVE EYE EQUIPMENT (GOGGLES) AND RUBBER GLOVES WHEN HANDLING AND APPLYING THE GRANULES BY HAND.**

Application can also be made with a mechanical spreader.

**Rate of Application:** Bactimos® Granules must be scattered over the top of scrap tire piles such that the interior tires in the pile are adequately covered. Granules can be placed directly on individual tires stored on racks. Ten (10) to twenty (20) granules will adequately treat a tire, depending on the size and amount of water it retains. One pound of Bactimos® Granules will treat between 45 and 60 passenger car tires.

**Treatment Schedule:** The most effective and cost efficient use of Bactimos® Granules would be to completely treat the entire scrap tire pile inventory ONCE EVERY TWO WEEKS during the mosquito season.

**WARRANTY:** NOVO NORDISK MAKES NO WARRANTY OF MERCHANTABILITY, FITNESS FOR ANY PURPOSE, OR OTHERWISE, EXPRESS OR IMPLIED, concerning this product or its uses which extend beyond the use of the product under normal conditions in accord with the statements made on this label. In no case shall the seller be liable for consequential, or indirect damages resulting from the use or handling of this product. All such risks shall be assumed by the buyer.

SPECIAL LABEL



# VectoBac® G

## Biological Larvicide Granules

### Active Ingredient:

*Bacillus thuringiensis*, Serotype H-14  
200 International Toxic Units (ITU) per mg  
(Equivalent to 0.091 billion ITU per pound) . . . 0.2%  
Inert Ingredients . . . . . 99.8%

EPA Registration No. 275-50  
PA Est. No. 33762-IA-1

### INDEX:

- 1.0 Precautionary Statements
- 2.0 Directions for Use
- 3.0 Storage and Disposal
- 4.0 Application Instructions
  - 4.1 Formulation
  - 4.2 Selectivity
- 5.0 General Information
  - 5.1 Rate for Mosquitoes
  - 5.2 Recommendations for Use
  - 5.3 Ground Application
  - 5.4 Aerial Application
- 6.0 Notice to User

### KEEP OUT OF REACH OF CHILDREN CAUTION

#### 1.0 PRECAUTIONARY STATEMENTS

If in eyes, flush eyes with plenty of water. Get medical attention if irritation persists.

#### 2.0 DIRECTIONS FOR USE

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

#### 3.0 STORAGE AND DISPOSAL

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

**Storage:** Store in a cool, dry place.

**Pesticide Disposal:** Wastes resulting from 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 GENERAL INFORMATION

VectoBac G biological larvicide is a highly selective insecticide for control of most species of mosquito larvae. It contains spores and delta-endotoxin crystals of *Bacillus thuringiensis*, Serotype H-14 (*B.t.* H-14). Activity against mosquito larvae is dependent upon the delta-endotoxin crystal. *B.t.* H-14 is well-suited for use in integrated pest management (IPM) control programs and environmentally sensitive areas, since toxicity testing has not indicated any harmful effect on mammals (and, by analogy, humans), birds, fish or aquatic invertebrate predators and parasites.

The rapid rate of kill, typically within 24 hours, is in harmony with the inspection and evaluation programs currently used by most mosquito control operators.

The fermentation of formulation expertise acquired by Abbott Laboratories (North Chicago, Illinois, USA) in developing *B.t.* products for agriculture and forestry is being applied to the production of VectoBac brand *B.t.* H-14, thereby insuring high quality, stability, and performance.

#### 4.1 FORMULATION

VectoBac G is a granular formulation of *Bacillus thuringiensis*, Serotype H-14, containing 200 International Toxic Units (ITU) per milligram (equivalent to 0.091 billion ITU's per pound).

This formulation, utilizing **5/8 mesh size corn cob granules**, has been designed with unique penetration and deposition properties for use in breeding areas with moderate to heavy vegetation, such as flooded pastures, salt marshes, ponds, ditches, and rice fields.

#### 4.2 SELECTIVITY

The insecticidal activity of VectoBac G is primarily limited to larvae of mosquitoes (Family Culicidae). Tests have been conducted to determine the safety of *B.t.* H-14 to nontarget species of vertebrates and invertebrates. Results of these tests have shown that *B.t.* H-14 provides excellent control of mosquito larvae, while demonstrating no harmful effects on mammals (and, by analogy, humans), fish and most non-target aquatic organisms and beneficial insects.

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**5.0 APPLICATION DIRECTIONS**

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**5.1 APPLICATION RATE FOR MOSQUITOES**

<b>Mosquito Habitat</b>	<b>Suggested Range Rate*</b>
-------------------------	------------------------------

(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.

Apply uniformly by aerial or ground conventional equipment.

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

**5.2 RECOMMENDATIONS FOR USE**

Application rates of VectoBac G mosquito larvicide are related to surface area of water to be treated, not depth. Recommended application rates range from 2.5 to 20 pounds of VectoBac granules per acre, depending upon habitat and larval stage.

**5.3 GROUND APPLICATION**

VectoBac G can be applied through manual and mechanically driven ground-rig granule applicators, e.g. cyclone seeder, Ortho® Whirlybird Seeder, and air-blast ground equipment, e.g. Buffalo turbines. Tests to date have shown VectoBac G application through a horn seeder to be unacceptable.

**5.4 AERIAL APPLICATION**

VectoBac G can be applied through conventional fixed wing and helicopter granule application equipment.

Higher application rates may be needed to control late 3rd and 4th instar larvae and in highly organic waters.

**NOTE:**

Alternate liquid formulation, VectoBac 12AS, is available for use against mosquito and blackfly larvae.

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**6.0 NOTICE TO USER**

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

# VectoBac® 12AS

**Biological Larvicide  
Aqueous Suspension**

**Active Ingredient:**

*Bacillus thuringiensis*, Serotype H-14, 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%

EPA Registration No. 275-66  
EPA Establishment No. 33762-IA-1

**INDEX:**

- 1.0 Precautionary Statements
  - 1.1 Hazards to Humans
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**KEEP OUT OF REACH OF CHILDREN**

**CAUTION**

**1.0 PRECAUTIONARY STATEMENTS**

**1.1 HAZARDS TO HUMANS**

As a precautionary measure in case of contact, flush eyes with plenty of water. In case of irritation, contact a physician.

**1.2 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.

**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 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:** Triple rinse (or equivalent).

**4.0 APPLICATION INSTRUCTIONS**

**4.1 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.	0.25 pt - 1 pt/acre
Polluted water (such as sewage lagoons, animal waste lagoons)	1 pt - 2 pts/acre

**4.2 APPLICATION RATE FOR BLACK FLIES**

Black Fly Habitat	Suggested Range Rate*
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.



# PERMETHRIN 57% OS

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.

## 8 CONDITIONS and RATES to USE 5 for MOSQUITO CONTROL FOR A BARRIER SPRAY

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

Normal use pattern of product requires a residual application on plant and other surfaces where mosquitoes may rest. Product commonly provides sustained control in wooded areas lasting up to 14 days in shaded areas. Secondary activity of product is through repellency. Apply product by ground application equipment such as mist blower, ULV equipment, power backpack or pressure sprayer. Not to be used within 100 feet (30 meters) of lakes and streams. To kill or repel mosquitoes, midges, deer flies and other biting flies, mix with enough oil mixture so as to easily apply 0.1 ounces 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 150 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 INGREDIENTS:

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

Contains petroleum distillates.

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

Contains 5 lb./gal. Permethrin

## CAUTION

KEEP OUT OF REACH OF  
CHILDREN

SAMPLE

MANUFACTURED BY

**CLARKE MOSQUITO CONTROL  
PRODUCTS, INC.**

159 N. GARDEN AVENUE  
ROSELLE, ILLINOIS 60172

E.P.A. EST. No. 8329IL01

EPA Reg. No. 8329-44

### NET CONTENTS

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

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

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

### TRUCK MOUNTED -ULV- EQUIPMENT

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

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

### FOR A 1:4 PERMETHRIN 57%/SOLVENT DILUTION RATIO

Mix one (1) part PERMETHRIN 57% with four (4) parts solvent and apply at the following rates.

Permethrin pounds/acre	Application Rates			Fl. oz. finished spray per acre
	5MPH	10MPH	15MPH	
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. finished spray per acre
	5MPH	10MPH	
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 the following rates.

Permethrin pounds/acre	Application Rates			Fl. oz. finished spray per acre
	5MPH	10MPH	15MPH	
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 4' above ground level and directed out the back of the vehicle. Failure to follow 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 MTD of 50 microns or less with no more than 2.5% exceeding 100 microns. Flow rate a 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.

### 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**

# PUNT™ 57-OS

## INSECTICIDE

A SYNTHETIC PYRETHROID FOR EFFECTIVE SPACE AND BARRIER CONTROL  
OF ADULT MOSQUITOES, GNATS, BITING AND NON-BITING MIDGES,  
BLACKFLIES AND OTHER BITING FLIES

FOR APPLICATION ONLY BY MOSQUITO ABATEMENT DISTRICTS,  
PUBLIC HEALTH OFFICIALS, AND TRAINED PERSONNEL OF  
OTHER MOSQUITO CONTROL PROGRAMS

### ACTIVE INGREDIENT:

Permethrin: (3-phenoxyphenyl) methyl (+/-) cis/trans 3-(2,2-dichloroethenyl) 2,2-dimethyl, cyclopropanecarboxylate . . . . .	57.00%
* INERT INGREDIENTS . . . . .	43.00%
TOTAL	100.00%

Cis/trans isomer ratio min. 35%(+/-)cis and max. 65%(+/-)trans. U.S. Patent No. 4,024,163.

\*Contains a Petroleum Distillate Solvent. This product Contains 5.0 lbs. Technical Permethrin/Gallon.

™ TRADEMARK OF VECTEC, INC.

### KEEP OUT OF REACH OF CHILDREN

## CAUTION

“PRECAUCION AL USUARIO: Si usted no lee ingles,, no use este producto  
hasta que la etiqueta haya sido explicado ampliamente”

### STATEMENT OF PRACTICAL TREATMENT

**IF SWALLOWED:** Call a Physician or Poison Control Center immediately. If possible vomiting should be induced under medical supervision. Solvent presents an aspiration hazard. Gastric lavage is indicated if material was taken internally. Do not induce vomiting or give anything by mouth to an unconscious or convulsing person.

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

**IF ON SKIN:** Remove contaminated clothing and wash affected area with soap and water.

**IF INHALED:** Remove victim to fresh air. Apply artificial respiration if indicated.

SEE SIDE/BACK PANEL FOR ADDITIONAL PRECAUTIONARY STATEMENTS

### PRECAUTIONARY STATEMENTS

#### HAZARDS TO HUMANS AND DOMESTIC ANIMALS

CAUTION: Harmful if swallowed or absorbed through the skin. Avoid contact with eyes, on skin, or clothing. Wash thoroughly after using and before eating or smoking. Avoid contamination of food and feed. Launder clothing before reuse. Solvek animal drinking water & feed before treating feedlots, etc.

#### ENVIRONMENTAL HAZARDS

This pesticide is highly toxic to fish. Do not apply to any body of water or wetlands (swamps, bogs, marshes, and potholes). 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 pesticide is highly toxic to bees exposed to direct treatment on blooming crops or weeds. Do not apply this product or allow it to drift to blooming crops or weeds while bees are actively visiting the treated areas.

NET CONTENTS \_\_\_ GALLON

EPA REG. NO. 42737-1

EPA EST. NO. 10370-TX-1

Manufactured For

# VECTEC, INC.

6984 VENTURE CIRCLE • ORLANDO, FLORIDA 32807-5392 • U.S.A.

## PHYSICAL AND CHEMICAL HAZARDS

Do not use, pour, spill 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.

**STORAGE:** Store product in its original labeled container in an ambient temperature, dry, locked, place designated for such insecticides and out of reach of children. If product is exposed to temperatures below 40 degrees F crystallization may result in which case, move product and warm to 80 degrees F and thoroughly mix. Do not use open flame to warm product. Do not contaminate water, food or feed by storage or disposal. In case of spillage, soak up with absorbent material such as sawdust, or fullers earth; sweep up and place in a labeled container and dispose of as follows. **PESTICIDE DISPOSAL:** Pesticide wastes are toxic. Improper disposal of excess pesticide, spray mixture, or rinsate is a violation of Federal law. If these wastes cannot be disposed of by use according to label instructions contact your State Pesticide or Environmental Control Agency, or the Hazardous Waste representative at the nearest EPA Regional Office for guidance. **CONTAINER DISPOSAL:** (Metal) 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. (Plastic) 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.

## INSECTS CONTROLLED

This product is recommended for OUTDOOR SPACE AND BARRIER CONTROL of ADULT MOSQUITOES, MIDGES (biting and non-biting), BLACKFLIES, DEER FLIES AND OTHER BITING FLIES such as "DOG FLIES" by use of specially designed non-thermal spray equipment capable of delivering the particle sizes specified for each type of treatment below. It is especially effective for reducing mosquito annoyance and the control of mosquitoes that may act as disease transmitting agents. \***SOLVENT FOR DILUTION:** PUNT 57 OS will not dilute in water. It may be applied as is or diluted with an oil mixture of 1 part soybean oil in 2 parts of a 54 second viscosity mineral oil or any other "non-phytotoxic" ULV suitable oil.

## WHERE TO USE

Areas that may be treated for insect control includes but are not limited to Animal Houses, Corrals, Feedlots, Drive-in Restaurants and Theaters, Gardens, Playgrounds, Recreational Areas, Zoos, Parks, Campsites, Woodlands, Athletic Fields, Golf Courses, Urban Areas, Residential Areas and Municipalities around the outside of apartment buildings, restaurants, stores and warehouses. To obtain optimum results, cover the immediate surroundings of housing and buildings, including plant foliage surfaces, where mosquitoes may rest. For large recreational areas such as Football Fields, Stadiums, Racetracks and Public Parks, also apply to the "interface of woods" surrounding the main area. Do not apply more than once in a 24 hour period.

Do not allow spray treatment to drift on pasture land, cropland, poultry ranges or water supplies. Do not use on crops used for food, forage or pasture. Under no condition should open water be treated with this product. Not to be used within 100 ft. (30 meters) of lakes and streams. In treatment of corrals, feed lots, zoos, cover any exposed drinking water, drinking fountains and animal feed before application.

## HOW TO APPLY AND HOW MUCH TO USE FOR A BARRIER SPRAY USE A "BACKPACK" ULV UNIT

For use in non-thermal ULV portable backpack equipment use a 1 to 9 mixing ratio by adding 2.5 Fl. Oz. of PUNT 57 OS to 22.5 Fl. Oz. of solvent\* making a total of 25 ounces; (see SOLVENT FOR DILUTION paragraph) and apply with equipment adjusted to deliver ULV particles of 50 to 100 microns mass median diameter. Use 25 fl. oz. of the diluted spray/acre as a 50 ft. (15.2m) swath while walking at a speed of 2 mph (3.2 kph).

## TRUCK MOUNTED "ULV" EQUIPMENT

For truck mounted non-thermal ULV equipment mix this product with refined soybean oil, light mineral oil of 54 second viscosity or another suitable non-phytotoxic solvent. Adjust equipment to deliver spray particles of 8 to 20 microns mass median diameter. Consult the following chart for dilution and application rates. See \***SOLVENT FOR DILUTION** paragraph on left panel for an appropriate oil for diluting PUNT 57 OS.

Amount of Undiluted Punt 57 or *1 to 9 Diluted Mix to use/Acre or Linear Mile				
lbs./A./Acre	Amt. of Undiluted OR 1 to 9 Mix to use per Acre	Amt. of Undiluted or 1 to 9 mix to use at mph/300 ft. wide		
		at 5 mph	at 10 mph	at 20 mph
0.0025#	Use 1.9 ml.(.06 oz.)/A Undiluted	5.7 ml. (0.19 oz.)	11.4 ml. (0.39 oz.)	22.8 ml. (0.77 oz.)
Amount of Undiluted spray mixture to use per Linear Mile = 68.4 ml. or 2.31 oz.				
OR	Use 19 ml.(.64 oz.)/A of a 1 to 9 mix	57 ml. (1.9 oz.)	114 ml. (3.85 oz.)	228 ml. (7.71 oz.)
Amount of Diluted spray mixture to use per Linear Mile = 684 ml. or 23.1 oz.				
0.005#	Use 3.8 ml.(.13 oz.)/A Undiluted	11.4 ml. (0.39 oz.)	22.8 ml. (0.77 oz.)	45.6 ml. (1.54 oz.)
Amount of Undiluted spray mixture to use per Linear Mile = 136 ml. or 4.62 oz.				
OR	Use 38 ml.(1.28 oz.)/A of a 1 to 9 mix	114 ml. (3.85 oz.)	228 ml. (7.71 oz.)	456 ml. (15.4 oz.)
Amount of Diluted spray mixture to use per Linear Mile = 1368 ml. or 46.26 oz.				
0.007#	Use 5.3 ml.(.18 oz.)/A Undiluted	15.9 ml. (0.53 oz.)	31.8 ml. (1.08 oz.)	63.6 ml. (2.15 oz.)
Amount of Undiluted spray mixture to use per Linear Mile = 190 ml. or 6.42 oz.				
OR	Use 53 ml.(1.3 oz.)/A of a 1 to 9 mix	159 ml. (5.37 oz.)	318 ml. (10.75 oz.)	636 ml. (21.5 oz.)
Amount of Diluted spray mixture to use per Linear Mile = 1.91 l. or 64.5 oz.				
0.1#	Use 74 ml.(2.5 oz.)/A Undiluted	222 ml. (7.5 oz.)	444 ml. (15 oz.)	888 ml. (30 oz.)
BARRIER SPRAY ONLY Amount of Undiluted spray mixture to use per Linear Mile = 2.66 l. or 90.0 oz.				

oz. = Fluid Ounces; ml. = milliliters;

l. = liter. (1 Fluid Ounce = 29.57 ml.)

\*Dilution rates other than 1 to 9;

such as: "1 to 15" or "1 to 29" may also be used.

## IMPORTANT ENVIRONMENTAL FACTORS THAT AFFECT INSECT CONTROL

Temperature & humidity fluctuations may require periodical adjustments of equipment to deliver the desired flow rate at the specified speed of travel. This flow rate must be maintained to insure the distribution of the proper amount of active ingredient per acre. Optimum control is achieved when air currents are 2 to 8 mph (3.2 to 12.9 kph). It is preferable to treat during early morning and evening when there is less breeze and convection currents are minimal. Apply 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 ULV particles throughout the area to be treated. Avoid inhalation of spray mist.

NOTICE: Buyer and user assume all risk and liability of use, storage and/or handling of this product not in accordance with the terms of this label.

Rev. 06-18-90 Apprvd. 12-24-90

# 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 OR GROUND APPLICATION

### ACTIVE INGREDIENTS:

\*† Resmethrin [5-(phenylmethyl)-3-furanyl]methyl 2,2-dimethyl-3-(2-methyl-1-propenyl)cyclopropanecarboxylate 4.14%w/w

\*\* Piperonyl Butoxide Technical 12.42%

INERT INGREDIENTS‡: 83.44%  
100.00%w/w

\* Cis/trans isomers ratio max. 30% (±) and min. 70% (±) trans.

† Roussel Uclaf'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 Roussel Uclaf Corporation

EPA Reg. No. 432-716

EPA Est. No. 10370-TX-1

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.)

KEEP OUT OF REACH OF CHILDREN

CAUTION

### STATEMENT OF PRACTICAL TREATMENT

IF SWALLOWED: Call a physician or Poison Control Center. Do not induce vomiting. This product contains aromatic petroleum solvent. Aspiration may be a hazard.

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

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

SEE SIDE PANEL FOR ADDITIONAL PRECAUTIONARY STATEMENTS

ROUSSEL UCLAF 

Roussel Uclaf Corporation

95 Chestnut Ridge Road

Montvale, NJ 07645

## PRECAUTIONARY STATEMENTS Hazards to Humans & Domestic Animals

### CAUTION

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

### Environmental Hazards

This product is toxic to fish and birds. Do not apply to lakes, streams or ponds. Do not apply when weather conditions favor drift from areas treated. Do not contaminate water by cleaning of equipment or disposal of wastes.

### Physical and Chemical Hazards

Do not use, pour, spill or store near heat or open flame. Flash point minimum 170°F (76.7°C).

### DIRECTIONS FOR USE

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

### STORAGE AND DISPOSAL

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

### READ ENTIRE LABEL FOR DIRECTIONS

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

IN THE STATE OF CALIFORNIA: 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 pursuant to Section 2426 of the Health and Safety Code.

### DIRECTIONS FOR USE (cont.)

This product is to be used for control of adult mosquitoes, midges (biting and non-biting) and blackflies in 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 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.

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 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 above flies may rest. Shrubby 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 traveling at 5 mph (8 kph) or at a rate of 356 fl oz/hr (10.53 L/hr) while traveling at 10 mph (16 kph). When spraying, apply across wind direction approximately 300 ft (91.4 m) apart. Apply when winds range from 1-10 mph (1.6-16.0 kph). Repeat for effective control.

## DIRECTIONS FOR 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.

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(266.2 ml)	18.0(532.3 ml)
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)	2.5(66.6 ml)	4.5(133.1 ml)
0.00117/0.00351	0.50(15 ml)	1.50(45 ml)	3.0(90 ml)

### WARRANTY STATEMENT

Our recommendations for use of this product are based upon tests believed to be reliable. The use of this product being beyond the control of the manufacturer, no guarantee, expressed or implied, is made as to the effects of such or the results to be obtained if not used in accordance with directions or established safe practice. The buyer must assume all responsibility, including injury or damage, resulting from its misuse as such, or in combination with other materials.

### 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)

