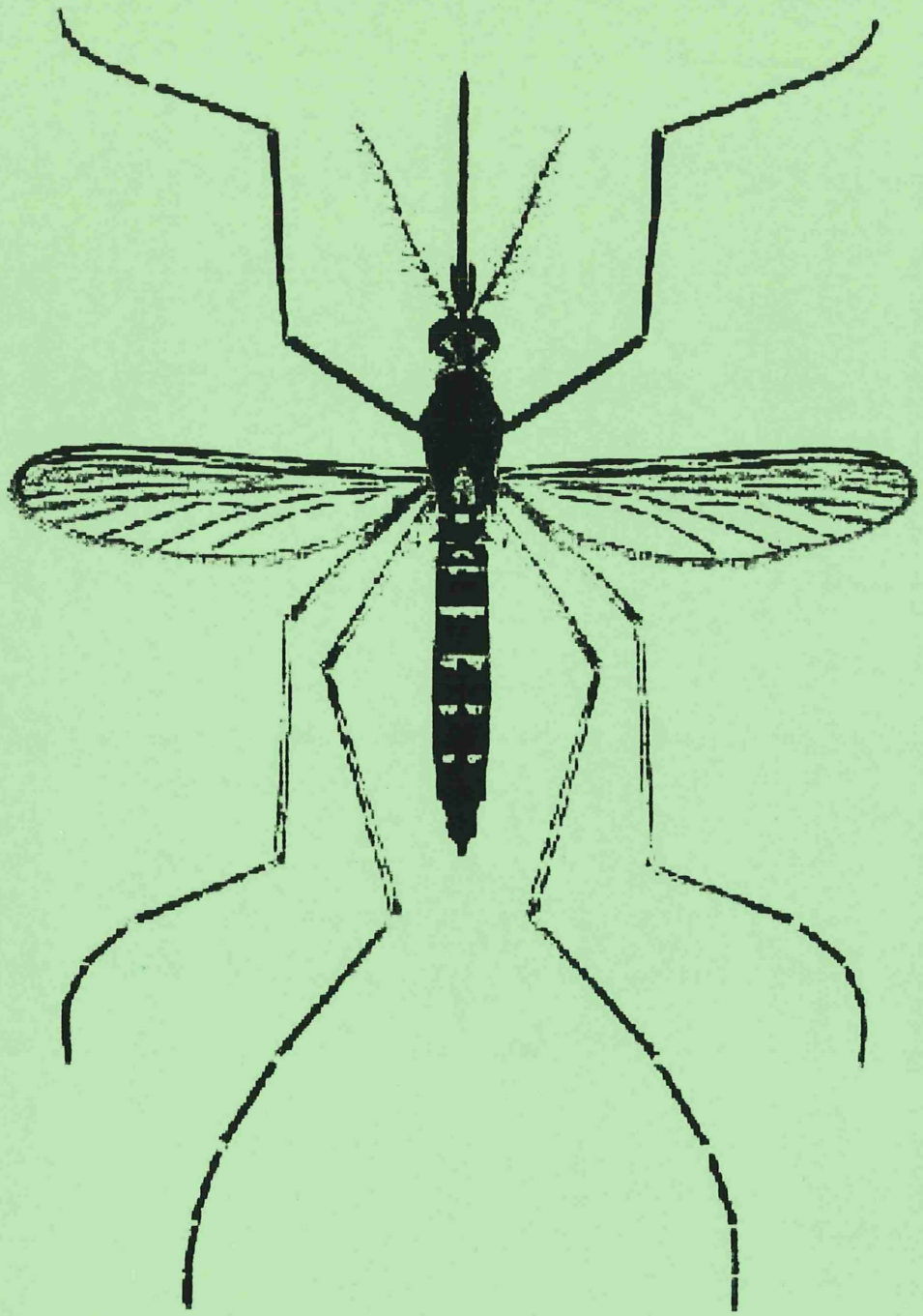
Metropolitan Mosquito Control District



2001 Operational Review and Plans for 2002

METROPOLITAN MOSQUITO CONTROL DISTRICT

MISSION

The Metropolitan Mosquito Control District's mission is to promote health and well being by protecting the public from disease and annoyance caused by mosquitoes, black flies, and ticks in an environmentally sensitive manner.

GOVERNANCE

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

METROPOLITAN MOSQUITO CONTROL COMMISSION 2001

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Myra Peterson	Washington Co.

TECHNICAL ADVISORY BOARD

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

TAB MEMBERS 2001-2002

Danny Tanner	US EPA
Greg Busacker	MnDOT
Laurence Gillette	Hennepin Parks
Steve Hennes	MPCA
Geir Friisoe	MDA
Gary Montz	MnDNR
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Karen Oberhauser	U of MN
David Neitzel, Chair	MDH
Susan Palchick	Henn. Co. Comm. Health
Robert Sherman	Independent Statistician
Terry Schreiner	USFWS

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ACKNOWLEDGMENTS

THANK YOU TO THE FOLLOWING PEOPLE WHO WROTE OR REVIEWED MAJOR PORTIONS OF THIS DOCUMENT: MIKE MCLEAN, SANDRA BROGREN, JANET JARNEFELD, KIRK JOHNSON, NANCY READ, KEN SIMMONS, MARK SMITH, AND JOHN WALZ.

JUNE 2002

FIRST DRAFT, MARCH 2002
FIRST REVISION, APRIL 2002
FINAL, JUNE 2002

METROPOLITAN MOSQUITO CONTROL DISTRICT
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JOSEPH F. SANZONE, BCE
Director

W.J. CAESAR
Business Admin.

Dear Reader:

The following report is the Metropolitan Mosquito Control District's (MMCD) 2001 Operational Review and Plans for 2002. It outlines program operations based on the policies set forth by the Metropolitan Mosquito Control Commission, MMCD's governing board of elected county commissioners.

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

TAB's recommendations and report were accepted by the Commission at their April 2002 meeting. The Commission approved the MMCD 2001 Operational Review and Plans for 2002 and thanked the TAB for their work.

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

Sincerely,

Joseph F. Sanzone
Director

MINNESOTA MDH DEPARTMENT OF HEALTH

Protecting, maintaining and improving the health of all Minnesotans

April 2, 2002

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

Dear Commissioner Bohnsack:

The Technical Advisory Board (TAB) met on January 25, 2002 to discuss MMCD operations in 2001 and plans for 2002. As you know, the TAB was originally formed to provide annual independent review of field control programs and to enhance inter-agency cooperation. During the recent meeting, there was much discussion of West Nile virus and other mosquito-transmitted disease. After an excellent interchange of questions and information between the TAB and MMCD staff (see attached meeting minutes), the TAB approved the following six motions.

1. We commend the District for its efforts to get objective measures of impacts and ways to improve programs.

2. We recommend that the District explore the historical record and consider what efforts are needed to reactivate the Minnesota Arbovirus Surveillance Committee.
   Note: The intention is to coordinate with MDH and other agencies such as UM, MDA, USFW, State Climatologist, US Army.

3. We commend the MMCD for acting professionally and responsibly and trying to adapt its program appropriately to changing conditions.

4. We recommend that MMCD continue its review of the literature on adulticide non-target effects.

5. We urge the MMCD to choose at least one important non-target species and pursue field studies in 2002 to evaluate potential effects of its resmethrin applications.
   Note: TAB would like to see results of a field study on an insect of some sort by this time next year.

6. We recommend that MMCD continue to try to refine how it presents data on mosquito surveillance and control to make it easier to compare among years and within a season.

Thank you for the opportunity to review the MMCD program.

Sincerely,

David F. Neitzel, M.S.,
Chair, Technical Advisory Board
Epidemiologist
Foodborne, Vectorborne and Zoonotic Disease Unit
Acute Disease Investigation and Control Section
Infectious Disease Epidemiology, Prevention and Control Division
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DFN:dd

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Executive Summary

The 2001 mosquito season was one of extremes. April was the wettest on record, with flooding from snow melt and two major rainfall events, each with 2-4 inches of rain. The remainder of the season was very dry.

Surveillance for *Ochlerotatus triseriatus*, the vector of La Crosse encephalitis, began in mid-May and continued into early October. The *Oc. triseriatus* population peak occurred near the end of June and declined thereafter, although small areas of local abundance were detected into September. Two cases of La Crosse encephalitis occurred in the District in 2001, both in Hennepin County, one in July and one in September. MMCD also responded to five other cases outside of but adjacent to the District boundaries.

The first ever seroconversion of a sentinel chicken for Western Equine Encephalitis (WEE) occurred in September in western Hennepin County. Populations of *Culex tarsalis,* the vector of WEE, peaked in mid-July but remained at relatively low levels throughout the season. *Culex tarsalis* was not detected by surveillance near the sentinel flock during the time period when the WEE-seropositive chicken was exposed, suggesting that the risk of humans contracting WEE was low.

The first Eastern Equine Encephalitis (EEE) case ever recorded in Minnesota occurred in August and was detected after a Blue Earth County horse died. Two additional Minnesota cases were identified in mid-September including one in Anoka County. These were apparently part of a larger outbreak of EEE centered in northwestern Wisconsin. Both larval and adult *Culiseta melanura*, a primary vector of EEE, were recovered within five miles of the Anoka case site. This species is rarely captured in the District.

MMCD assisted the Minnesota Department of Health (MDH) in surveillance for West Nile Virus (WNV). The virus was not identified in Minnesota in 2001. The virus has been detected in 28 states including Wisconsin and Iowa. Dead birds have proven to be the most sensitive indicator of WNV presence in an area. District employees were instructed to collect freshly dead birds (no visible decay, usually within 24 hours of death), especially crows, for submission to MDH for viral analysis. MMCD also responded to citizens reporting dead birds on their property. MMCD reported 18 dead birds to MDH, of which seven were submitted for analysis.

Staff continued to monitor potential changes in *Ixodes scapularis* distribution within the District and also participated in cooperative research projects with the University of Minnesota and the Department of Military Affairs. In addition, MMCD developed a radio public service announcement (PSA) on tick-borne disease prevention featuring Doug Woog, former University of Minnesota hockey coach and former Lyme disease patient. We announced the PSA by putting together a media kit and sending it to all Twin Cities and out state radio stations in areas considered at risk for Lyme disease. While we did not have the resources to track the use of this PSA, anecdotal evidence indicated that the message was played regularly on at least one major Twin Cities radio station (KSTP-AM). The message continues to be available through our web site (www.mmcd.org) to

anyone wishing to download it.

The extremely wet conditions in April and May along with a rapid temperature increase in early May accelerated larval mosquito development so that large numbers of adults appeared about two weeks earlier than usual. There were three large broods, one each in late April, mid-May and early June. Over 41,000 acres were treated with *Bti* between April 23 and May 5. During this two-week period over one third of the yearly total of larvicide treatments was applied. The majority of adulticide treatments were applied in May and June.

In 2001, the amount of liquid *Bti* applied for larval black fly control was similar to 1998 and 1999 and much greater than 2000. The average number of adult black flies as estimated by adult sampling was slightly below the average number collected since the large river control program began in 1991.

In August, adult mosquito treatments were monitored in a variety of conditions using several different types of GPS devices to evaluate which of these devices could be used to improve adult treatment records at what cost. All of the devices examined were reliable and accurate enough for recording cold fog treatments. Inexpensive GPS units produced variable results when used to record hand (backpack) and ATV applications potentially limiting their use in monitoring these types of treatments. Inexpensive GPS units have been more useful for recording larval or adult sampling locations.

Vector Surveillance and Control

Chapter Highlights: Mosquito Vectors

2001 Results/Plans for 2002

La Crosse Encephalitis (LAC)

- Two cases of LAC occurred in the District in 2001. MMCD responded to five other cases outside the District.
- 16,278 tires were collected and processed in 2001.
- An additional 6,000 tires were removed from an auto salvage yard in St. Paul Park in a cooperative effort with Washington County Dept. of Public Health and Environment and MPCA.

For 2002

- Increase *Ochlerotatus triseriatus* surveillance in rural portions of the District near recent LAC cases.
- Foster La Crosse encephalitis prevention efforts in counties bordering the District.

Western Equine Encephalitis (WEE)

- The *Culex tarsalis* population peaked early in 2001 but remained at relatively low levels.
- One sentinel chicken in Hennepin County was infected with the WEE virus in early September.

For 2002

- Continue to monitor three sentinel chicken flocks and *Culex tarsalis* populations.

Eastern Equine Encephalitis (EEE)

- EEE was confirmed in a horse boarded at an Anoka County farm and in horses in two other Minnesota counties.

For 2002

- Develop and implement surveillance strategies for *Culiseta melanura*, the enzootic vector.

West Nile Virus (WNV)

- MMCD assisted MDH in surveillance for WNV. The virus was not identified in Minnesota in 2001.

For 2002

- Supplement WNV surveillance in Minnesota by providing MDH with mosquito and dead bird samples for viral analysis.
- Develop and implement surveillance strategies for vectors of WNV.
- Refine plans for response to detections of WNV in Minnesota.

Species Introductions

- There were no exotic mosquito species detected in the District in 2001.

For 2002

- Continue surveillance at and around Greenman Technologies and other sites where *Aedes albopictus* has been detected.

Vector Surveillance and Control

Chapter Highlights: Tick Vectors

Ixodes scapularis Distribution

The District continued to sample the network of 100 sites set up in 1991-1992 to monitor potential changes in tick distribution over time, but results are not yet available. In results from 2000, total *I. scapularis* collections and the total number of sites where at least one *I. scapularis* was found were the highest since the inception of this study in 1990.

Cooperative Studies

- **Metro-wide serology effort** To collect comparative data with past efforts, samples were again drawn from small mammals (primarily *Peromyscus leucopus*, the white-footed mouse) collected for our *I. scapularis* distribution study and delivered to Dr. Russell Johnson (UM-Mpls) to determine whether exposure to either the HGE agent or *B. burgdorferi* had occurred. Results are not yet available.
- **Re-sampling Ramsey County** Several study sites in North Oaks were re-sampled approximately monthly from July - September, 2001 to collect additional comparative information. Results are not yet available.
- **Metro vs. Little Falls (continuation)** Results of tick load comparisons between the Little Falls and metro area samples and between 2000 and 2001 are underway, and the small mammal HGE agent and *B. burgdorferi* testing is in progress. Questing nymphs that had been collected in the dragging effort in 2000 and 2001 will also be tested in an attempt to determine the specific host that each larva had fed on.

Tick Identification Services/Outreach

The Public Affairs Department developed a radio public service announcement on tick-borne disease prevention featuring Doug Woog, former University of Minnesota hockey coach and former Lyme disease patient.

Chapter 1 Vector Surveillance and Control

Background

District staff provide a variety of disease surveillance and control services, including public education, to reduce the risk of the mosquito-borne illnesses: La Crosse encephalitis, Western Equine encephalitis, Eastern Equine encephalitis, and West Nile encephalitis and the tick-borne illnesses: Lyme disease and ehrlichiosis. Past District efforts have also included determining metro-area risk for infections of Jamestown Canyon virus, babesiosis, Rocky Mountain spotted fever, and Sin Nombre virus (a hantavirus).

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

Sentinel chicken flocks are utilized by MMCD to detect enzootic transmission of Western Equine encephalitis virus. Flocks are located at three sites in the District and blood is sampled on a weekly basis for submission to MDH for antibody analysis. MMCD uses various surveillance methods to monitor populations of the vector mosquito *Culex tarsalis*.

Eastern Equine encephalitis was detected for the first time in Minnesota in 2001. MMCD is developing a surveillance plan for the enzootic vector, *Culiseta melanura*, to be initiated in 2002. MMCD is also developing surveillance and response plans in anticipation of an introduction of West Nile virus. Since its detection in New York City in 1999, West Nile virus has been detected in most states east of the Mississippi River as well as in Iowa, Missouri, Arkansas, and Louisiana. The virus is expected to spread throughout North America.

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

MMCD initiated tick surveillance to determine the range and abundance of the black-legged tick (*Ixodes scapularis*, also known as the deer tick) and the Lyme disease spirochete, *Borrelia burgdorferi* within the District. To date, MMCD has mapped the current distribution of black-legged ticks (545 total sites sampled) and continues to monitor their populations in the metropolitan area, as well as undertaking cooperative spirochete and ehrlichiosis studies with the University of Minnesota. All data collected are summarized and given to the MDH for risk analysis. Because no ecologically or economically wide-scale tick control measures exist to date, tick control is limited to

public education activities which emphasize tick-borne disease awareness and prevention. District staff continue to provide tick identifications upon request and are used as a tick referral resource by agencies such as the MDH and the Minnesota Department of Natural Resources (MNDNR).

2001 Mosquito-borne Disease Services

La Crosse Encephalitis

- ***Ochlerotatus triseriatus* Surveillance and Control** Intensive surveillance of adult *Oc. triseriatus* populations continued in 2001 throughout the District with efforts concentrated in areas at greater risk of La Crosse virus transmission. To monitor adult *Oc. triseriatus* populations and to direct adult and larval control efforts, mosquitoes resting in wooded areas are sampled by aspirator.

  In 2001, MMCD staff made 2,155 aspirator collections, of which 473 samples exceeded the threshold for *Oc. triseriatus* set by the District. Inspections were provided as a follow-up service in most of the wooded areas with above threshold samples. Additionally, staff made 311 adulticide treatments when *Oc. triseriatus* samples exceeded threshold. Adult *Oc. triseriatus* were captured in 567 of 1,222 individual wooded areas sampled. This ratio is similar to those from recent years (Table 1.1).

Table 1.1 Individual wooded areas sampled by aspirator and the number of those with *Oc. triseriatus* captured 1996 - 2001. Data from 1997 are incomplete and have been excluded from comparison.

Year	Total Wooded Areas Surveyed	Total Wooded Areas Where *Oc. triseriatus* Were Captured	Percent of Wooded Areas Where *Oc. triseriatus* Were Captured
1996	476	238	50.0%
1998	713	343	48.1%
1999	895	397	44.4%
2000	1037	575	55.4%
2001	1222	567	46.4%

Surveillance for *Oc. triseriatus* adults was initiated during the week of May 14 with the first aspirator captures occurring during the week of May 28. Early season rainfall and above normal temperatures allowed *Oc. triseriatus* populations to peak during the week of June 25 (Figure 1.1). Typically, the seasonal population peak occurs in July or August. Hot, dry conditions during the months of July and August in 2001 may have limited *Oc. triseriatus* population growth at that time. There was a moderate increase observed in the adult population during the first two weeks of August.

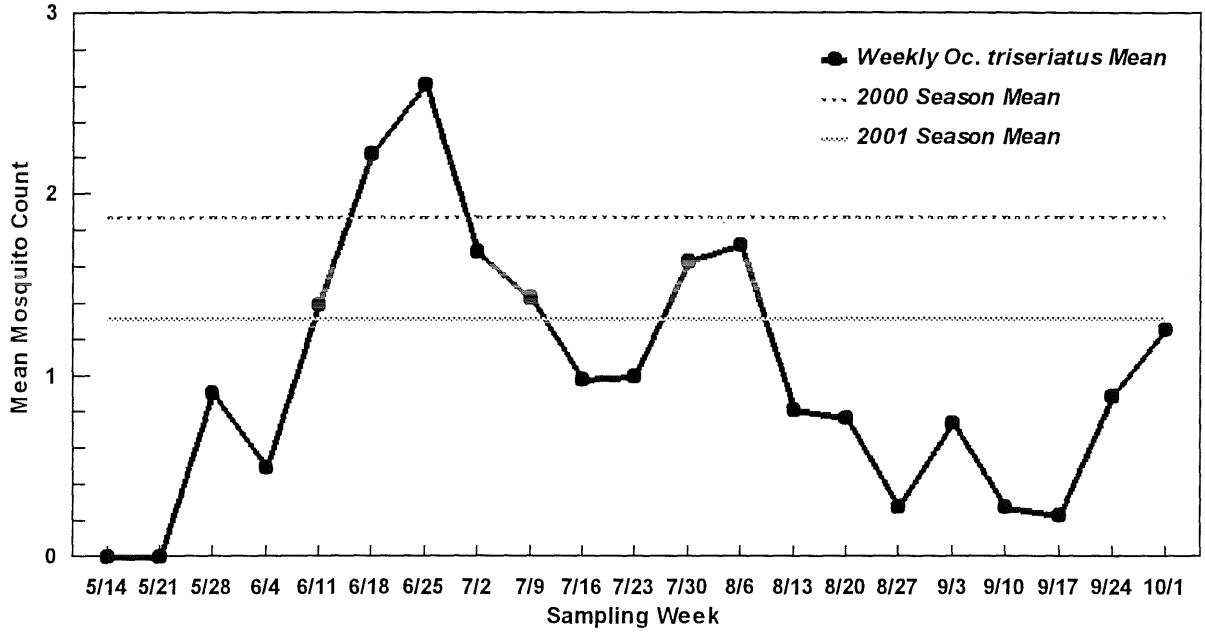


Figure 1.1 Mean number of *Oc. triseriatus* adults in aspirator samples, plotted by week. Dates listed are the first sampling day of each week. Sites sampled each week vary, although many sites were sampled repeatedly during the season.

In 2001, MMCD recycled 16,278 tires which were removed from the field by staff. Since 1988 the District has recycled 373,421 tires. Carver County and Dakota County continued to assist MMCD's tire recycling efforts in 2001. Additionally, MMCD assisted Washington County in a second remediation effort at a tire dump site in the community of St. Paul Park. In 2001 the weight equivalent of 6,000 waste tires was removed from the site bringing the total number of tires removed from the dump to over 12,000 since November of 2000.

During routine surveillance and in response to La Crosse encephalitis cases, MMCD completed 4,911 property inspections including inspections of 593 individual wooded areas. In addition to the tires removed, these inspections resulted in the filling of 2,880 tree holes and the elimination of 4,043 artificial container breeding sources.

As in past years, MMCD staff distributed La Crosse encephalitis prevention brochures door to door to residents in identified risk areas. MMCD also distributed brochures at public functions such as county fairs and the Minnesota State Fair. The goals of these forms of information were to educate the public on La Crosse encephalitis and to stress personal protection by eliminating sources of *Oc. triseriatus* larval habitat around an individual's home.

- **La Crosse Encephalitis Case Responses** Twelve probable or confirmed cases of La Crosse encephalitis were reported to MDH in 2001. MMCD responded to seven of these cases (Table 1.2) in and near the District with adult *Oc. triseriatus* surveillance and control, breeding

source elimination, and public education efforts. Two of the La Crosse encephalitis cases occurred within the District, both in Hennepin County residents. MMCD responded to five La Crosse encephalitis cases immediately outside of the District– 2 cases occurred in western Carver County and Le Sueur, Rice, and Wright counties each had one case.

Possible La Crosse virus exposure locations are identified through interviews with the patient and/or the parents or other family members of the patient. Because the incubation period for the La Crosse virus ranges from 5 to 15 days, MMCD considers inspecting areas visited by the patient up to one month prior to the onset of symptoms of the illness.

Table 1.2 La Crosse encephalitis cases investigated by MMCD in 2001. Possible exposure locations in bold type lie within the District.

MMCD Case #	Age Gender	County of Residence	Date of Onset of Symptoms	Date Reported to MMCD	Date of Initial Response	Possible Exposure Areas
A01	18 Months Male	Carver	June 18	June 25	June 26	Neighborhood of Residence Neighborhood of Daycare
B01	7 Years Female	Rice	Aug. 2	Aug. 15	Aug. 16	Neighborhood of Residence Neighborhood of Daycare **Grandparent's Farmstead** **Cliff Fen Park**
C01	7 Years Male	Carver	Sept. 4	Sept. 10	Sept. 11	Family Farmstead Wooded Area Near Daycare
D01	12 Years Male	Le Sueur	Sept. 9	Sept. 17	Sept. 18	Family Farmstead Pepin Lake Access
E01	7 Years Male	Hennepin	July 20	Sept. 25	Sept. 27	**Neighborhood of Residence** **Baker Park Reserve**
F01	5 Years Male	Wright	Sept. 20	Sept. 27	Oct. 2	Neighborhood of Residence
G01	13 Years Male	Hennepin	Sept. 7	Sept. 27	Sept. 28	**Neighborhood of Residence** **Grandparent's Residence**

Results of the inspections conducted in response to the seven La Crosse encephalitis cases investigated by MMCD are summarized in Table 1.3 and Table 1.4. Larval samples were collected from breeding sources found in the areas investigated. Mosquito larvae were reared to adults in the MMCD laboratory. Forty pools of adult or larval *Oc. triseriatus* were submitted to MDH for viral analysis. La Crosse virus was detected in one sample collected from Watertown in response to La Crosse encephalitis case A01. The sample was collected from tires located on a property adjoining the infected child's home property.

Table 1.3 Breeding sources removed from properties inspected in response to seven La Crosse encephalitis cases in and near MMCD during 2001. Locations in bold type are in the District.

MMCD Case # and Inspection Area	County	Properties Inspected	Tires Removed	Containers Eliminated	Treeholes filled
A01 Residence	Carver	34	4	35	2
A01 Daycare	Carver	21	14	8	0
B01 Residence	Rice	6	11	4	0
B01 Daycare	Le Sueur	4	1	0	0
B01 Grandparent's Farm	Scott	1	1	5	0
B01 Cliff Fen Park Area	Dakota	23	37	29	14
C01 Residence	Carver	1	9	9	0
C01 Daycare	Carver	1	0	2	0
D01 Residence	Le Sueur	1	5	5	0
D01 Pepin Lake	Le Sueur	2	6	0	0
E01 Residence	Hennepin	106	1	6	0
E01 Baker Park Reserve Area	Hennepin	44	4	122	311
F01 Residence	Wright	86	5	15	2
G01 Residence	Hennepin	9	2	7	0
G01 Grandparent's Residence	Hennepin	55	115	38	0

Table 1.4 Adult and larval mosquito samples collected from possible La Crosse virus exposure areas for seven La Crosse encephalitis cases in and near MMCD during 2001. Locations in bold type lie within the District.

MMCD Case # Location	Aspirator Samples Collected	Aspirator Samples with *Oc. triseriatus*	Live Larval/Egg Samples Collected (All Species)	*Oc. triseriatus* Pools to MDH for Viral Analysis
A01 Residence	3	3	11	18 (1 LAC+)
A01 Daycare	2	2	9	7
B01 Residence	2	2	4	6
B01 Daycare	1	0	1	1
B01 Grandparent's Farm	1	1	2	1
B01 Cliff Fen Park Area	13	7	0	0
C01 Residence	3	0	2	1
C01 Daycare	1	0	1	1
D01 Residence	0	0	1	0
D01 Pepin Lake	3	1	1	1
E01 Residence	0	0	1	0
E01 Baker Park Reserve Area	4	0	2	0
F01 Residence	4	2	7	4
G01 Residence	0	0	0	0
G01 Grandparent's Residence	2	2	0	0

Western Equine Encephalitis

- ***Culex tarsalis* and Western Equine Encephalitis (WEE) Surveillance** Midwestern climate conditions during the first half of 2001 were ideal for the mosquito vector of WEE, *Culex tarsalis*. There was extensive spring flooding due to a heavy winter snow pack and heavy spring rain. This coupled with warm temperatures in May created a breeding environment which allowed the *Cx. tarsalis* population to increase earlier than usual.

  The District's CO_2 trap captures of *Cx. tarsalis* (Figure 1.2) reflected either a waning adult population or a decline in feeding behavior indicated by a reduction in the rate of capture beginning in late July when we began to experience hot weather. Typically, the peak CO_2 trap capture rate of *Cx. tarsalis* occurs during the first or second week of August in the District. This occurred on the July 16 sampling night in 2001.

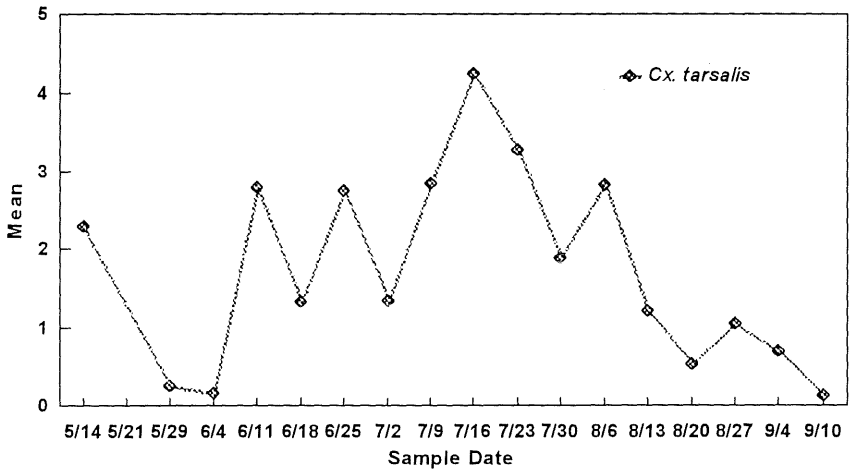


Figure 1.2 Mean number of *Cx. tarsalis* per sample date in CO_2 trap collections from May -September, 2001. Data are from MMCD Monday night surveillance network.

Sentinal Flocks Blood samples were again collected each week from sentinel chicken flocks in Anoka County, Hennepin County, and Scott County to monitor for WEE virus activity. MMCD submitted 1,166 blood samples to the MDH for analysis. MDH detected antibodies to WEE virus from a Hennepin County chicken blood sample collected September 5, 2001. MMCD was notified on September 13, 2001, four working days after submission of the sample. This was the first detection of WEE antibodies from MMCD's sentinel chicken surveillance program since its inception in the mid 1980's. Subsequent CO_2 trap and CDC gravid trap surveillance failed to capture a single *Cx. tarsalis* specimen in the vicinity of the Hennepin County flock. District mosquito populations had declined substantially prior to mid-September. Through a press-release, the District informed the public residing in western Hennepin County that WEE was detected in the area, but risk of WEE infection was low due to the decline in mosquito activity.

Eastern Equine Encephalitis

- ***Culiseta melanura* and Eastern Equine Encephalitis (EEE)** EEE was confirmed in three Minnesota horses in 2001 including a horse boarded in Linwood Township in Anoka County. The other cases were identified in Blue Earth and Kanebec counties. In addition, an EEE outbreak occurred over a large portion of northwestern Wisconsin with 27 equine cases confirmed. An isolated equine case was confirmed in northeastern Iowa, as well. MMCD conducted adult and larval mosquito surveillance in Anoka County and assisted MDH with the same in Blue Earth and Kanabec counties. MMCD and MDH provided mosquito surveillance for the Wisconsin Division of Health, as well, at several Wisconsin locations. In each area investigated, adult mosquitoes were sampled by aspirator and CO_2 traps. In addition, a gravid trap was used at the Blue Earth County site. Wetlands and artificial containers were inspected for mosquito larvae. Adult mosquito samples were pooled by species and submitted to MDH for viral analysis. The EEE virus was not identified

in mosquito samples from any of the locations investigated.

Of particular importance for EEE transmission is *Cs. melanura*, a mosquito species considered rare in the District. The species is the primary vector of the EEE virus and is responsible for the perpetuation of the virus along with several species of passerine birds. *Culiseta melanura* adults were collected in all but the Blue Earth County location. *Culiseta melanura* larvae were collected near the Anoka County and Kanabec County locations. The *Cs. melanura* larvae collected in Anoka County are the first on record from within the District.

West Nile Virus

West Nile Virus (WNV) West Nile virus, an old world virus, was first identified in North America late in the summer of 1999 in New York City during an epidemic of human West Nile encephalitis. The natural cycle of the virus is maintained by several avian host species and several mosquito vector species. Sporadic human illnesses and human epidemics do occur, however, as do cases of equine illness. Also, since 1999, WNV has been responsible for substantial bird deaths in the United States and Canada. The virus has been particularly lethal to American crows (*Corvus brachyrhyncos*).

WNV has been detected in 28 states since 1999 (Figure 1.3). The virus was detected in 27 states in 2001. There were two areas of intense transmission, one in the northeast states, the other in northern Florida and southern Georgia.

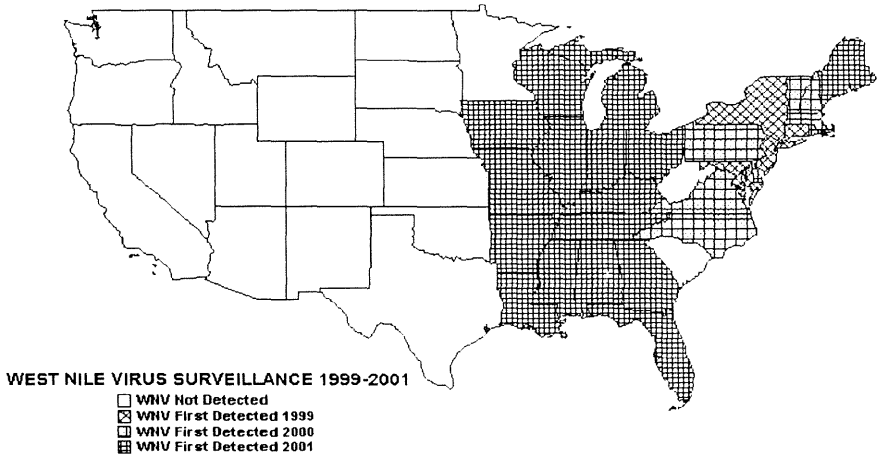


Figure 1.3 West Nile Virus detections 1999 through 2001. Detections include one or more positive results in either humans, horses, birds, or mosquitoes.

There were 66 human cases of West Nile encephalitis reported in the United States, nine of which resulted in or contributed to the death of the patient. In addition, WNV caused illness in 731 horses in 2001. One human WNV infection was reported in the Cayman Islands, and 122 WNV infected birds were collected in an area in Ontario extending from Windsor to Toronto.

Dead Bird Surveillance Dead birds have proven to be the most sensitive indicator of WNV presence in an area. In 2001, MMCD responded to calls from citizens reporting dead birds on their property and employees noted dead birds found while conducting mosquito control activities. MMCD reported 18 dead birds to MDH. Seven birds were submitted for WNV analysis, however, the virus was not detected.

Possible Vectors Several *Culex* species have been implicated as enzootic vectors of WNV. Because they posses the capacity to transmit WNV and prefer to take blood meals from birds, *Cx. pipiens*, *Cx. restuans*, and *Cx. salinarius* have been identified as likely maintenance vectors in many of the states having detected WNV thus far. In addition, *Cx. tarsalis* has been identified as a capable vector of WNV in laboratory studies. *Culex tarsalis* also feeds primarily upon birds and is likely to have some involvement in maintenance of the WNV cycle in areas where the species is found. An added concern is that *Cx. salinarius* and *Cx. tarsalis* may be involved in transmission of WNV to humans and other mammals as neither species is strictly ornithophyllic and both will seek mammalian hosts.

***Culex* sampling** The District's Monday night CO_2 trap surveillance network is one method used to monitor fluctuation in *Culex* populations. Figure 1.4 shows the seasonal distribution of adult *Culex* species from mid-May to mid-September.

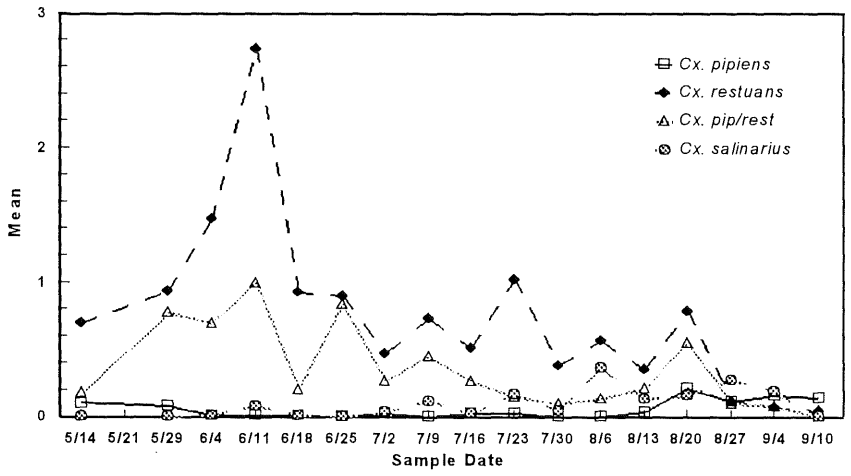


Figure 1.4 2001 mean CO_2 trap captures of selected *Culex* species per sample date. Data are from MMCD Monday night surveillance network. The *Cx. pip/rest* category is used when the two species are indistinguishable.

Gravid Traps The CDC gravid trap has been an effective tool for capturing WNV infected adult mosquitoes in many parts of the country and was used by MMCD in 2000 and 2001. The trap uses fermenting vegetation (i.e. infusion) to attract ovipositing female mosquitoes. The infusion material is placed in the pan and the battery is connected to turn the trap on. Ovipositing females are sucked into the collection bag when they come in close proximity to the fan. The trap was designed to capture *Cx. pipiens*, but it will also capture several other species of interest for WNV study.

In 2001, modifications were made to MMCD's gravid trap placement procedure and to the infusion used to attract mosquitoes to the trap resulting in increased capture rates. Gravid traps ran for 48 hours each week at ten locations. Captures of selected *Culex* species are represented in Figure 1.5. *Aedes vexans* and *Cq. perturbans* were captured frequently, also. Two pools of mosquitoes collected by gravid trap were submitted to MDH for WNV analysis. WNV was not isolated from any sample collected in Minnesota in 2001.

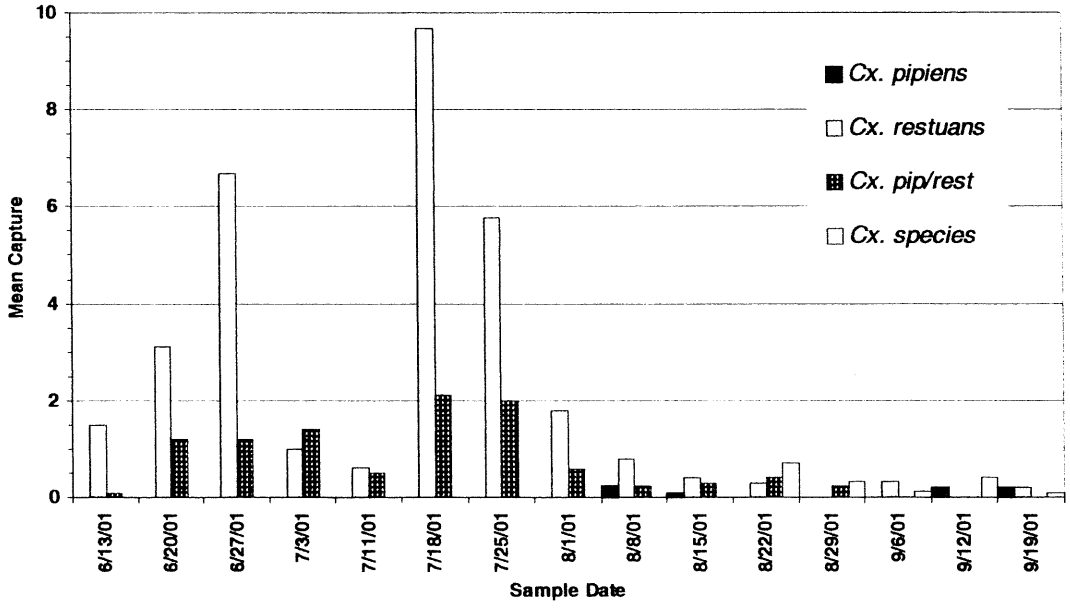


Figure 1.5 Gravid trap capture rates of *Culex* species.

***Culex* breeding site characterization** The specific habitat requirements of *Culex* species within the District are not well known. Discovery of physical or chemical factors of preferred breeding sites for vectors of WNV is essential to the development and implementation of larval control strategies designed to limit WNV transmission. In 2001, a sampling regime was designed to determine the extent of localized production for each *Culex* species and identify physical characteristics of breeding sources which may be associated with a particular species. Because of staffing limitations we chose to evaluate one physical characteristic, water temperature.

From June through August of 2001, staff conducted *Culex* larval surveillance at the neighborhood level in three communities: Roseville, Eagan, and Sand Creek Township of Scott County. Thirty-three wetland sites and 135 artificial mosquito breeding sources were visited once each week. Additionally, 64 artificial breeding sources were visited for part of the summer until they were either removed by property owners or physically altered so as to no longer contain water. Water temperature was recorded for each wetland and each container at the time of sampling. Staff made species level identifications of larvae from each breeding source, when possible.

Observations made during the course of this survey support the need to better understand the potential of a breeding site to adequately support the larvae of various *Culex* species. Of twelve wetlands in the study group which remained wet during the entire study period (Table 1.5), six produced multiple *Culex* species which were collected at each site on multiple occasions. Another five of the sites produced *Cx. territans* with regularity, but did not produce other *Culex* species regularly. The remaining site produced only *Cx. restuans* on one occasion. In 2002, staff will continue to investigate factors which determine a wetland's potential to serve as larval habitat for particular *Culex* species.

Table 1.5 Number of occurrences of species of *Culex* in each site sampled. N=number of times a site was surveyed.

Culex	Site 1 N=11	Site 2 N=11	Site 3 N=13	Site 4 N=11	Site 5 N=12	Site 6 N=13	Site 7 N=13	Site 8 N=13	Site 9 N=13	Site 10 N=12	Site 11 N=13	Site 12 N=12
pipiens	1	—	—	—	3	7	4	2	9	—	—	—
restuans	2	—	—	—	2	8	2	4	12	—	—	1
tarsalis	6	—	—	—	3	7	7	1	9	—	1	—
territans	10	3	3	3	6	5	8	8	6	5	6	—
salinarius	—	—	—	—	2	2	—	—	1	—	1	—

There was little difference in either the temperature ranges in which each species was found or the median temperatures at which each species was found for wetlands and for containers. Also, wetlands which had no larvae present at the time of surveillance had a temperature range and median that did not differ from those for wetlands with mosquitoes present. However, mean water temperatures in containers with no larvae present were significantly higher than mean water temperatures of containers with mosquito larvae present (t-test, $p<0.001$).

Plans for 2002

- Increase *Oc. triseriatus* surveillance in rural portions of the District near recent LAC cases.
- Foster La Crosse encephalitis prevention efforts in counties bordering the District.
- Support WNV surveillance in Minnesota by providing MDH with mosquito and dead bird samples for viral analysis.
- Continue to monitor three sentinel chicken flocks and *Cx. tarsalis* populations.
- Develop and implement a surveillance strategy for *Cs. melanura*, the vector of eastern equine encephalitis.
- Supplement WNV surveillance in Minnesota by providing MDH with mosquito and dead bird samples for viral analysis.
- Develop and implement surveillance strategies for vectors of WNV.
- Refine plans for response to detections of WNV in Minnesota.
- Continue surveillance at and around Greenman Technologies and other sites where *Ae. albopictus* has been detected.

Tick-borne Disease

Ixodes scapularis Distribution

The District continued to sample the network of 100 sites set up in 1991-1992 to monitor potential changes in tick distribution over time. As in previous years, the primary sampling method involved capturing small mammals from each site and removing any attached ticks from them. Collections from the northeastern metropolitan area (primarily Anoka and Washington counties) have consistently detected *I. scapularis* populations, and in 1998 *I. scapularis* was detected in Hennepin and Scott counties for the first time using this study methodology. *Ixodes scapularis* was re-detected at the Hennepin County location in 2000. Total *I. scapularis* collections and the total number of sites where at least one *I. scapularis* was found for 2000 were the highest since the inception of this study in 1990. Surveillance continued in 2001 but results are not yet available.

Cooperative Studies

Human granulocytic ehrlichiosis (HGE) agent & *Borrelia burgdorferi*

Collaborators: MMCD, Dr. Russell Johnson (University of Minnesota-Mpls), Marty Skoglund and Jay Brezinka (Dept of Military Affairs, Little Falls, MN).

Cooperative studies regarding the distribution and prevalence of *B. burgdorferi* (causal agent of Lyme disease) and the human granulocytic ehrlichiosis (HGE) agent continued in 2001. Research consisted of a metro-wide serology collection, re-sampling in North Oaks (Ramsey County), and a continuation of a metro (Arden Hills) versus greater Minnesota (Little Falls; near Brainerd) comparative study.

- **Metro-wide serology effort. District/UM-Mpls.** Samples were taken from small mammals (primarily *Peromyscus leucopus*, the white-footed mouse) collected for the District's *I. scapularis* distribution study and delivered to Dr. Russell Johnson (UM-Mpls) to determine whether exposure to either the HGE agent or *B. burgdorferi* had occurred. Results are not yet available.

- **Re-sampling North Oaks (Ramsey County). District/ UM-Mpls.** Several study sites were re-sampled approximately monthly from July 9 - September 12, 2001 to collect additional comparative information. Results are not yet available.

- **Small mammal trapping and dragging for questing ticks in Little Falls and Arden Hills, Minnesota (continuation). District/ UM-Mpls./Camp Ripley** Small mammals were collected from a total of six sites (four in Little Falls and two in the metro area) approximately monthly from April 16 - October 24, 2001 for one trap night each sample period. Results are not yet available. Results of tick load comparisons between the Little Falls and metro area samples and between 2000 and 2001 will be made after all of the ticks have been removed and identified. Dragging/flagging results are also pending, and nymphs collected in the dragging effort will be tested in an attempt to determine the specific host upon which each larva had fed.

Tick Identification Services/Outreach

The overall scope of tick-borne disease education activities and services (including tick identifications) were maintained in 2001 utilizing previously described methods and tools. The Public Affairs Department developed a radio public service announcement on tick-borne disease prevention featuring Doug Woog, former University of Minnesota hockey coach and former Lyme disease patient.

Plans for 2002–Tick-borne Disease

The metro-area surveillance of the distribution of *I. scapularis* which began in 1990 will continue unchanged. A project initially slated to begin in 2001 (*Risk Assessment of the Expanding Distribution of Lyme Disease in the North - Central US, Drs Uriel Kitron, Edward Walker, and Mark Wilson)* will begin. Collaborators from throughout the Midwest will assist the co-investigators by collecting questing *I. scapularis* at several sites. The District's involvement in small mammal trapping and dragging for questing ticks in Little Falls and Arden Hills, Minnesota will be discontinued as it is believed two years of data will be adequate. Additionally the re-sampling effort in North Oaks will end. No new projects are planned for 2002.

Chapter 2: Surveillance

Surveillance

Chapter Highlights

- April was the wettest in history, with flooding from snow melt and two major rainfall events, each with 2-4 inches of rain, while the remainder of the season was very dry.
- There were three large broods of *Aedes vexans*, one each in late April, mid-May, and early June.
- Populations of the cattail mosquito (*Coquillettidia perturbans*) peaked in early July 2001, about two weeks earlier than in 1999 and 2000.

Chapter 2: Surveillance

Background

The District conducts a variety of surveillance activities to monitor mosquito populations, to identify the presence of disease vectors, to identify the need for control, and to evaluate the District's progress toward reducing mosquito levels. Rainfall information is collected from 77 gauges to help identify where mosquito production is likely. This rainfall information is also forwarded to the MnDNR State Climatology Office to supplement their network. Larval samples taken from breeding sites before treatment are identified to detect the presence and amount of human-biting mosquito species. MMCD uses sweep nets, CO_2 traps, and New Jersey light traps to monitor adult mosquitoes.

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

CO_2 traps baited with dry ice are also used to monitor mosquito population levels during the peak mosquito activity period, and to monitor the presence of disease vector mosquito species. Employees set traps in their yards on the same nights as the sweep net collections, once per week for 18 weeks.

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

Surveillance

Rainfall

Average rainfall per gauge in the District from May 1 through September 30, 2001 was 17.73 inches (Table 2.1). This is 1.40 inches below the 43-year District average. The northern and central counties received more rainfall than the southern counties.

Table 2.1 Average amount of rainfall (inches) received in each county from May through September 1997-2001 and 43-year average.

	Anoka	Carver	Dakota	Hennepin	Ramsey	Scott	Wash.	District
1997	19.21	24.01	26.27	19.52	23.21	23.49	22.34	21.33
1998	18.95	18.70	23.53	18.30	19.26	22.06	19.89	19.43
1999	22.12	20.12	22.66	22.55	22.95	22.43	21.60	22.41
2000	13.81	15.69	21.38	17.33	20.19	16.63	20.90	17.79
2001	17.40	15.38	16.23	18.98	18.94	15.01	17.78	17.73
43-Year Avg	18.81	NA	19.65	19.46	19.76	19.21	20.04	19.33

Chapter 2: Surveillance

Even though the yearly rainfall total was below average, most of the rain fell in the spring (Fig. 2.1). This created a season of extremes. April was the wettest in history, with flooding from snow melt and two major rainfall events, each with 2-4 inches of rain. There were two large broods in May and one in early June. The remainder of the season was very dry.

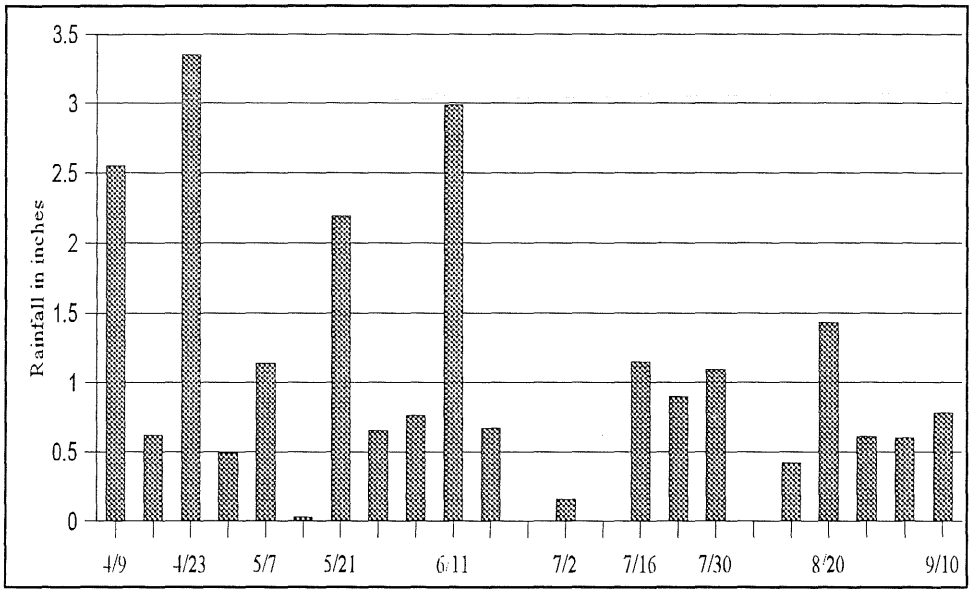


Figure 2.1 Weekly rainfall average per gauge April-September, 2001.

Larval Collections

In 2001, staff identified 12,382 larval collections (Appendix A). To accelerate the identification of samples from sites to be treated by air, larvae are identified to the genus level only, resulting in a high percentage of unidentified *Aedes/Ochlerotatus* species (44.7%). Lower priority samples are identified to species. The most abundant species District-wide were *Aedes vexans* (29.7%), *Ae. cinereus* (10.0%), *Ochlerotatus stimulans* (4.1%) and *Oc. trivittatus* (1.8%).

Adult Collections

Mosquito Abundance

- **Evening Sweep Net Collections** Summer *Aedes/Ochlerotatus* and *Cq. perturbans* were the usual predominant species in the sweep net collections (Table 2.2). Populations of *Cq. perturbans* in 2001 were the lowest in the past five years. Spring *Ae./Oc.* increased slightly due to the high amount of snow melt in the spring. Weather conditions the past 5 years have not been conducive for high levels of *Cx. tarsalis*. *Ochlerotatus triseriatus* are daytime biters and do not

fly very far from their breeding habitat, consequently, evening sweep net collections are not the best method to accurately detect this species, as indicated by the low capture counts shown in Table 2.2. The number of collections taken varied between 54-114 per night depending on the number of staff available to take sweeps.

Table 2.2 Average number of mosquitoes collected per evening sweep net collections within the District, 1997-2001.

Species	1997	1998	1999	2000	2001
Summer *Ae./Oc.*	4.0	4.2	5.6	2.4	2.6
Cq. perturbans	0.7	1.4	1.9	0.5	0.3
Spring *Ae./Oc.*	0.1	0.1	0.1	0.01	0.1
Cx. tarsalis	0.01	0.04	0.01	0.01	0.02
Oc. triseriatus	0.01	0.01	0.01	0.01	0.01

- **Evening CO_2 Trap Collections** CO_2 traps baited with dry ice are used to monitor mosquito populations and to identify presence of disease vector species. Employees set traps in their yards on the same nights as the sweep net collections, once per week for 18 weeks. The District operated 92 traps in 2001. The summer species of mosquitoes were dominant in the trap collections (Table 2.3). The number of spring *Ae./Oc.* collected in CO_2 traps was the highest in the past five years.

Table 2.3 Average number of mosquitoes collected per night in CO_2 trap collections within the District, 1997-2001.

Species	1997	1998	1999	2000	2001
Summer *Ae./Oc.*	182.7	138.2	327.9	245.0	253.0
Cq. perturbans	30.9	31.9	45.6	34.6	35.2
Spring *Ae./Oc.*	2.4	0.9	1.9	0.3	7.7
Cx. tarsalis	0.7	0.4	0.6	1.3	1.6
Oc. triseriatus	0.5	0.2	0.3	0.3	0.3

Seasonal Distribution Evening sweep net and CO_2 trap collections showed that the seasonal peak of mosquito activity was on the first collection date, May 14 (Figure 2.2, Figure.2.3). These mosquitoes resulted from the unusually large rainfall events in April and May. The second half of the season was relatively dry and the mosquito populations lower.

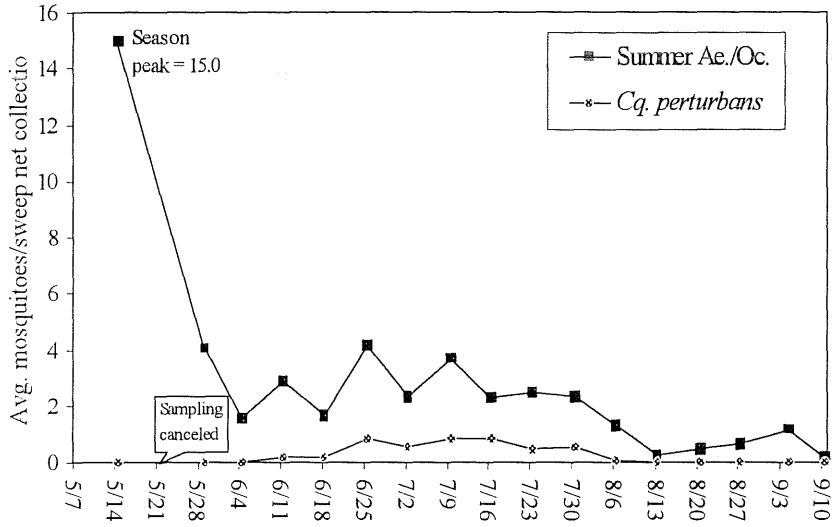


Figure 2.2 Average number of summer *Ae./Oc.* and *Cq. perturbans* per evening sweep, 2001. (Sampling canceled on 5/21 due to bad weather.)

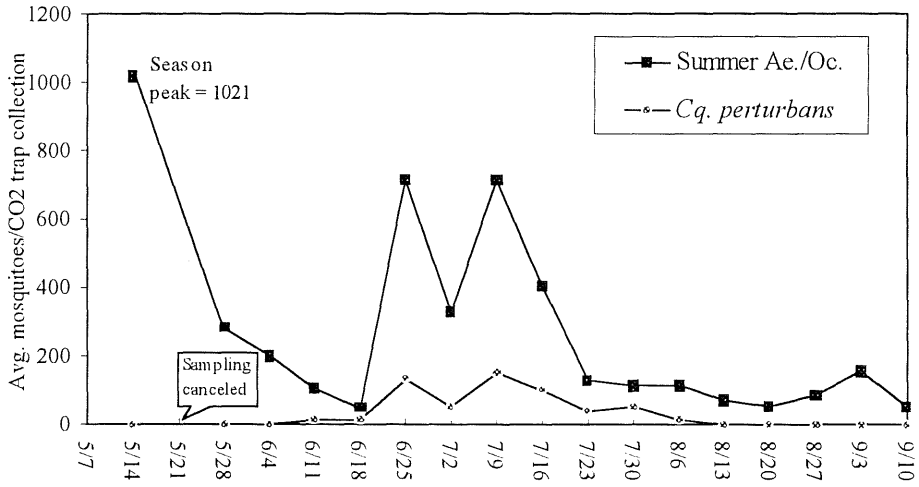


Figure 2.3 Average number of summer *Ae./Oc.* and *Cq. perturbans* in CO_2 traps, 2001. (Sampling canceled on 5/21 due to bad weather.)

Chapter 2: Surveillance

New Jersey Light Traps The District operated seven traps in 2001. Trap 1 was located in St. Paul, trap 9 in Lake Elmo, trap 13 in Jordan, trap16 in Lino Lakes, trap 20 in Elm Creek Park Reserve, trap CA1 in Carlos Avery Wildlife Refuge and trap AV at the Minnesota Zoo in Apple Valley (Fig.2.4). Traps 1, 9 and 16 have operated each year since 1960.

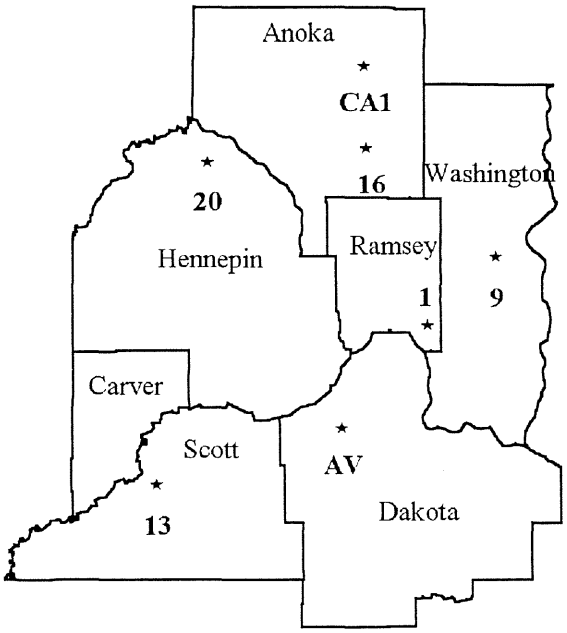


Figure 2.4 New Jersey Light Trap Locations— 2001

Data collected from light traps are used to compare mosquito species population levels from year to year. These are the only collections where all female mosquitoes are identified to species. A total of 104,406 female mosquitoes were identified in 2001 (Table 2.4), with *Aedes vexans* being the most predominant species and *Cq. perturbans* second. The number of mosquitoes collected per night from 1965 to 2001 is displayed in Appendix B.

Table 2. 4. New Jersey light trap collection totals May 12-Sept. 28, 2001.

Trap No.	1	9	13	16	20	CA1	AV	Season	% of female	Average
Location	St. Paul	Lk. Elmo	Jordan	Lino Lks.	N. Henn.	Carlos	Apple Valley	total	total	per night
No. of coll.	139	139	130	140	96	139	131	914		
1. *Oc. abs.*	1	0	0	3	0	78	0	82	0.08%	0.09
3. *aur.*	0	0	2	1	0	0	0	3	0.00%	0.00
6. *can.*	0	0	0	0	14	3	0	17	0.02%	0.02
7. *Ae. cin.*	11	33	14	164	1,085	1,057	59	2,423	2.32%	2.65
10. *Oc. dor.*	3	0	1	4	0	1	0	9	0.01%	0.01
11. *exc.*	0	3	5	3	45	10	0	66	0.06%	0.07
12. *fit.*	0	1	0	1	1	2	0	5	0.00%	0.01
18. *punc.*	0	0	0	0	3	82	0	85	0.08%	0.09
19. *rip.*	0	0	0	3	7	5	0	15	0.01%	0.02
21. *stic.*	0	21	148	7	405	652	30	1,263	1.21%	1.38
22. *stim.*	0	0	3	0	31	3	1	38	0.40%	0.04
23. *prov.*	0	0	1	0	0	31	0	32	0.03%	0.04
24. *tris.*	0	1	0	1	68	5	2	77	0.07%	0.08
25. *triv.*	0	48	4	0	5,404	11	66	5,533	5.30%	6.05
26. *Ae. vex.*	350	3,693	981	6,466	19,932	30,767	7,980	70,169	67.21%	76.77
261. *Ae./Oc.* sp.	9	79	13	117	7,173	751	81	8,223	7.88%	9.00
118. *abs/punc*	0	0	2	6	50	868	0	926	0.89%	1.01
28. *An. earl.*	0	0	0	4	17	31	0	52	0.05%	0.06
29. *punc.*	1	13	16	7	463	54	18	572	0.55%	0.63
30. *quad.*	0	0	0	0	2	0	1	3	0.00%	0.00
31. *walk.*	0	10	25	8	13	215	12	283	0.27%	0.31
311. *An.* sp.	0	1	0	2	20	12	1	36	0.03%	0.04
33. *Cx. pip.*	0	1	0	1	0	2	4	8	0.01%	0.01
34. *rest.*	39	91	25	62	97	202	107	623	0.06%	0.68
35. *sal.*	0	2	3	0	0	1	0	6	0.01%	0.01
36. *tars.*	2	17	22	109	6	42	16	214	0.20%	0.23
37. *terr.*	1	6	1	8	30	5	13	64	0.06%	0.07
371. *Cx.* sp.	32	68	10	49	176	178	46	559	0.54%	0.61
372. *Cx. pip/res*	5	9	0	4	3	3	6	30	0.03%	0.03
38. *Cs. inor.*	25	68	53	211	116	87	522	1,082	1.04%	1.18
40. *minn.*	3	8	6	220	12	74	4	327	0.31%	0.36
41. *mors.*	1	7	0	2	0	11	0	21	0.02%	0.02
411. *Cs.* sp.	1	9	1	68	67	86	2	204	0.20%	0.22
42. *Cq. pert.*	13	53	16	469	1,235	7,868	334	9,988	9.57%	10.93
48. *Ur. sapp.*	2	205	16	6	303	24	62	618	0.59%	0.68
501. Unident.	7	14	5	42	246	409	27	750	0.72%	0.82
Female Total	506	4,461	1,374	8,048	37,024	43,600	9,394	104,406	78.30%	114.23
Male Total	233	1,989	379	2,046	17,301	5,845	1,136	28,929	21.70%	31.65
Grand Total	739	6,450	1,753	10,094	54,325	49,445	10,530	133,335		145.88

Mosquito Control

Chapter Highlights

- MMCD treated 10,897 more acres with larvicides in 2001 than in 2000.
- MMCD treated 6,126 more acres with adulticides in 2001 than in 2000.
- In May 2001, MMCD and MnDNR finalized an agreement for floodwater mosquito sampling, surveillance and treatments in Ft. Snelling State Park.
- MMCD and MnDNR successfully implemented the agreement in June 2001.
- Staff made major progress on creating digitized maps of all wetland areas possibly producing mosquitoes in the District, and wooded areas that provide habitat for La Crosse encephalitis vectors or other adult mosquitoes.

Plans for 2002

- MMCD will continue to implement enhanced security procedures as a result of the September 11 attacks.
- No other major changes to the control program are planned except that *Culex* species implicated in WNV transmission could be targeted for both larval and adult control if WNV is detected within the District in 2002.

Chapter 3: Mosquito Control

Background

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

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

Control Strategy Overview

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

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

A description of the control materials is found in Appendix D. Pesticide labels are located in Appendix E. Appendix F summarizes the number of acres treated with each control material.

2001 Mosquito Control

The 2001 season was one of extremes. April was the wettest on record, with flooding from snow melt and two major rainfall events, each with 2-4 inches of rain. The extremely wet conditions in April and May along with a rapid temperature increase in early May accelerated larval mosquito development so that large numbers of adults appeared about two weeks earlier than usual. There were three large

broods, one each in late April, mid-May and early June (Figure 3.1). The remainder of the season was very dry.

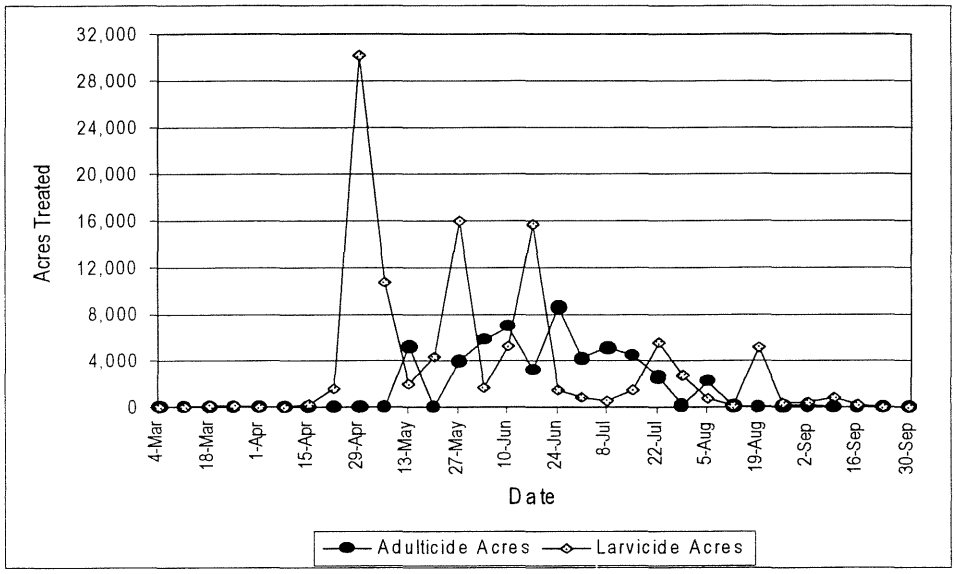


Figure 3.1 Acres of larvicide and adulticide treatments each week (March-September 2001).

Larval Mosquito Control

In 2001, MMCD treated about 11,000 more acres with larvicides than in 2000 (Table 3.1). Ground treatments began in March with briquet applications for cattail mosquito control, increased dramatically in April through June and decreased thereafter. Air work began in late April and continued into September. Treatments decreased significantly after flood waters receded in late June (Figure 3.1). The actual geographic area treated is smaller because some sites are treated more than once.

In 2001, the number of acres treated with Altosid® briquets, Altosid® pellets, Altosid® SR-20 and altosand products were all slightly higher than in 2000 (Table 3.1). *Bti* treatments in 2001 were also higher than in 2000 (Table 3.1). Treatment thresholds for air sites are used to help direct treatments to sites with the most intense breeding and potential to affect the most citizens (i.e., proximity to human population).Thresholds remained unchanged in 2001— Priority Zone 1=0.1/dip in the spring and 2/dip in the summer, and 0.5/dip in the spring and 5/dip in the summer in Priority Zones 2 and 3. The change from spring threshold to summer thresholds generally occurs in mid-May.

Table 3.1 Comparison of larvicide usage in 2000 and 2001.

Material	2000 Amount Used	2000 Acres Treated	2001 Amount Used	2001 Acres Treated
Altosid® briquets (150-day)	700 cases	533	749 cases	589
Altosid® pellets	44,484.60 lb	11,121	43,057.23 lbs	14,791
Altosand products	5,500 lb	786	13,111.10 lbs	1,889
Altosid® SR-20	586.60 ml	29	2,316.60 ml	91
Bti corncob	676,168.00 lb	84,521	724,143.37 lbs	90,527
Total Acres Treated		96,990		107,887

Adult Mosquito Control

Adult mosquito control operations were triggered when mosquito levels were above the following thresholds: 2 mosquitoes in a 2-minute sweep or 2-minute slap test, 130 mosquitoes in an overnight CO_2 trap. Staff conducted treatments in areas identified by District surveillance and customer mosquito annoyance reports (phone calls).

In 2001, MMCD treated about 6,126 more acres with adulticides than in 2000 (Table 3.2). The number of acres treated with permethrin in 2001 was slightly lower than 2000. In 2001, 49,734 acres of ULV adulticide treatments (resmethrin = 41,311 acres, sumithrin = 8,423 acres) were applied compared to 42,986 acres in 2000 (all resmethrin). The majority of adulticide treatments happened early in the season (May-June) (Figure 3.1) and in the northern parts of the District (Figure 3.2).

Table 3.2 Comparison of adulticide usage in 2000 and 2001.

Material	2000 Gallons Used	2000 Acres Treated	2001 Gallons Used	2001 Acres Treated
Permethrin	794.10	4,066	672.60	3,444
Resmethrin	503.74	42,986	490.73	41,311
Sumithrin	—	—	202.12	8,423
Total Acres Treated		47,052		53,178

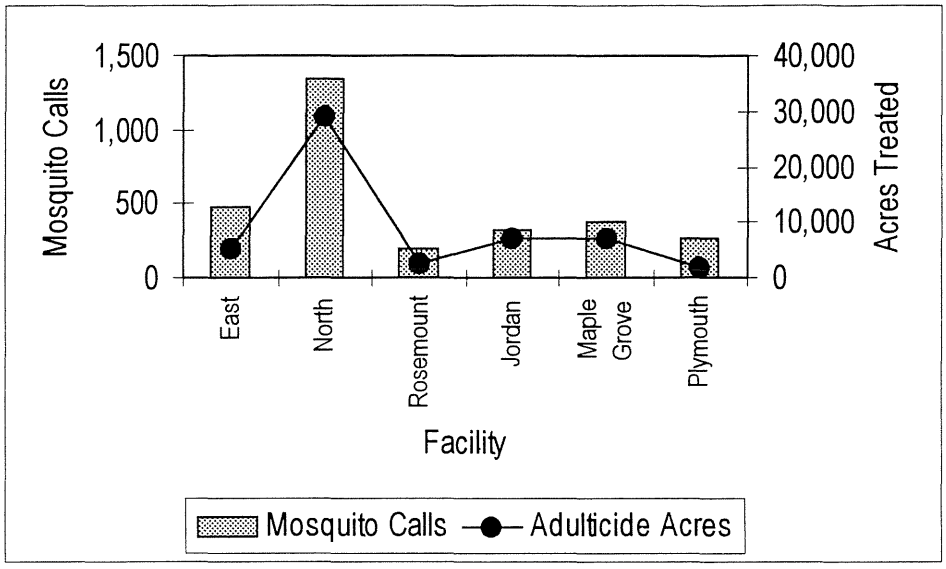


Figure 3.2 Acres of adulticide treatments by each field facility and their corresponding mosquito complaint calls (March-September 2001).

Average mosquito levels as measured by Monday night sweeps were higher earlier in the season, especially outside of Priority Zone 1 (Figure 3.3). The percentage of Monday night sweeps that met or exceeded the treatment threshold were both higher earlier in the season and higher outside of Priority Zone 1 (Figure 3.4).

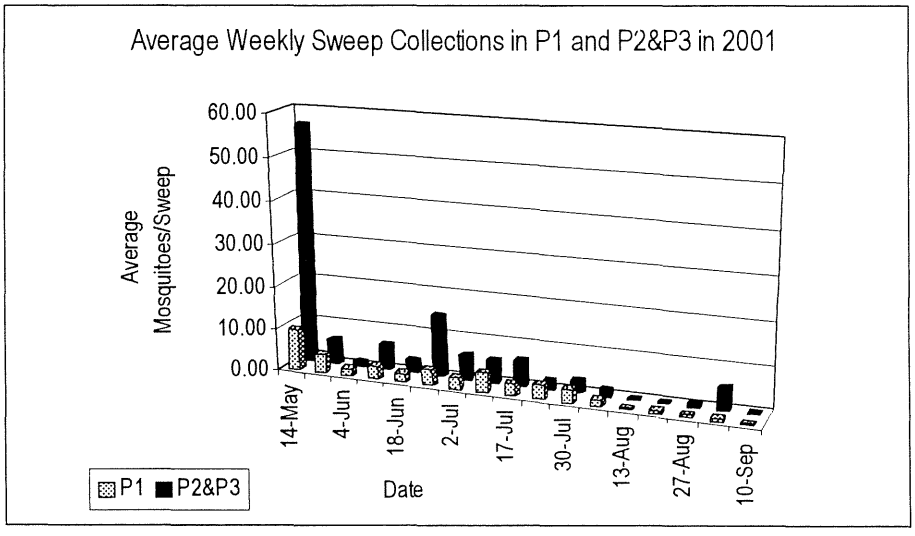


Figure 3.3 Average number of mosquitoes per sweep in Priority Zones 1 and Priority Zones 2 and 3 combined.

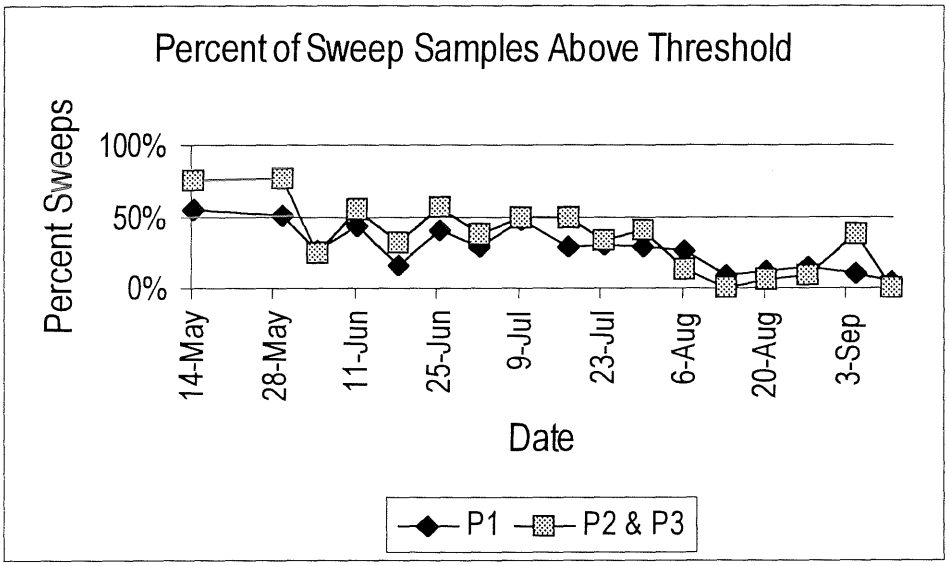


Figure 3.4 **Percentage of weekly sweeps above threshold and average mosquitoes per sweep in Priority Zones 1 (P1) and Priority Zones 2 and 3 (P2&P3) in 2001.**

Additional Projects

- **Ft. Snelling State Park Treatment Agreement** In May, 2001, MMCD managment and representatives of MnDNR State Parks and Ecological Services finished negotiation of a plan which was approved by both agencies. Specific areas of the park are permitted for sampling and treatment. Work will continue in the park in 2002.

- **Mapping** In 2001, MMCD staff started a major project to complete digitizing wetlands and wooded areas ("harborage") in the remaining areas of the District, primarily outer areas (Priority 2 and 3). Significant progress was made in the late summer and fall when low rainfall resulted in time available for mapping. Most outlying areas are now completed, with the remainder (northern Anoka and southern Dakota counties) expected to be completed by March 2003. This project is intended to facilitate quicker response and recording of adult monitoring and other disease-related activities in wooded areas. Completion of the wetland digitizing will allow better acreage estimates for proposed treatments and a unified data handling system for site data throughout the District, as well as providing a resource for other agencies. Staff are also updating digitized wetlands and wooded areas in the Priority 1 area.

2002 Plans for Mosquito Control Services

- **Enhanced Security** MMCD will continue to implement security procedures designed to protect staff, equipment, control materials and other resources from any terrorist activity stemming from the September 11 attacks.

- **Larval Control: Cattail Mosquito** *Coquillettidia perturbans* has a limited flight range of five miles. Consequently, MMCD will focus control activities on the most productive cattail marshes near human population centers. Briquet applications will start in early March to frozen sites (floating sites, deep water cattail sites, remotely located sites). Beginning in late May, staff will treat with pellets applied by helicopter at a rate of 4 lbs/acre.

- **Larval Control: Floodwater Mosquito and other species (except *Cq. perturbans*, *Oc. triseriatus* and *Ae. albopictus*)** The larval treatment strategy for 2002 will be similar to 2001. Staff will treat ground sites (< three acres) with methoprene products and *Bti* corn cob granules. MMCD also plans to continue using six helicopters for the treatment of air sites. Based on the same larval thresholds as used in 2001, breeding sites in highly populated areas will receive treatments first during a wide-scale mosquito brood. The District will expand treatments into less populated areas where treatment thresholds are higher.

  The primary control material will again be *Bti* corn cob granules. Forecasted *Bti* material needs in 2002 are similar to 2001. As in previous years, to minimize shortfalls, control material use may be more strictly rationed during the second half of the season, depending upon the amount of the season remaining and control material supplies. Regardless of annoyance levels, MMCD will maintain sufficient resources to protect the public from potential disease risk.

- **Adult Mosquito Control** Forecasted permethrin, resmethrin and sumithrin requirements in 2002 are similar to 1998, 1999, 2000 and 2001. MMCD will direct adult mosquito control treatments to provide the greatest customer benefit—generally high risk disease areas and areas that have high levels of mosquitoes. Also, MMCD will provide service in high use park and recreation areas and for public functions.

  The Adult Mosquito Control Information Line (651-643-8383) will again enable citizens to hear a daily recording on where adult mosquito control operations are taking place (e.g. parks, neighborhoods, and public events). MMCD will also have this information on its Internet web site (www.mmcd.org). MMCD will continue notification in 2002 at a level similar to 2001.

- **Vector Mosquito Control** Field staff routinely monitor and control *Oc. triseriatus* (La Crosse encephalitis vector), *Cx. tarsalis* (western equine encephalitis vector) and *Ae. albopictus* populations. See the Vector-Borne Disease section of this report for details.

- **Adulticide Non-target Research** In 2002, staff intends to continue to evaluate effects of ULV-applied adulticides upon non-target insects in two ways. First, a literature review of non-target

effects of pyrethroid adulticides concentrating on ULV applications will be continued. Second, a caged-insect study will be designed as part of continued ULV adulticide efficacy tests similar to those conducted in 2000 and 2001. See the Supporting Work section for details.

- **Ft. Snelling State Park Agreement** MMCD Tech. Services staff and Rosemount field staff will meet prior to season to plan surveillance and control. MMCD staff will also meet with Park staff regarding installation of a remote-reading water depth gauge to give early warning of major flooding events.

Chapter 4 Black Fly Control

Black Fly Control Program

Chapter Highlights

2001 Results

- Due to increased flow rates, slightly more liquid *Bti* was used to treat small streams in 2001 (13.2 gal) than in 2000 (12.1 gal.).
- The number of large river treatments and the amount of liquid Bti used in 2001 was similar to 1998 and 1999 and much larger than in 2000.
- The average number of adult black flies recovered in 2001 was slightly below the average observed in 1999.
- Field samples to monitor non-target effects of liquid *Bti* treatments were collected in 2001 as part of the black fly control permit applications process agreed to with MnDNR.
- A study of human response to adult black fly numbers was scheduled to begin in 2001. After conferring with Dr. Ken Simmons, the District's black fly program consultant, the project was postponed until a time when mosquito populations were low enough to not influence people's behavior related to black fly annoyance.

For 2002

- There will be no major changes to the larval surveillance and control program.
- The preliminary testing of the human tolerance to black flies will be completed in 2002.
- Taxonomy and results of non-target sampling will be completed and included in the black fly permit application submitted to MnDNR in 2003.

Chapter 4 Black Fly Control

Background

The goal of the black fly program is to reduce pest populations of adult black flies within the MMCD to tolerable levels. Black fly larval populations are monitored using standardized sampling techniques at about 140 small stream and 21 large river sites during the spring and summer. Liquid *Bti* is applied to sites when the target species reaches the treatment threshold. The small stream program began in 1984. The large river program began with experimental treatments and non-target impact studies in 1987. A full-scale large river treatment program began in 1996.

2001 Black Fly Control Program

Small Stream Program - *Simulium venustum* Control

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

A total of 140 potential *S. venustum* breeding sites were sampled in mid-April to determine larval abundance using the standard grab sampling technique developed by the MMCD in 1990. The treatment threshold is 100 *S. venustum* per sample. A total of 22 sites on 9 streams met the threshold and were treated once using 13.2 gallons of *Bti* (Table 4.1).

Large River Program

There are 3 large river-breeding black fly species that 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, and is abundant from mid-May through August. *Simulium meridionale* and *S. johannseni* breed primarily in the Crow and Minnesota rivers. These species are most abundant in May and June, although *S. meridionale* populations will remain high throughout the summer if stream flow is also high.

The black fly population size at each treatment location was measured approximately every seven days in 2001 using artificial substrates at 21 sites permitted by the Minnesota Department of Natural Resources on the Rum, Mississippi, Crow and Minnesota rivers. The treatment thresholds were the same as those used since 1990. A total of 45 treatments totaling 4046.9 gallons of *Bti* were used to control large river-breeding black fly larvae in 2001 (Table 4.1).

Table 4.1. Summary of *Bti* treatments for black fly control by the MMCD in 2001.

Water body	Number of application sites	Number of treatments	Gallons of *Bti* used
Small streams	22	22	13.2
Mississippi River	2	14	1626.1
Crow River	1	2	30.5
Minnesota River	7	11	2239.2
Rum River	3	18	151.1
Total	35	67	4060.1

Differences in the number of treatments made and amount of material used are mainly due to river discharge and flow. Table 4.2 compares the number of treatments and amount of *Bti* used for the years 1997-2001. Substantially less *Bti* was used in 2000 compared to most years because river discharges were below normal due to a drought. In 2001 flows on the four large rivers were above average from April through July (except on the Crow River) and below average in August and September.

Table 4.2 Number of large river treatments made and gallons of *Bti* used for the years 1997-2001

Year	No. of Treatments	No. of Gallons Used	Discharge cfs
1997	65	5,419.0	9,446
1998	77	4,209	5,076
1999	50	4,299.0	6,857
2000	18	808.6	808.5
2001	45	4,046.9	11,243

The average post-*Bti* treatment larval mortality (measured 250 m downstream of the point of *Bti* application) in 2001 was 96% on the Rum River (based on only one treatment), 82% on the Minnesota River, and 98% on the Mississippi River (exclusive of a failed treatment on May 16). Two treatments were made on the Crow River in 2001, one in late June and one in early July. Post treatment mortality for those treatments was 99 and 100%.

Adult Population Sampling

- **Sweep Net Collections** The adult black fly population was monitored in 2001 at 48 standard locations throughout the MMCD using the District's standard black fly over-head net sweep monitoring technique that was established in 1984. Samples were taken twice weekly from early May

to mid-September, generally between 8 and 10 AM. The average number of all species of adult black flies captured in 2001 was 1.30 (Table 4.3). This is one of the lowest overall average net sweep counts observed since the District-wide larval control program was started in 1991 and is well below the counts observed in 1984 through 1986, before any *Bti* treatments were done on the large rivers (Table 4.3). Only limited experimental *Bti* treatments were done on the large rivers in 1987, 1989 and 1990. No treatments were done in 1988, which was a year of extreme drought and very low black fly populations. Between 1998 and 2000, the overall average number of adults captured was 2.85, 1.63 and 2.38, respectively (Table 4.3).

The average number of adult *S. venustum* captured in 2001 was 0.01, which is similar to the average number captured in previous years of the program. As in previous years, S. *venustum* also made up a low percentage of the total black flies collected in 2001 (Table 4.3). The number of *S. venustum* captured in the net-sweep samples always is low and is not representative of the actual population density. This is because samples are averaged for the entire field season and *S. venustum* adults are rare after late May because there is only a single generation in the spring.

The most abundant black fly collected in the overhead net-sweep samples in 2001 was *S. luggeri,* comprising 75% of the black flies collected (Table 4.3). The overall average number of *S. luggeri* captured in the net-sweep samples in 2001 was 0.98, which is the second lowest average observed since monitoring began in 1984. The low number of *S. luggeri* captured in 2001 was likely due to a combination of effective *Bti* treatments and the drought conditions observed between July and September. The average number of *S. luggeri* captured since the start of the District-wide control program in 1991 is 2.19.

Peaks in the S. *luggeri* population occurred in late May, early July, late July and mid-August. *Simulium luggeri* was most abundant in Anoka County in 2001, as it has been in all previous years of the program. The average number of *S. luggeri* captured in Anoka County was 3.45 in 2001 compared to 16.00, 5.32, and 10.38 in 1998, 1999 and 2000, respectively. The high number *of S. luggeri* captured in Anoka County is most likely due to its close proximity to the Rum and Mississippi rivers (especially untreated portions of the rivers that are outside the MMCD), which have abundant *S. luggeri* larval habitat.

Table 4.3 Annual mean number of black fly adults captured in over-head net sweeps in bi-weekly samples taken at 48 standard sampling locations throughout the MMCD between mid-May and mid-September.

Year	All species[1]	*Simulium luggeri*	*Simulium johannseni*	*Simulium meridionale*
1984	17.95	16.12	0.01	1.43
1985	14.56	13.88	0.02	0.63
1986	11.88	9.35	0.69	1.69
1987	6.53	6.33	0.02	0.13
1988[2]	1.60	1.54	0.05	0.00
1989	6.16	5.52	0.29	0.18
1990[3]	6.02	5.70	0.01	0.24
1991	2.59	1.85	0.09	0.60
1992	2.63	2.19	0.12	0.21
1993	3.00	1.63	0.04	1.24
1994	2.41	2.31	0.00	0.03
1995	1.77	1.34	0.32	0.01
1996	0.64	0.51	0.01	0.07
1997	2.91	2.49	0.00	0.25
1998	2.85	2.64	0.04	0.04
1999	1.63	1.34	0.04	0.06
2000	2.38	2.11	0.01	0.02
2001	1.30	0.98	0.04	0.18

[1]All species includes *S. luggeri*, *S. meridionale*, *S. johannseni*, *S. vittatum* and *S. venustum*.
[2] 1988 was a severe drought year and limited black fly production occurred.
[3]The first operational treatments of the Mississippi River began in 1990 at the Coon Rapids Dam.

- **CO_2 Trap Collections** Adult black fly populations were also monitored twice weekly from May 4 until mid-June by CO_2-baited traps at four sites in Scott/Carver counties, at four sites in Anoka County and at three sites outside the MMCD in Monticello. The sampling sites in Anoka and Scott/Carver counties were located near *S. venustum* breeding sites on small streams. The traps were placed at the edges of woodlots and open areas, which is the optimal host-seeking habitat for black flies and *S. venustum* in particular. The three sampling sites in Monticello were located near the Mississippi River and were selected to serve as general reference sites outside the MMCD black fly treatment area. Sampling has been conducted at these sites with CO_2 traps since 1998.

  The average number of *S. venustum* captured per CO_2 trap in 2001 was 7.29 (exclusive of the Monticello traps, which were not collected in 1997 or 1998). In 1998, 1999, and 2000 the average number of *S. venustum* captured per trap was 10.5, 3.7 and 3.38, respectively. The average number of *S. luggeri* per trap at the three reference sites in Monticello in 2001 was 93.05 versus 0.65 per

trap at the seven sites within the MMCD. In 2001 the *S. meridionale* population was the highest observed since CO_2 trap sampling program began in 1998. The average number of S. *meridionale* was 611 per trap in Scott/Carver counties, which was most likely due to the flood-level flows observed in the Minnesota River during May and June and the fact that no *Bti* treatments were done on the river between June 1 and June 22 because of the high flows. The highest numbers of *S. meridionale* were captured between June 1 and June 11.

Non-target Monitoring

The District conducts biennial monitoring of the non-target invertebrate population in the Mississippi River as a requirement of its permit from the MnDNR. The study was designed to provide a long-term assessment of the invertebrate community in *Bti*-treated reaches of the Mississippi River. Sampling was conducted in 2001 and data are currently being analyzed. The results from monitoring sampling conducted in 1995, 1997 and 1999 do not indicate that any large-scale changes have occurred within the invertebrate community (collected on Hester-Dendy multiplates) in the *Bti* treated reaches of the Mississippi River.

Public Perception of Annoyance from Black Flies

In 2001, the Black Fly Team planned a study designed to estimate public annoyance relative to black fly numbers, to establish what level of annoyance is tolerable, and to estimate the value the public places on reducing black fly annoyance. Data from this study will provide the framework for a quantitative assessment of the cost-effectiveness of the black fly control program. Fieldwork originally was scheduled to begin in 2001 but was canceled because extremely high mosquito populations during May and June could have affected the results. Fieldwork on the project will begin in 2002.

Plans for 2002

The District's goal is to continue to effectively control black flies in the large rivers and small streams. The larval population monitoring program and thresholds for treatment will remain the same as in previous years. Taxonomic identification and enumeration of the non-target samples collected in 2001 will be completed and a report submitted to MnDNR in the spring of 2003. Staff will also continue to monitor adult black fly populations with the over-head net sweep method and CO_2 traps.

Product and Equipment Tests

Chapter Highlights

- MMCD expanded laboratory analyses of active ingredient (AI) concentrations to include adulticides as well as methoprene products. All three adulticides used in 2001 met label AI claims as did Altosid® briquets, pellets and sand.
- Bioassays of Altosid® pellets and briquets indicated that they controlled *Ae. vexans* as effectively in 2001 as in 2000.
- Aerially-applied Vectobac® *Bti* achieved ≈89.5% control of floodwater mosquitoes, essentially the same as in 2000 (90.8%).
- The droplet size optimization program was expanded to include backpack sprayers.
- In August, adult mosquito treatments were monitored in a variety of conditions using several types of GPS equipment.
- Tests done during truck cold fog treatment simulations were reliable and accurate enough with most types of GPS units to warrant use as treatment recording devices.
- GPS receivers tested in handheld and ATV applications gave highly variable results, potentially limiting GPS use in monitoring these types of treatments unless better GPS equipment is used.
- Inexpensive GPS receivers have been useful for applications that do not require as high degree of accuracy and reliability, such as recording larval or adult sampling locations in wooded areas or larger breeding sites.

Plans for 2002

MMCD will continue to:

- Improve calibration techniques to optimize adult mosquito control equipment.
- Standardize backpack sprayers and optimize the barrier treatment program.
- Optimize ULV equipment droplet distributions.
- Increase knowledge of aerial adulticiding to be prepared for an emergency response to mosquito-borne disease outbreaks.
- Work to integrate the use of DataMaster GPS into adulticiding operations and assess its usefulness for data recording.

MMCD plans additional tests of the following control materials:

- IcyPearl® *Bti* (frozen) granules
- Teknar® *Bti* granules
- Agnique® as a pupicide

MMCD will begin evaluating natural pyrethrum products for adult mosquito control.

Chapter 5 Product and Equipment Tests

Background

Product and equipment testing is an integral part of MMCD which ensures the District provides effective and efficient service. Testing processes focus on control material evaluations, label compliance, application analysis, calibration and exploration of new technologies to improve operations. The Technical Services Team provides project management and technical support. The regional process teams provide coordination of field testing and data collection.

2001 Projects

Quality assurance processes focused on equipment and new product evaluations. These evaluations provide important information on which to base purchasing, budgeting, and operational decisions. The District continued the certification process on four control materials and introduced one new control material in 2001. These ongoing material evaluations lead to four products being certified which will provide MMCD with more tools to use in its operations.

Acceptance Testing of Altosid® (methoprene) Briquets, Pellets and XR-G Sand

During 2001, warehouse staff collected random Altosid® product samples from shipments received from Wellmark International for methoprene content analysis. MMCD contracted an independent testing laboratory, Legend Technical Services, to complete the analysis. Zoecon Corporation, Dallas, Texas, furnished the testing methodologies. The laboratory protocols used were CAP No. 311, "Procedures for the Analysis of S-Methoprene in Briquets and Premix" and CAP No. 313, "Determination of Methoprene in Altosid® Sand Granules".

Analyses revealed that all 2001 samples of Altosid® briquets and pellets contained the label claim of methoprene content (Table 5.1). Sand products (Altosid® XR-G Sand, Altosand) carried over from the previous year contained less than the label claim of methoprene (Table 5.1), therefore, it is recommended that Altosid® sand products be used in the season of manufacture.

Table 5.1 Methoprene analysis (AI) for Altosid® briquets, pellets and sand products.

Methoprene product	No. of samples	Methoprene content: label claim	Methoprene content: analysis average	SD
150-day XR briquets	31	2.10%	2.0997%	0.0485
30-day pellets	40	4.25%	3.9265%	0.1176
20-day XR-G Sand	5*	1.50%	1.2310%	0.1085
10-day Altosand	9*	0.50%	0.0976%	0.0639
6-day Altosand	3*	0.50%	0.0387%	0.0025

* Sand analysis was part of a carryover study in which year 2000 production material was evaluated.

Evaluation of Active Ingredient Levels in Adult Mosquito Control Products

MMCD has periodically requested the certificates of Active Ingredient (AI) analysis from the manufacturers for product AI verification. Because of a 2001 EPA product analysis of various manufacturers on the East Coast, MMCD incorporated AI analysis as part of District product evaluation procedures. Technical Services selected adulticide samples from product received in 2000 and 2001 for analysis. All products were within label parameters with the exception of the Permethrin 57-OS concentrate (Table 5.2). This product evaluation is questionable because this same concentrate was diluted (10:1) with mineral & soybean oils to create our permethrin 5.7% barrier spray and all five samples from our mixture were analyzed at the correct 5.7% level. Staff requested the manufacturer's AI analysis which showed the product to be at the correct label concentration. MMCD staff concluded that the oil-based concentrate was stratified at the time of sample collection and the allotment was not taken from a homogenous mixture. In 2002, MMCD will continue to sample adulticides and compare results with stated label claims and manufacturer's certificates of analysis.

Table 5.2 Active ingredient analysis for Permethrin 57-OS, Scourge® 4+12, and Anvil® 2+2.

Adulticide Material	Year	Active Ingredient	AI Content: Label Claim	AI Content: Laboratory Analysis	PBO Content Analysis
Permethrin 57-OS Concentrate	2001	Permethrin	57.0 %	44.1 %	n/a
Permethrin 5.7 % mixture	2001	Permethrin	5.7 %	5.43 % (n=ave. of 5)	n/a
Scourge® 4+12	2001	Resmethrin	4.14 %	5.03 %	12.60 %
Scourge® 4+12	2000	Resmethrin	4.14 %	5.12 %	12.80 %
Anvil® 2+2	2001	Sumithrin	2.0 %	1.96 %	1.85 %
Anvil® 2+2	2000	Sumithrin	2.0 %	1.98 %	2.37 %

Efficacy of Control Materials

- **Altosid® Briquet, XR-G Sand and Altosand Applications** Both wet conditions in April through mid-June and dry conditions thereafter hampered successful collection of bioassays. During the wet months, staff were overwhelmed dealing with huge mosquito broods. Later many sites dried completely before mosquito pupae for a bioassay could be collected. In 2001, studies focused on Altosid® briquets, Altosid® pellets, Altosid® XR-G sand, and Altosand.

  Untreated control emergence averaged 88.71%, essentially the same as in 2000 (84.51%), 1999 (88.13%) and 1998 (86.64%) (Table 5.3).

Table 5.3 Bioassay results for untreated control sites in 2001.

	n	Mean % emergence	Median % emergence	SD	Min % emergence	Max % emergence
Untreated control	14	88.71	90.50	12.04	52.00	99.00

Mean and median Altosid® briquet efficacy were fairly low and essentially unchanged from 2000. (Table 5.4, 5.5). Mean and median Altosid® pellet efficacy in 2001 were both excellent and slightly better than in 2000, though probably not significantly (Table 5.4, 5.5). Pellet efficacy did not decrease as the number of days between treatment with pellets and when bioassays were collected increased beyond the 30-day field life of the product, similar to 2000 results.

In 2000, Altosand efficacy (7 lb/acre) appeared to improve slightly over disappointing results in 1999. This pattern did not hold in 2001 for aerial applications even when bioassays were collected within the 10-day field life of the material (Table 5.4, 5.5). Therefore, we decided to discontinue aerial Altosand applications. Efficacy of both ground and aerially-applied XR-G sand were higher in 2001 than in 2000 (Table 5.4, 5.5), although the increase in effectiveness cannot be demonstrated to be significant because 2001 evaluations include too few bioassays.

Table 5.4 Bioassay results for Altosid® briquets, pellets, XR-G sand, and Altosand in 2001. Emergence inhibition (EI) is corrected for untreated control mortality.

Material	Days post-treatment sample taken	n	Mean % EI	Median % EI	S.D.	Min % EI	Max % EI
Briquet (150-day)	21 to 102	15	64.60	69.81	35.37	0.00	100.00
Pellet (30-day)	12 to 41	23	92.75	100.00	16.03	30.11	100.00
	12 to 30	16	95.91	100.00	8.65	66.18	100.00
	31 to 41	7	85.51	100.00	25.83	30.11	100.00
XR-G Sand (5lb) (20-day) ground	3 to 13	23	76.10	94.19	33.61	0.00	100.00
XR-G Sand (7lb) (20-day) aerial	0 to 13	8	75.40	90.85	36.79	0.00	100.00
Altosand (10-day)	8 to 14	10	44.40	49.60	38.44	0.00	100.00
	8 to 10	6	36.85	25.93	39.58	0.00	100.00
	11 to 14	4	55.72	67.87	39.22	0.00	81.12

Table 5.5 Bioassay results for Altosid® briquets, pellets, XR-G sand, and Altosand in 2000 compared to 2001. Includes only aerial applications of XR-G sand and Altosand. Emergence inhibition (EI) is corrected for untreated control mortality.

Material	2000				2001			
	Days post-treatment sample taken	n	Mean % EI	Median % EI	Days post-treatment sample taken	n	Mean % EI	Median % EI
Briquet:150-day	0 to 146	27	65.30	66.87	21 to 102	15	64.60	69.81
Pellet:30-day	0 to 74	84	84.33	100.00	12 to 41	23	92.75	100.00
XR-G Sand: 20-day, 5 lb*	3 to 16 *	34 *	57.01 *	62.09 *	3 to 13	23	76.10	94.19
XR-G Sand: 20-day, 7 lb	8 to 24	20	45.38	40.33	0 to 13	8	75.40	90.85
Altosand : 10-day, 7 lb/acre	9 to 16	10	57.69	73.06	8 to 14	10	44.40	49.60

* Data from 1998

- ***Bti* Corncob Applications** Vectobac® brand *Bti* (5/8 inch mesh size corncob granules) from Abbott Laboratories was the primary *Bti* product applied by helicopter in 2001. Efficacy as calculated in terms of pre-treatment and post-treatment larval counts was similar in 2001 and 2000 (Table 5.6).

Table 5.6 Efficacy of aerial *Bti* (Vectobac® brand) applications in 2000 and 2001 (8 lb/acre).

2000		2001	
No. of checkbacks (% total treatments)	Average% mortality	No. of checkbacks (% total treatments)	Average% mortality (2001)
n=571 (12%)	90.8	n=401 (9.4%)	89.5

- **LarvX® SG Biological Soluble Granules (Meridian Vector Management)** In 1999, ground-applied LarvX® granules achieved a good rate of control (81.5%), but the efficacy of helicopter applications was too low (48.4%). Consequently, MMCD increased the aerial dosage of LarvX® granules using a 5 lb/acre rate in 2000 and 2001. Efficacy increased in 2000 and 2001 (Table 5.7) but still remained well below that achieved by Vectobac® brand *Bti* (Table 5.6).

Table 5.7 Efficacy of aerial LarvX® applications in 2000 and 2001.

2000			2001		
Per acre dosage	**Number of checkbacks**	**Average % mortality**	**Per acre dosage**	**Number of checkbacks**	**Average% mortality**
5 lb/acre	n=10	69.1	5 lb/acre	n=5	69.1

Product Certification Trials

The District, as part of its Continuous Quality Improvement philosophy, desires to continually improve its control materials and methods. The District attempts to use the most environmentally friendly products possible while achieving acceptable control rates. As part of this process, MMCD certifies materials to be acceptable with District-run evaluations prior to operational use. Results of those tests follow.

- **Teknar® *Bti* granule (Certis)** Teknar® is a *Bti* granule similar to Vectobac®. MMCD received 2,000 lbs of corncob granules for evaluation. Teknar® achieved good control (93.8%, n=8) in a small aerial test, and thus completed the second phase of the certification process. Teknar® will proceed to a large-scale operation use evaluation (40,000 lbs) in 2002.

- **Altosid® XR-G Granules (Wellmark)** Although this product is already certified as a water-applied larvicide, MMCD continues to evaluate this product for use as pre-hatch product. MMCD would like to apply this material to dry or wet breeding sites prior to mosquito larvae being present and then determine if satisfactory control occurs 20 days post-application.

  In 2001, field staff conducted three pre-hatch applications and achieved 92-100% control. Although there was good control in 2001 evaluations, staff were not yet convinced that the material provides consistent results as a pre-hatch material. MMCD will continue to evaluate this control material in 2002.

  MMCD staff continue to search for an environmentally sound, cost-effective pre-hatch material in which treatments could be completed in historically active breeding sites during non-peak activity periods. Using pre-hatch materials could allow for expanded service including additional surveillance, expanded quality assurance processes, and more larval treatments after a significant rainfall event.

Experimental Products

- **Vectolex® granules for Cattail Mosquito Control (Clarke) Vectolex®** contains *Bacillus sphaericus*, a bacterium that is specific to mosquitoes and can recycle in mosquito larvae, sometimes resulting in longer field suppression than *Bti*. Due to low water levels and low larval dip counts in cattail marshes, MMCD decided to postpone product evaluations until more representative natural conditions occur. Product evaluations will be considered in 2002.
- **Vectolex® granules for control of permanent water mosquito species (*Culex*, *Culiseta*)** This product is used extensively in other parts of the USA for *Culex* species control. MMCD is discussing evaluation of this product as part of our vector control program. Database searches for historical breeding areas are complete, and small-scale product evaluations are planned in those sites for 2002.
- **Altosid® SBG Single-Brood Methoprene Sand (5-day)(Wellmark)** Wellmark International provided 400 lbs of the new SBG granules for product evaluation. The new product demonstrated excellent efficacy (98% EI, n=1) by ground applications, but staff did not see any significant benefits to a single-brood methoprene product. In comparison to a *Bti* single-brood corncob granule, the SBG granule actually increased the workload of employees due to the efficacy evaluation bioassay process. Staff felt that, because of the additional workload and cost, this granule was not a viable product for the District when compared to other currently available materials. MMCD will not conduct further evaluations on this product in 2002.
- **Aqua-Scourge® (Resmethrin)(Aventis)** This water-based adulticide product incorporates the new FFAST (Film Forming Aqueous Spray Technology) droplet technology which eliminates the need for an oil-based formulation. A water-based formulation is desirable because it eliminates the need for inert oils as carriers being applied into the environment, reduces material and shipping costs, and can be easily mixed just prior to application. Efficacy of Aqua-Scourge® was promising (Table 5.8) in an initial trial using the District's standard adulticide test protocol conducted in Anoka County using Scourge® as a standard along with an untreated control.

Table 5.8 Efficacy of Aqua-Scourge® and Scourge® in 2001. Values are percent change relative to catches the night before treatment.

	Percent Reduction		
Material	Night of Treatment	24 hrs post-Treatment	48 hrs post-Treatment
Scourge®	97.1	78.8	45.3
Untreated Control	22.2	45.2	16.6
Aqua-Scourge®	83.8	-2.7[a]	9.8

[a] Indicates a slight increase in mosquito density as measured by CO_2-traps, essentially zero efficacy

Chapter 5 Product and Equipment Tests

Equipment Evaluations

- **Helicopter Swath Analysis and Calibration Procedures** Staff conducted three helicopter calibrations during the 2001 season. Two sessions were held at the municipal airport in LeSueur, MN and one session was located in Lino Lakes, MN. Staff completed calibrations for six different operational and experimental control materials. In total, six helicopters were calibrated and each helicopter was set up to apply an average of three different control materials.

- **Beecomist Spray Heads for Aerial Adulticide Applications** The helicopter aerial spray units are being evaluated to prepare for a possible disease outbreak that could require a large-scale adult mosquito control operation. Staff will evaluate the application methodologies and analyze the swath patterns for the viability of use under emergency conditions. MMCD had scheduled an evaluation of these aerial spray units in May 2001. Due to heavy rains, the evaluations were postponed because the helicopters were needed to complete a large number of granular larval applications. The evaluations were rescheduled for September, 2001, but the 9/11 terrorists' attacks and related events ended all flight operations for the 2001 season. The District plans to conduct these evaluations in spring, 2002.

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

  Eighty backpacks were evaluated in 2001. Due to the variability of the backpack brands and various ages of the equipment, the testing demonstrated the need for additional data for each backpack to standardize the comparison of similar packs. A new database will be developed for a complete evaluation of all District backpacks in 2002. All of the backpacks tested were adjusted to apply the correct droplet range for barrier treatments. Technical Services staff will continue use this technology to improve the consistency of the District's adult mosquito treatment program.

- **Baseline Specifications for Evaluating Equipment Performance** Technical Services staff worked directly with manufacturers to produce baseline specifications of new spray equipment. MMCD gathered information on truck-mounted cold foggers, ATV-mounted cold foggers, handheld ULV units, and backpacks to create a standard for comparing MMCD equipment. By comparing District equipment to the original production standards, staff will enhance its ability to evaluate equipment, create improved calibration standards, and to build a database to make quality decisions in District purchasing processes.

- **DataMaster GPS Mosquito Control Data System for Truck-mounted Electric Cold Foggers**
  MMCD purchased two Beecomist Pro-Mist HD sprayers with data collection systems that allow precise application information to be collected automatically as the system is being operated. This computerized system creates custom reports of time, location, speed and direction of application, flow rate, sprayer status and other pertinent information. These data can also be downloaded and incorporated used with District GIS systems.

- **Global Positioning System (GPS) use with MMCD Adulticide Equipment: Field Study 2001**
  Following is a summary of a poster presentation made at the Minnesota GIS-LIS Conference, in Duluth, MN, October 2001. A full report is available upon request.

Summary This study was designed to test the accuracy and reliability of Garmin 12 GPS units in various configurations (handheld, helmet-mount, external antenna, differential correction beacon), and the DataMaster GPS unit included in truck-mounted cold foggers from Clarke, Inc. The GPS units were tested in eight sites with light to heavy tree cover typical of mosquito control treatment areas, with simulated treatment with either a backpack sprayer (four sites), ATV-mounted sprayer (two sites) or truck-mounted ULV fogger (two sites). Tracks recorded by the GPS units were compared with a baseline "known" path established for each site. GPS units were run on three different days in August, 2001 at each site. Results were evaluated based on accuracy (% of points in the track run that were within 12 meters of the baseline) and reliability (% of runs with 90% of points within 12 m).

Results Results suggested the DataMaster GPS units in new truck-mounted foggers are accurate enough to provide a useful mechanical record of approximate path, but reliability will depend primarily on operator training (Table 5.9). These units added approximately $3,500 to the price of the foggers. The Garmin 12 GPS units were able to receive satellite signals most days in most sites for most of the treatment paths, even with heavy cover. Accuracy was good in some sites and poor or varied widely on different days in others; in many sites they were not reliable enough to be counted on as the sole record of treatment path. The use of an external antenna or differential correction improved both accuracy and reliability, but overall reliability was still marginal for use as a record of treatment location.

Table 5.9 Number of Runs with ≥90% of Track Points within 12 m of Actual Path (of 3 runs possible, unless otherwise noted)

	Truck Fogger light cover		ATV mixed or heavy cover		Backpack mixed or light cover		Backpack heavy cover				
	Site E1	Site E2	Site E3	Site W1	Site E4	Site W4	Site W3	Site W2	**Total >90%**	#Runs	% of Runs
GPS12: Plain	1	2	0	0	2	3	2	1	**11**	24	**46**
Helmet	--	--	--	0	1 [a]	2[a]	2 [a]	0 [a]	**5**	11	**45**
External	2	3	1	0	2	2	1	1	**12**	24	**50**
Differential	1	3	0	0	3	3	3	1	**14**	24	**58**
Diff. + Ext.	2	3	2	0	2	2	3	2	**16**	24	**67**
DataMaster	2 [(b)]	2 [(b)]	--	--	--	--	--	--	**4**	4 [b]	**100**[b]

[a] Only 2 runs made

[b] Only 2 runs at each site collected data; 1 run at each site had mechanical or setup problems

Plans for 2002

A primary goal of product and equipment testing is to ensure adequate information for all evaluations. The District will continue to improve its calibration techniques to optimize our adult mosquito control equipment. Staff will continue to improve and make quality decisions based upon data. The following control materials will be evaluated or tested:

- Large scale Certification/Evaluation of Teknar® granules applied aerially.
- Initial evaluation of Agnique®, a monomolecular surface film to be used as a pupicide.
- Initial evaluation of natural Pyrethrum products for adult control.
- The District also plans to test IcyPearl®, a new frozen *Bti* formulation. The new formulation has obvious drawbacks, one being that it has to be kept frozen until used. A big advantage is that no helicopter recalibration is required because the amount of *Bti* per pound of formulated product can be adjusted to modify the per acre *Bti* dosage without changing the weight of formulated product. Planned IcyPearl® tests in 2001 could not be performed because application hoppers were not ready.
- Technical Services staff will continue to work with field staff to integrate the use of DataMaster GPS into adulticiding operations and assess its usefulness for data recording. Offers have also been received from other agencies of GPS equipment loans for additional testing.

Supporting Work
Chapter Highlights

2001 Projects

Wright County Long-term Nontarget Impact Study: Making results available to a wider audience

- Results of 1997-1998 extension of *Bti* and methoprene nontarget study were presented at local and national professional meetings and reports are being placed on MMCD web site.
- Authors met in February 2001 to plan publication in a peer-reviewed journal.
- Additional analyses were done on species richness to compare with 1991-1993 study; no significant effect in 1997-1998 on richness of Chironomidae or other insect taxa.
- Primary author is still unable to assemble draft by end of 2001, so other authors are now doing assembly for review with support from MMCD staff.

Purple Loosestrife Biocontrol and MMCD Adulticides

- A MnDNR/MMCD cooperative study comparing purple loosestrife beetle success for biological control relative to MMCD adulticide treatments was started last year with data from 55 sites in the eastern Metro area.
- The study was expanded in 2001 to include data from 80 additional release sites throughout the District.
- Results were similar to the pilot study reported last year. Proximity to treatments was not sufficient to explain beetle success or failure as a whole; sites with treatments within 300 feet were less likely to show rapid expansion in beetle populations, a few sites showed likely problems from close treatments, but most release sites were not close to treatments and their success or failure could not be related to treatment.
- Increased communication is underway to prevent future problems.

Chapter 6 Supporting Work

The District on occasion will undertake projects which support our overall mission but are not directly related to control operations. Results of these projects are reported in this chapter.

Wright County Long-term Nontarget Impact Study: Making results available to a wider audience

The Wright County nontarget study sites are 27 wetlands in Wright County, Minnesota, selected for a project directed by an independent panel of scientists with funding from MMCD. The sites were studied three years, assigned to three treatment groups (*Bti*, methoprene sand, or untreated control), and treated six times per year from 1991 through 1999. Results from 1988-1993 showed no difference due to treatment for zooplankton, breeding red-winged blackbirds, or the bird community in the wetlands (Niemi et al. 1999). Macroinvertebrates in core sediments showed no difference in 1991, but significant decreases were found in insects, mostly Chironomidae (non-biting midges), in later sampling dates from 1992 and especially 1993 (Hershey et al. 1998). The 1991-1993 study results were published by the original authors from the Natural Resources Research Institute and are being widely discussed, especially by agencies concerned about use of *Bti* or methoprene on their lands.

At the request of the independent panel, additional core sampling was done by Lake Superior Research Institute in 1997 and 1998, which found high numbers of invertebrates in all the sites and no difference in chironomid numbers or biomass as a whole, although some groups within the Chironomidae were lower or higher on some dates in treated sites (Balcer et al. 1999). Because the later results show a more complete picture of non-target impacts and change the interpretation of the earlier study results, it is important that they be widely disseminated.

In 2001, results of the 1997-1998 study extension were presented at professional meetings of the American Mosquito Control Association, Society of Wetland Scientists, and Association of Minnesota Naturalists. Copies of the reports produced by LSRI were distributed to interested parties as requests came in. However, the results have not been published in a peer-reviewed journal.

In 2000, Dr. Mary Balcer, principal investigator from LSRI for the 1997-1998 work, was not available to work on a publication, but she indicated she could work on it in 2001 with support from a team assembled to cover aspects outside her expertise. In early February, 2001, MMCD staff member N. Read arranged a meeting with Drs Mary Balcer and Kurt Schmude (LSRI), Lyle Shannon (UMD), and Richard Anderson (EPA, Continuation Panel member), and all agreed on the minimum required in a publication, what areas needed further analysis, who would assemble data and/or do analysis, and a time line. Supporting data was assembled by N. Read and provided to Dr. Balcer. Statistician A. Lima completed additional analyses needed. R. Anderson worked on choice of journal. Unfortunately Dr. Balcer was again unable to assemble a draft publication. At this time N. Read and R. Anderson are working on assembling a draft from the LSRI reports, which will be given to Dr. Balcer (primary author) for review, and reviewed by other panelists prior to submission for publication in a peer-reviewed journal.

Chapter 6 Supporting Work

The additional analysis done by Ann Lima, in consultation with Panel member Dr. Stuart Hurlbert (San Diego State University), showed that species richness was not significantly reduced by *Bti* or methoprene on any sampling dates in 1997 or 1998 for either Chironomidae, non-chironomid Diptera, or non-dipteran insects, or for total insects.

Staff are also in the process of making the Wright County study reports available to download from MMCD web site.

References

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

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

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

Purple Loosestrife Biocontrol and MMCD Adulticides

Purple loosestrife (*Lythrum salicaria*), a highly invasive exotic wetland plant species, has in the past decade been the target of a biological control program by the MnDNR. Using beetles (*Galerucella pusilla* and *G. calmariensis*) that selectively attack purple loosestrife, a certain amount of control has been observed statewide. In the seven-county metropolitan area, however, fewer beetle populations have been successful.

MMCD primarily treats mosquitoes in their larval stage with target-specific, biological controls that do not affect loosestrife beetles. However, loosestrife beetles have a known sensitivity to pyrethroid-based products such as those MMCD uses for localized treatments to reduce adult mosquitoes. Although the MMCD does not treat wet areas with pyrethroids, a question was raised as to whether or not proximity to MMCD adult mosquito treatments could be related to reduced beetle success.

In 2000, MMCD started a cooperative study with Luke Skinner (MnDNR) and Dave Ragsdale (U of M) examining whether adult mosquito control treatments made by MMCD in nearby areas could be related to reduced beetle success at loosestrife biocontrol release sites. Locations and success "grades" of MnDNR-recorded loosestrife beetle release sites in the metro area were obtained from MnDNR records. Adulticide treatment locations for dates after beetle release were mapped based on MMCD treatment records. Distances between treatments and beetle release sites were compared with beetle activity success or failure grade recorded by MnDNR observers (Grades A and B represent widespread

high beetle densities and damage, C represents beetle density and damage low, D represents beetles rare, and F represents no beetles or damage found).

Of the 135 beetle release sites examined, 32 (24%) had treatments within 600 ft that occurred between the release date and the grade date. The 24 sites with treatments within 300 feet were less likely to have grades of A or B than the untreated sites (Chi-squared analysis, p=0.007, 2 df) (Table 6.1), but were not more likely to have grades of D or F. Looking at the 135 sites as a group, however, the number of treatments within 300 ft was not a significant predictor of grade (R^2=0.003, p for significance of regression 0.53).

Table 6.1 Comparison of Loosestrife Beetle Release Success ("Grade") in the Metro Area with Proximity to MMCD Adult Mosquito Control Treatments (Resmethrin or Permethrin).

		Grade, 2000				
		A or B	C	D or F	Total	
Not Near Treatment	# sites	**28**	**25**	**50**	**103**	
	% of total	27%	24%	49%		Chi-squared
Trt. within 600 ft	# sites	4	14	14	32	p=0.062
		13%	44%	44%		
Trt. within 300 ft	# sites	**2**	**13**	**9**	**24**	p=0.007
		8%	54%	38%		
Trt. within 150 ft	# sites	**2**	**11**	**8**	**21**	p=0.026
		10%	52%	38%		

From these results we concluded that:

- There were a few sites where adult mosquito treatments may have reduced the success and spread of beetle populations.
- Of the sites near mosquito treatments, most had some beetles surviving (grade D or better); few received an F grade (no beetles left).
- Many locations with poor beetle success were not close to adult mosquito treatments.

- Mosquito control activity alone did not account for a significant portion of grade variability in the metropolitan area.

Beetle populations are most susceptible to adulticide treatments shortly after release, when their populations are low. Established populations are unlikely to be affected by treatments. By notifying MMCD of release sites, a temporary treatment buffer can be established that might increase the chance of beetle success, therefore it is important for local cooperators working with the MnDNR on releases to notify MMCD of their exact location. Analysis of recent treatments shows few potential problem areas indicating that existing efforts at communication appear to be effective.

Appendix

Appendices

Appendix A Frequency of Occurrence (%) of Larval Species in Standard Dipper Collections, 2001[a]

	Anoka	Carver	Scott	Dakota	Hennepin	Ramsey	Wash.	District
No of Collections ->	2,122	510	772	1,668	4,641	1,669	1,000	12,382
1. Ochlerotatus abserratus	0.3	0.2	0.0	0.1	0.2	0.2	0.3	0.2
6. Oc. canadensis	0.1	0.2	0.5	1.2	0.1	0.1	0.5	0.3
7. Aedes cinereus	7.8	8.6	9.1	11.2	9.1	10.4	17.8	10.0
8. Oc. communis	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0
10. dorsalis	0.0	0.0	0.0	0.1	0.1	0.4	0.1	0.1
11. excrucians	0.4	0.0	0.4	1.0	1.1	2.4	4.6	1.3
12. fitchii	0.1	0.0	0.0	0.2	0.0	0.7	0.7	0.2
14. implicatus	0.0	0.2	0.1	0.1	0.1	0.3	0.6	0.1
15. intrudens	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18. punctor	0.1	0.2	0.1	0.1	0.0	0.4	0.4	0.2
19. riparius	0.2	0.6	0.0	0.2	0.5	0.4	0.4	0.4
20. spencerii	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
21. sticticus	0.2	0.2	0.6	1.5	0.8	3.2	2.2	1.2
22. stimulans	1.2	2.0	2.7	5.1	3.5	7.2	8.4	4.1
23. provocans	0.0	0.0	0.1	0.2	0.0	0.8	1.2	0.3
25. trivittatus	0.3	0.6	1.6	5.5	1.3	1.9	1.5	1.8
26. Ae. vexans	20.5	25.7	25.4	45.6	24.6	39.6	34.9	29.7
261. Ae./Oc. species[b]	61.5	42.0	43.9	36.0	47.5	31.9	34.1	44.7
28. Anopheles earlei	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0
29. punctipennis	0.0	0.0	0.0	0.1	0.0	0.2	0.5	0.1
31. walkeri	0.0	0.2	0.0	0.0	0.0	0.1	0.0	0.0
311. An. species	0.2	0.8	0.6	0.2	0.5	0.5	1.1	0.5
33. Culex pipiens	0.9	3.3	1.6	0.5	1.2	1.1	0.3	1.1
34. restuans	6.6	12.2	9.2	8.9	12.4	13.5	6.4	10.4
35. salinarius	0.0	0.2	0.3	0.2	0.0	0.2	0.3	0.1
36. tarsalis	1.0	1.6	3.1	2.0	1.5	2.2	1.7	1.7
37. territans	1.6	5.5	4.1	2.5	2.0	3.1	5.9	2.7
371. Cx. species	8.2	3.3	3.9	2.8	5.6	5.0	7.6	5.5
38. Culiseta inornata	20.4	18.6	25.3	26.1	20.0	25.0	17.9	21.7
39. melanura	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40. minnesotae	0.6	0.2	0.6	0.2	0.8	0.5	1.0	0.6
411. Cs. species	7.2	7.5	6.7	3.9	4.6	5.8	7.4	5.6
48. Ur[c]*. sapphirina*	0.2	1.6	0.4	0.8	0.6	1.3	1.9	0.8
501. Unidentifiable	1.0	0.6	1.4	0.7	0.8	1.4	2.6	1.1

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

[b] Genus level identifications only.

[c] *Uranotaenia*

Appendix B Average Number of Common Mosquito Species Collected per Night in New Jersey Light Traps 1965-2001

Year	*Ochlerotatus abs/punc*	*Aedes cinereus*	*Ochlerotatus sticticus*	*Ochlerotatus trivittatus*	*Aedes vexans*	*Culex tarsalis*	*Coquilletidia perturbans*	All species	Average Rainfall
1965	1.03	0.77	0.19	0.08	89.00	4.70	1.43	111.74	27.97
1966	1.29	0.13	0.00	0.02	33.70	0.69	17.66	61.78	14.41
1967	0.64	0.24	0.65	0.12	75.40	1.61	14.37	101.55	15.60
1968	0.14	1.60	0.04	0.77	119.30	1.25	2.43	136.54	22.62
1969	0.70	0.19	0.02	0.17	19.90	0.65	4.27	30.82	9.75
1970	0.17	0.57	0.06	0.33	73.10	0.76	2.78	83.16	17.55
1971	0.69	0.55	0.15	0.33	52.10	0.28	3.51	62.93	17.82
1972	0.98	2.13	0.41	0.35	124.50	0.39	8.12	142.35	18.06
1973	1.29	0.70	0.11	0.06	62.20	0.41	25.86	95.14	17.95
1974	0.17	0.32	0.14	0.12	30.30	0.15	7.15	40.09	14.32
1975	0.28	0.63	0.44	0.17	40.10	6.94	4.93	60.64	21.47
1976	0.10	0.05	0.04	0.00	2.30	0.23	4.42	9.02	9.48
1977	0.20	0.16	0.01	0.02	17.50	2.44	1.16	25.17	20.90
1978	0.17	0.74	0.33	0.24	51.40	1.35	1.04	62.63	24.93
1979	0.07	0.24	0.10	0.21	18.30	0.13	4.39	25.59	19.98
1980	0.02	0.26	0.33	0.77	47.40	0.25	13.87	65.28	19.92
1981	0.01	0.10	0.25	1.03	57.00	0.44	3.98	65.30	19.08
1982	0.01	0.21	0.08	0.03	23.10	0.15	8.63	34.60	15.59
1983	0.03	0.24	0.08	0.14	55.60	0.58	8.72	69.71	20.31
1984	0.08	0.16	0.14	0.35	65.40	1.82	1.60	92.42	21.45
1985	0.05	0.17	0.05	0.02	21.20	0.21	5.07	28.51	20.73
1986	0.40	0.23	0.12	0.03	25.80	0.92	2.61	34.30	23.39
1987	0.00	0.11	0.01	0.15	29.10	0.96	3.37	37.77	19.48
1988	0.01	0.51	0.00	0.00	21.00	0.72	1.40	27.28	12.31
1989	0.66	1.60	0.01	0.12	14.40	1.01	0.12	26.35	16.64
1990	0.83	11.37	1.22	0.34	125.80	2.65	0.99	159.45	23.95
1991	1.17	2.67	1.55	0.51	90.80	1.37	6.03	14.44	26.88
1992	0.09	0.09	0.02	0.24	36.00	0.49	38.31	79.81	19.10
1993	0.54	0.50	1.01	1.50	71.20	1.20	34.10	120.45	27.84
1994	0.70	0.47	0.46	0.33	29.70	0.15	68.45	104.52	17.72
1995	2.13	1.62	0.25	0.40	129.01	0.37	48.28	193.26	21.00
1996	0.82	0.62	0.58	0.47	25.82	0.09	40.65	72.05	13.27
1997	1.53	1.91	0.19	4.46	72.66	0.10	48.47	132.48	21.33
1998	1.86	0.66	0.08	0.54	53.93	0.05	36.16	89.89	19.43
1999	2.48	0.93	0.31	0.37	60.73	0.04	28.71	82.64	22.41
2000	0.38	0.30	0.00	1.33	56.61	0.15	20.61	89.85	17.79
2001	1.20	2.65	1.38	6.05	76.77	0.23	10.93	114.23	17.73

Appendix C Mosquito Biologies

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

Disease Vectors

- *Ochlerotatus triseriatus*, also known as the eastern tree hole mosquito, is the vector of La Crosse encephalitis. It breeds in tree holes and artificial containers, especially discarded tires. The adults are found in wooded or shaded areas and stay within ¼ to ½ miles from where they emerged. They are not aggressive biters and are not attracted to light. Vacuum aspirators are best for collecting this species.
- *Culex tarsalis* is the vector of western equine encephalitis. In late summer, egg laying spreads to temporary pools and artificial containers, and feeding shifts from birds to horses or humans. MMCD monitors this species using New Jersey light traps and CO_2 traps. Viral activity is monitored by testing blood from sentinel chicken flocks.
- *Culiseta melanura*, the enzootic vector of eastern equine encephalitis, inhabits spruce tamarack bogs and adults to not fly far from their breeding sources. A sampling regime is currently being developed by staff.

Spring Snow Melt Mosquitoes

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

Summer Flood Water Mosquitoes

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

Coquillettidia perturbans

This summer species breeds in cattail marshes and is called the cattail mosquito. A unique characteristic of this mosquito is that it can obtain oxygen by attaching its specialized siphon to the roots of cattails and other aquatic plants. They overwinter in this manner. Adults begin to emerge in late June, with peak emergence around the first week of July. They are very aggressive biters,

even indoors, and will fly up to five miles from the breeding site. Peak biting activity is at dusk and dawn. Surveillance of adults is best achieved with CO_2 traps.

Permanent water species

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

Appendix D Description of Control Materials

The following is an explanation of the control materials currently in use by MMCD. The specific names of products used in 2001 are given. The generic products will not change in 2002, although the specific formulator may change.

ALTOSID® (METHOPRENE) 150-DAY BRIQUETS

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

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

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

ALTOSID® (METHOPRENE) SR-20 LIQUID

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

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

ALTOSID® (METHOPRENE) PELLETS

(Wellmark International/Zoecon-Altosid® Pellets)

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

ALTOSID® (METHOPRENE) XR-G SAND

(Wellmark International/Zoecon-Altosid® XR-G Sand)

Altosid® XR-G Sand consists of methoprene formulated in a sand-sized granule designed to provide up to 10 days control. Applications will be made to ground sites (less than three acres in size) at a rate of five lbs per acre for *Aedes* control.

BACILLUS THURINGIENSIS ISRAELENSIS (*BTI*) CORN COB

(Valent Biosciences-Vectobac® G)

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

BACILLUS THURINGIENSIS ISRAELENSIS (*BTI*) LIQUID

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

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

LARVX SG

(Meridian Vector Management-LarvX SG)

LarvX SG is a soluble granular formulation of *Bti* applied aerially or by ground crews using cyclone seeders or power back packs to sites suitable for corn cob formulated *Bti*. This formulation is designed to pass through the water column (larval mosquito feeding zone) while slowly disintegrating and releasing *Bti* which should prolong direct exposure of feeding larvae to *Bti* thereby enhancing efficacy.

PERMETHRIN

(Clarke Mosquito Control Products-Permethrin 57% OS)

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

Adult control is initiated when MMCD surveillance (sweep net and light trap collections) indicates nuisance populations of mosquitoes, when employee conducted landing rate collections document high numbers of mosquitoes, or when a large number of citizen complaints of mosquito annoyance are received from an area. In the case of citizen complaints, MMCD staff evaluate mosquito levels to determine if treatment is warranted. MMCD also treats functions open to the public, and public owned park and recreation areas upon request and at no charge if the event is not-for-profit.

The District mixes permethrin with soybean and food grade mineral oil and applies it to wooded areas with a power backpack mister at a rate of 25 ounces of mixed material per acre (0.0977 lb active ingredient per acre).

RESEMETHRIN

(Aventis-Scourge® 4+12)

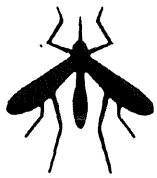
Resmethrin is used by the District to treat adult mosquitoes in known areas of concentration or nuisance. Resmethrin is applied from truck or an all-terrain-vehicle mounted ULV machines that produce a fog that contacts mosquitoes when they are flying. Fogging may also be done with hand held cold fog machines that enables the applications in smaller areas than can be reached by truck. Cold fogging is done either in the early morning or at dusk when mosquitoes become more active. Resmethrin is applied at a rate of 1.5 ounces of mixed material per acre (0.0035 lb active ingredient per acre). Resmethrin is a restricted used compound and is applied only by Minnesota Department of Agriculture licensed applicators.

SUMITHRIN

(Clarke-Anvil® 2+2)

Sumithrin is used by the District to treat adult mosquitoes in known areas of concentration or nuisance. Sumithrin is applied from truck or an all-terrain-vehicle mounted ULV machines that produce a fog that contacts mosquitoes when they are flying. Fogging may also be done with hand held cold fog machines that enable applications in smaller areas than can be reached by truck. Cold fogging is done either in the early morning or at dusk when mosquitoes become more active. Sumithrin is applied at a rate of 3.0 ounces of mixed material per acre (0.0035 lb active ingredient per acre). Sumithrin is a non-restricted use compound.

Altosid® XR
EXTENDED RESIDUAL BRIQUETS



A SUSTAINED RELEASE PRODUCT TO PREVENT ADULT MOSQUITO EMERGENCE

SPECIMEN LABEL

ACTIVE INGREDIENT:
(S)-Methoprene (CAS #65733-16-6)
(Dry Weight Basis) 2.1%
OTHER INGREDIENTS: 97.9%
Total . . . 100.0%

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

EPA Reg No. 2724-421

KEEP OUT OF REACH OF CHILDREN
CAUTION

INTRODUCTION

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

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

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

PRECAUTIONARY STATEMENTS
HAZARDS TO HUMANS AND DOMESTIC ANIMALS
CAUTION
ENVIRONMENTAL HAZARDS

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

DIRECTIONS FOR USE

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

APPLICATION TIME

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

APPLICATION RATES

Aedes and *Psorophora* spp.: For control in non-(or low-) flow shallow depressions (≤ 2 feet in depth), treat on the basis of surface area, placing 1 briquet per 200 ft². Briquets should be placed in the lowest areas of mosquito breeding sites to maintain continuous control as the site alternately floods and dries up.

Culex, Culiseta, and *Anopheles* spp.: Place one ALTOSID XR BRIQUET per 100 ft².

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

Culex sp. in storm water drainage areas, sewers, and catch basins: For catch basins, place 1 briquet into each basin. In cases of large catch basins, follow the chart below to determine the number of briquets to use. For storm water drainage areas, place 1 briquet per 100 feet square of surface area up to 2 ft deep. In areas that are deeper than 2 feet, use 1 additional briquet per 2 feet of water depth.

Large water flows may increase the dissolution of the briquet thus reducing the residual life of the briquet. Regular inspections (visual or biological) in areas of heavy water flow may be necessary to determine if the briquet is still present. The retreatment interval may be adjusted based on the results of an inspection.

Number of Briquets	Catch Basin Size (Gallons)	Surface Area/ Water Depth (ft)
1	0 – 1500	0 – 2
2	1500 – 3000	2 – 4
3	3000 – 4500	4 – 6
4	4500 – 6000	6 – 8

APPLICATION SITES

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

STORAGE AND DISPOSAL

STORAGE

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

DISPOSAL

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

WARRANTY AND CONDITIONS OF SALE

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

For information, or in case of an emergency, call 1-800-248-7763 or visit our Web site: www.altosid.com.

Wellmark

ZOËCON Professional Products

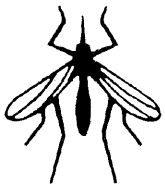
Wellmark International
Schaumburg, Illinois U.S.A.

November 2000
Schaumburg, IL

21-24-019

Made in the U.S.A.

Altosid® Pellets
MOSQUITO GROWTH REGULATOR



A GRANULAR PRODUCT TO PREVENT ADULT MOSQUITO EMERGENCE

SPECIMEN LABEL

ACTIVE INGREDIENT:	
(S)-Methoprene (CAS #65733-16-6)	4.25%
OTHER INGREDIENTS:	95.75%
Total	100.00%

EPA Reg No. 2724-448

KEEP OUT OF REACH OF CHILDREN
CAUTION

PRECAUTIONARY STATEMENTS
HAZARDS TO HUMANS AND DOMESTIC ANIMALS
CAUTION
ENVIROMENTAL HAZARDS

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

DIRECTIONS FOR USE

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

INTRODUCTION

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

GENERAL DIRECTIONS

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

APPLICATION SITES AND RATES

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

APPLICATION SITES AND RATES (CONT.)

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

APPLICATION METHODS

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

STORAGE AND DISPOSAL

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

STORAGE

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

PESTICIDE DISPOSAL

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

CONTAINER DISPOSAL

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

WARRANTY AND CONDITIONS OF SALE

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

Always read the label before using this product.

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

Wellmark

ZOËCON Professional Products

Wellmark International
Bensenville, Illinois U.S.A.

20 - 24 - 001

Made in the USA

November 1999
Bensenville, IL

Altosid® XR-G

AN EXTENDED RESIDUAL GRANULAR PRODUCT TO PREVENT ADULT MOSQUITO EMERGENCE

SPECIMEN LABEL

ACTIVE INGREDIENT:	
(S)-Methoprene (CAS #65733-16-6)	1.5%
OTHER INGREDIENTS:	98.5%
Total:	100.0%

EPA Reg No. 2724-451
EPA Est. No. 2724-TX-1

KEEP OUT OF REACH OF CHILDREN
CAUTION

PRECAUTIONARY STATEMENTS
HAZARDS TO HUMANS AND DOMESTIC ANIMALS
CAUTION

Avoid contact with skin or eyes. Due to the size and abrasiveness of the granule, use protective eyewear and clothing to minimize exposure during loading and handling.

FIRST AID

In case of contact, immediately flush eyes or skin with plenty of water. Get medical attention if irritation persists.

ENVIRONMENTAL HAZARDS

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

DIRECTIONS FOR USE

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

GENERAL DIRECTIONS

ALTOSID® XR-G releases effective levels of ALTOSID® insect growth regulator for up to 21 days after application. Applications should be continued throughout the entire season to maintain adequate control. Treated larvae continue to develop normally to the pupal stage where they die.

Rotary and fixed-wing aircraft equipped with granular spreaders capable of applying rates listed below may be used to apply ALTOSID XR-G. Ground equipment which will achieve even coverage at these rates may also be used. Apply ALTOSID XR-G uniformly and repeat application as necessary.

NOTE

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

APPLICATION TIME

Apply ALTOSID XR-G at any stage of larval mosquito development. Granules may be applied prior to flooding (i.e., "pre-hatch" or "pre-flood") in areas which flood intermittently. In such areas, one application of ALTOSID XR-G can prevent adult mosquito emergence from several subsequent floodings. The actual length of control depends on the duration and frequency of flooding events.

APPLICATION RATES

Aedes, Anopheles and *Psorophora spp.*: Apply ALTOSID XR-G at 5-10 lb/acre (5.6-11.2 kg/ha). *Culex, Culiseta, Coquillettidia, Mansonia spp*: Apply ALTOSID XR-G at 10-20 lb/acre (11.2-22.4 kg/ha). Within these ranges, use lower rates when water is shallow [<2 feet (60 cm)] and vegetation and/or pollution are minimal. Use higher rates when water is deep [≥2 feet (60 cm)] and vegetation and/or pollution are heavy.

APPLICATION SITES

NON-CROP AREAS

ALTOSID XR-G may be applied as directed above to temporary and permanent sites which support mosquito larval development. Examples of such sites include: snow pools, salt and tidal marshes, freshwater swamps and marshes (cattail, red cedar, white maple marshes), woodland pools and meadows, dredging spoil sites, drainage areas, ditches, wastewater treatment facilities, livestock runoff lagoons, retention ponds, harvested timber stacks, swales, storm water drainage areas, sewers, catch basins, tree holes, water-holding receptacles (e.g., tires, urns, flower pots, cans, and other containers), and other natural and manmade depressions.

CROP AREAS

ALTOSID XR-G may be applied as directed above to temporary and permanent sites which support mosquito larval development. Examples of such sites include: irrigated croplands, pastures, rangeland, vineyards, rice fields (domestic and wild), date palm, citrus, fruit, nut orchards, berry fields and bogs.

NOTE

Application of ALTOSID XR-G to sites subject to water flow or exchange will diminish the product's effectiveness and may require higher application rates and/or more frequent applications.

STORAGE AND DISPOSAL

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

STORAGE

Store closed containers of ALTOSID XR-G in a cool dry place.

PESTICIDE DISPOSAL

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

CONTAINER DISPOSAL

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

WARRANTY AND CONDITIONS OF SALE

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

Always read the label before using this product.

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

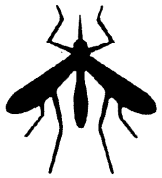
ZOËCON Wellmark

Wellmark International
Schaumburg, Illinois U.S.A

January 2000

20-24-023

Altosid® Liquid Larvicide CONCENTRATE



PREVENTS EMERGENCE OF ADULT FLOODWATER MOSQUITOES

SPECIMEN LABEL

ACTIVE INGREDIENT:	
(S)-Methoprene*	20.0%
OTHER INGREDIENTS:	80.0%
Total	100.0%

* CAS # 65733-16-6

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

EPA Reg No. 2724-446

KEEP OUT OF REACH OF CHILDREN

CAUTION

SEE ADDITIONAL PRECAUTIONARY STATEMENTS

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

PRECAUTIONARY STATEMENTS

HAZARDS TO HUMANS

CAUTION

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

ENVIRONMENTAL HAZARDS

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

DIRECTIONS FOR USE

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

CHEMIGATION

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

MIXING AND HANDLING INSTRUCTIONS

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

RECOMMENDED APPLICATIONS

INTRODUCTION

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

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 gallons of spray solution per acre is usually satisfactory. Do not apply when weather conditions favor drift from areas treated.

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

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

APPLICATION SITES

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

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

INTERMITTENTLY FLOODED NONCROP AREAS
A.L.L. may be applied as directed above when flooding may result in floodwater mosquito hatch. Typical sites include: freshwater swamps and marshes, salt marshes, woodland pools and meadows, dredging spoil sites, drainage areas, waste treatment and settling ponds, ditches and other natural and manmade depressions.

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

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

STORAGE AND DISPOSAL

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

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

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

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

For information call 1-800-248-7763

Always read the label before using the product.

Wellmark

ZOECON Professional Products

Wellmark International
Schaumburg, Illinois U.S.A.

21-24-004

Made in the U.S.A.

October 2000
Schaumburg, IL

AQUABAC™ xt

Biological Larvicide Aqueous Suspension

SPECIMEN

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

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

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

EPA Reg. No. 62637-1

KEEP OUT OF REACH OF CHILDREN
CAUTION!

STATEMENT OF PRACTICAL TREATMENT

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

See Additional Precautionary Statements on Next Page.

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

PRECAUTIONARY STATEMENTS

CAUTION

HAZARDS TO HUMANS AND DOMESTIC ANIMALS:

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

DIRECTIONS FOR USE

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

STORAGE AND DISPOSAL

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

Storage: Store in a cool, dry place.

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

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

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

DISCLAIMER

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

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

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

MOSQUITOES:

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

SPECIFIC APPLICATION INSTRUCTIONS

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

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

BLACKFLIES:

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

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

SPECIFIC APPLICATION INSTRUCTIONS

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

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

ABBOTT LABORATORIES

VectoBac® 12AS

Biological Larvicide
Aqueous Suspension

ACTIVE INGREDIENT:

Bacillus thuringiensis, subsp. *israelensis*, 1200 International Toxic Units (ITU) per mg (Equivalent to 4.84 billion ITU per gallon, 1.279 billion ITU per liter)..... 1.2%
INERT INGREDIENTS..... 98.8%
TOTAL..... 100.0%

EPA Reg. No. 275-102
EPA Est. No. 33762-IA-1 List No. 5605

INDEX:

KEEP OUT OF REACH OF CHILDREN

CAUTION

1.0 STATEMENT OF PRACTICAL TREATMENT

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

If on Skin: Wash thoroughly with plenty of soap and water. Get medical attention if signs of irritation persists.

2.0 PRECAUTIONARY STATEMENTS

2.1 HAZARD TO HUMANS (AND DOMESTIC ANIMALS)

CAUTION

Hazards to Humans

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

2.2 Physical and Chemical Hazards

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

3.0 DIRECTIONS FOR USE

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

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

3.1 Chemigation

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

4.0 STORAGE AND DISPOSAL

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

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

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

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

5.0 APPLICATION DIRECTIONS

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

Mosquito Habitat *(Such as the following examples):*	Suggested Rate Range*
Irrigation ditches, roadside ditches, flood water, standing ponds, woodland pools, snow melt pools, pastures, catch basins, storm water retention areas, tidal water, salt marshes and rice fields.	0.25 - 1 pt/acre

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

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

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

CONTINUED

5.0 APPLICATION DIRECTIONS (continued)

*Use higher rate range 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.

Blackflies Habitat	Suggested Rate Range
Streams	
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 range when stream contains high concentration of organic materials, algae, or dense aquatic vegetation.

**Discharge is a principal factor determining carry of Bti. Use higher rate or increase volume by water dilution in low discharge rivers or streams under low volume (drought) conditions.

6.0 SMALL QUANTITY DILUTION RATES

Gallons Spray Solution/Acre
(Ounces Needed per Gallon of Spray)

VectoBac 12AS
Rate in Pints

Per Acre	10 Gal/A	25 Gal/A	50 Gal/A
0.25 (4 oz)	0.4	0.16	0.08
0.5 (8 oz)	0.8	0.32	0.16
1.0 (16 oz)	1.6	0.64	0.32
2.0 (32 oz)	3.2	1.28	0.64

7.0 GROUND AND AERIAL APPLICATION

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

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

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

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

Rinse and flush spray equipment thoroughly following each use.

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

8.0 CHEMIGATION

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

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

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

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

8.1 Rice-Flood (Basin) Chemigation

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

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

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

9.0 NOTICE TO USER

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

Abbott Laboratories - Quality Health Care World Wide
Agricultural Products, North Chicago, IL 60064 (800) 323-9597 04-2711/R3 3/99

ABBOTT LABORATORIES

VectoBac® G

Biological Larvicide Granules

ACTIVE INGREDIENT:

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

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

INDEX:

KEEP OUT OF REACH OF CHILDREN
CAUTION

1.0 STATEMENT OF PRACTICAL TREATMENT

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

2.0 DIRECTIONS FOR USE

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

3.0 STORAGE AND DISPOSAL

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

Storage: Store in a cool, dry place.

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

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

4.0 APPLICATION DIRECTIONS

VectoBac G is an insecticide for use against mosquito larvae.

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

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

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

Apply uniformly by aerial or ground conventional equipment.

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

5.0 NOTICE TO USER

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

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

SPECIMEN LABEL

Teknar® G

High Potency Larvicide for Mosquitoes

KEEP OUT OF REACH OF CHILDREN

ACTIVE INGREDIENT

Bacillus thuringiensis subspecies *israelensis*	1.7%
Equivalent to 200 ITU/mg.	
OTHER INGREDIENTS	98.3%
TOTAL	100.0%

The percent active ingredient does not indicate product performance and potency measurements are not federally standardized.

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

PERSONAL PROTECTIVE EQUIPMENT (PPE)
Mixer/loaders and applicators must wear a dust/mist filtering respirator meeting NIOSH standards of at least N-95, R-95, or P-95. Repeated exposure to high concentrations of microbial proteins can cause allergic reactions.

FIRST AID
IF ON SKIN OR CLOTHING:
Take off contaminated clothing.

Rinse skin immediately with plenty of water for 15-20 minutes.

Call a poison control center or doctor for treatment advise.

IF INHALED:
Move person to fresh air.

If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably mouth-to-mouth if possible.

Call a poison control center or doctor for treatment advice.

Have the product container or label with you when calling a poison control center or doctor, or going for treatment.

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:
Completely empty bag into application equipment. Then dispose of empty bag in a sanitary landfill or by burning. If burned, stay out of smoke.

EPA Registration Number: 70051-73
EPA Establishment Number: EPA Est. No. 44616-MO-01
LOT NUMBER:

Teknar G is a highly selective microbial insecticide effective against mosquitoes in a variety of habitats.

DIRECTIONS FOR USE:
It is a violation of Federal Law to use this product in a manner inconsistent with its labeling. Teknar G may be applied to any water sites except treated, finished water reservoirs or drinking water receptacles.

MOSQUITOES:

Habitat	Rate Required for Control*
Aquatic/Wetland areas including Ponds, Small lakes, Irrigation Ditches, Rice Fields, Pastures, Woodland Pools, Woodland Ponds, Snow Melt Pools, Tidal Water, Salt Marshes, Catch Basins, Storm Water Retention Areas	2.5 - 10.0 pounds/acre
All Wastewater(s): sewage treatment areas such as sewage effluent, sewage lagoons, oxidation ponds, septic ditches, sewage pipes, animal waste lagoons	2.5 - 20.0 pounds/acre

*When late third and early fourth instar larvae predominate, larval populations are high, or water is heavily polluted and/or algae are prevalent, use 10-20 pounds/acre.

SPECIFIC APPLICATION INSTRUCTIONS:
Teknar G should be applied uniformly in conventional aerial and ground equipment. A seven to fourteen-day interval between applications should be employed. Longer periods of mosquito population suppression may result where sufficient numbers of non target aquatic invertebrate parasites and predators are present, since these are not affected by Teknar G and contribute to mosquito population reduction.

WARRANTY:
CERTIS USA, L.L.C. warrants that the material contained herein conforms to the description on the label and is reasonably fit for the purposes referred to in the directions for use. Timing and method of application, weather, watering practices, nature of soil, the insect problem, condition of the crop, incompatibility with other chemicals not specifically recommended, and other influencing factors in the use of this product are beyond the control of the seller. Buyer assumes all risks of use, storage or handling not in strict accordance with the directions given herein. NO OTHER EXPRESS OR IMPLIED WARRANTY OR THE FITNESS OR MERCHANTABILITY IS MADE.

NET CONTENTS: 40 POUNDS (18.1 KG)

CERTIS

CERTIS USA, L.L.C. • 9145 Guilford Road, Suite 175 • Columbia, MD 21046

LarvX™ SG

Biological Larvicide Soluble Granules

ACTIVE INGREDIENT:

Bacillus thuringiensis, subspecies *israelensis*
262 International Toxic Units (ITU) per mg
(Equivalent to 0.119 billion ITU per pound) 00.26%

INERT INGREDIENTS: 99.74%

100.00%

There is no direct relationship between intended activity (potency) and the Percent Active Ingredient by Weight.

KEEP OUT OF REACH OF CHILDREN

CAUTION

STATEMENTS OF PRACTICAL TREATMENT

IF IN THE EYES: Flush with plenty of water. Call a physician if irritation persists.

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

DIRECTIONS FOR USE

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

LarvX™ SG is a microbial insecticide effective against mosquitoes in a variety of habitats.

Mosquito Habitat Examples	**Rate Range***
Irrigation runoff, flood water, woodland pools, snow melt pools, ponds, pastures, rice fields, freshwater marshes, ditches, tidal water, salt marshes.	2 - 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 deep, heavily polluted, and/or algae is abundant. Soft bottom sites may require the higher rates.

Apply uniformly by conventional aerial or ground equipment as needed to maintain mosquito control. For permanently flooded habitats, a 7 to 14 day interval between applications may be employed.

PRECAUTIONARY STATEMENTS

HAZARDS TO HUMANS AND DOMESTIC ANIMALS: Causes moderate eye irritation. As a general precaution when exposed to potentially high concentrations of living mircrobial products such as this, all mixer/loaders and applicators not in enclosed cabs or aircraft must wear a dust/mist filtering respirator meeting NIOSH standards of at least N-95, R-95, or P-95. Avoid contact with skin and eyes, or clothing. Wash thoroughly with soap and water after handling.

ENVIRONMENTAL HAZARDS: Do not apply directly to treated, finished drinking water reservoirs or drinking water receptacles. Avoiding spray drift at the application site is the responsibility of the applicator. The interaction of many equipment-and-weather-related factors determine the potential for spray drift. The applicator and the grower are responsible for considering all these factors when making decisions.

STORAGE AND DISPOSAL

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

STORAGE: Store in a cool, dry place.

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

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

NOTICE TO USER

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

Meridian LLC
5137 14th Avenue South
Minneapolis, MN 55417-1801

EPA Reg. No. 69504-1
EPA Est. No. 54094-MN-1

Lot No: _____

Net Weight: 40 Pounds (18.2 Kg.)

MERIDIAN
Vector Management

U.S. Patent Number 5,484,600

PERMETHRIN 57% OS

CLARKE

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

Precautionary Statements

HAZARDS TO HUMANS AND DOMESTIC ANIMALS

CAUTION

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

STATEMENT OF PRACTICAL TREATMENT

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

ENVIRONMENTAL HAZARDS

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

PHYSICAL OR CHEMICAL HAZARDS

Do not use or store near heat or open flame.

DIRECTIONS FOR USE

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

CONDITIONS and RATES to USE for MOSQUITO CONTROL

FOR A BARRIER SPRAY

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

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

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

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

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

Contains petroleum distillates.

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

Contains 5 lb./gal. Permethrin

CAUTION

KEEP OUT OF REACH OF CHILDREN

SAMPLE

MANUFACTURED BY

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

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

NET CONTENTS_____

LOT NO. _____

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

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

To Kill Gypsy Moths and Tentcaterpillars infesting woodland and forest areas: Apply the insecticide-oil mixture (as described above) directly to insect nests and vegetation by backpack applicator using 82 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, golf courses, residential areas and municipalities, gardens, [illegible] recreational areas and overgrown waste areas. Do not apply this product within 100 feet of lakes and streams. Do not allow spray treatment to drift on pastureland, cropland, poultry ranges or water supplies. Best results are [illegible] when mosquitoes are most active and weather conditions are [illegible] to keep the fog close to the ground, e.g. cool temperatures and [illegible] not greater than 10 mph. Applications during the cool hours of the night or early morning are usually preferable. Repeat treatment as needed.

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

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

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

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

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

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

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

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

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

STORAGE & DISPOSAL

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

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

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

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

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

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

IN CASE OF EMERGENCY, CALL INFOTRAC 1-800-535-5053

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

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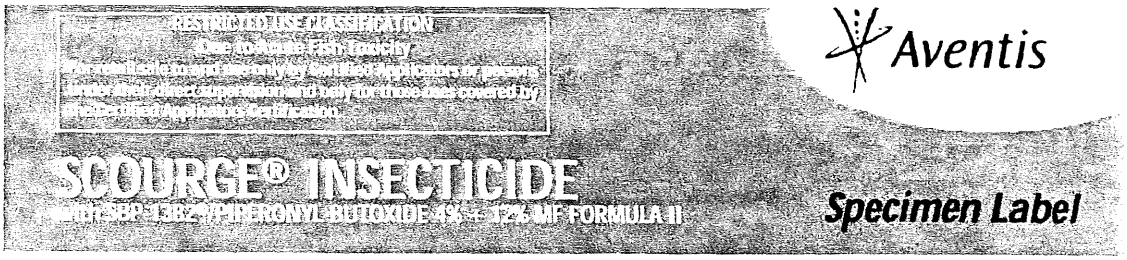

- *A READY TO USE SYNTHETIC PYRETHROID FOR EFFECTIVE ADULT MOSQUITO (INCLUDING ORGANOPHOSPHATE RESISTANT SPECIES), MIDGE (BITING AND NON-BITING), AND BLACK FLY CONTROL*
- *TO BE APPLIED BY MOSQUITO ABATEMENT DISTRICTS, PUBLIC HEALTH OFFICIALS AND OTHER TRAINED PERSONNEL IN MOSQUITO CONTROL PROGRAMS.*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

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

*Cis/trans isomers ratio: max. 30% (+) cis and min. 70% (-) trans.
Avenis Environmental Science SBP-1382® brand of resmethrin insecticide
**Equivalent to 9.94% (butylcarbityl) (6-propylpiperonyl) ether and 2.48% related compounds.
†Contains Petroleum Distillates

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

EPA REG. NO. 432-716 **EPA EST. NO.** 716res: 06/00:k

KEEP OUT OF REACH OF CHILDREN
CAUTION
FIRST AID

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

See Side Panel For Additional Precautionary Statements

In case of Medical emergencies or health and safety inquiries or in case of fire, leaking or damaged containers, information may be obtained by calling 1-800-334-7577.

For product information Call Toll-Free:1-800-331-2867

NET CONTENTS:

AVENTIS ENVIRONMENTAL SCIENCE USA LP

PRECAUTIONARY STATEMENTS
Hazards To Humans & Domestic Animals

CAUTION

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

Environmental Hazards

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

DIRECTIONS FOR USE

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

STORAGE AND DISPOSAL

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

Storage: Store product in original container in a locked storage area.

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

Container Disposal: Triple rinse (or equivalent). Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or by other procedures approved by State and Local authorities.

READ ENTIRE LABEL FOR DIRECTIONS

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

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

This product is to be used for control of adult mosquitoes (including organophosphate resistant species), midges (biting and non biting) and blackflies by specially designed aircraft capable of applying ULTRA LOW VOLUME of finished spray formulation or by ground application with non thermal 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 (371-742 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 0.0035-0.007 lb ai SBP 1382/A (3.92-7.85 gm/ha) plus 0.0105-0.021 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 TIFCO HD or MICRO GEN or WHISPERMIST XL, adjust equipment to deliver fog particles of 8-20 microns mass median diameter. Consult the following chart for application rates.

Treatment lb ai/A of Scourge Wanted: SBP-1382/PBO	Fl oz/A of Undiluted Spray to be Applied	Application Rate-Fl oz/Min	
		5 MPH	10 MPH
0.007/0.021	3.090 ml)	9.0(266.2ml)	18.0(532.2ml)
0.0035/0.0105	1.545 ml)	4.5(133.1 ml)	9.0(266.2 ml)
0.00175/0.00525	0.75(22.5 ml)	2.2(66.6 ml)	4.5(133.1 ml)
0.00117/0.00351	0.50(15 ml)	1.5(44.3 ml)	3.090 ml)

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

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

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

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

DIRECTIONS FOR STABLE FLY, HORSE FLY, DEER FLY CONTROL

Treat shrubbery and vegetation where the above flies may rest. Shrubbery and vegetation around stagnant pools, marshy areas, ponds and shorelines 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 1.78 fl oz/hr (5.26 l/hr) by use of a suitable ULV generator travelling at 5 mph (8 kph) or at a rate of 356 fl oz/hr (10.53 l/hr) while travelling at 10 mph (16 kph). When spraying, apply across wind direction approximately 300 ft (91.4 m) apart.

Apply when winds range from 1-10 mph (1.6-16.0 kph). Repeat for effective control.

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

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

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

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

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

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

APPLICATION INSTRUCTIONS FOR PRODUCT IN AIRCRAFT USAGE

lb ai/A Wanted SBP-1382/PBO	Fl oz/A of Undiluted Spray to be Applied
0.007/0.021	3.0 (90 ml)
0.0035/0.0105	1.5 (45 ml)
0.00175/0.00525	0.75 (22.5 ml)
0.0017/0.0035	0.50 (15 ml)

IMPORTANT: READ BEFORE USE

Read the entire Directions for Use, Conditions, Disclaimer of Warranties and Limitations of Liability before using this product. If terms are not acceptable, return the unopened product container at once.

By using this product, user or buyer accepts the following conditions, disclaimer of warranties and limitations of liability.

CONDITIONS: The directions for use of this product are believed to be adequate and should be followed carefully. However, it is impossible to eliminate all risks associated with the use of this product. Ineffectiveness or other unintended consequences may result because of such factors as weather conditions, presence of other materials, or the manner of use or application, all of which are beyond the control of Aventis Environmental Science USA LP. All such risks shall be assumed by the user or buyer.

DISCLAIMER OF WARRANTIES: AVENTIS ENVIRONMENTAL SCIENCE USA LP MAKES NO OTHER WARRANTIES, EXPRESS OR IMPLIED, OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE OR OTHERWISE, THAT EXTEND BEYOND THE STATEMENTS MADE ON THIS LABEL. No agent of Aventis Environmental Science USA LP is authorized to make any warranties beyond those contained herein or to modify the warranties contained herein. Aventis Environmental Science disclaims any liability whatsoever for special, incidental or consequential damages resulting from the use or handling of this product.

LIMITATIONS OF LIABILITY: THE EXCLUSIVE REMEDY OF THE USER OR BUYER FOR ANY AND ALL LOSSES, INJURIES OR DAMAGES RESULTING FROM THE USE OR HANDLING OF THIS PRODUCT, WHETHER IN CONTRACT, WARRANTY, TORT, NEGLIGENCE, STRICT LIABILITY OR OTHERWISE, SHALL NOT EXCEED THE PURCHASE PRICE PAID, OR AT AVENTIS ENVIRONMENTAL SCIENCE'S ELECTION, THE REPLACEMENT OF PRODUCT.

Aventis Environmental Science USA LP
95 Chestnut Ridge Road
Montvale, NJ 07645
S4-12 SL 6/00

ANVIL® 2+2 ULV

Contains An Oil Soluble Synergized Synthetic Pyrethroid For Control of Adult Mosquitoes (Including Organophosphate-Resistant Species) Midges, and Black Flies in Outdoor Residential and Recreational Areas.

CLARKE

Precautionary Statements
HAZARDS TO HUMANS AND DOMESTIC ANIMALS

Harmful if swallowed or absorbed through the skin. Do not induce vomiting because of aspiration pneumonia hazard. Avoid contact with skin, eyes or clothing. In case of contact flush with plenty of water. Wash with soap and water after use. Obtain medical attention if irritation persists. Avoid contamination of food and feedstuffs.

ENVIRONMENTAL HAZARDS

Do not contaminate untreated water by cleaning of equipment. Cleaning of equipment or disposal of wastes must be done in a manner that avoids contamination of bodies of water or wetlands. For terrestrial uses, do not apply directly to water, or to areas where surface water is present or to interlidal areas below the mean high water mark.

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.

USE AREAS: For use in mosquito adulticiding programs involving outdoor residential and recreational areas where adult mosquitoes are present in annoying numbers in vegetation surrounding parks, woodlands, swamps, marshes, overgrown areas and golf courses.

For best results, apply when mosquitoes are most active and weather conditions are conducive to keeping the fog close to the ground. i.e. cool temperatures and wind speed not greater than 10 mph.

E.P.A. EST. No. 8329-IL-01
EPA Reg. No. 1021-1687-8329

NET CONTENTS

LOT NO.

ACTIVE INGREDIENTS:	
3-Phenoxybenzyl-(1RS, 3RS; 1RS, 3SR)-2,2-dimethyl-3-(2-methylprop-1-enyl) cyclopropanecarboxylate	2.00%
* Piperonyl Butoxide, Technical	2.00%
** INERT INGREDIENTS	96.00%
	100.00%

* Equivalent to 1.60% (butylcarbityl) (6-propylpiperonyl) ether and .40% related compounds
** Contains a petroleum distillate
Contains 0.15 pounds of Technical SUMITHRIN®/Gallon and 0.15 pounds Technical Piperonyl Butoxide/Gallon

SUMITHRIN®- Registered trademark of Sumitomo Chemical Company, Ltd.

KEEP OUT OF REACH OF CHILDREN
CAUTION

PRECAUCION AL USUARIO: 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. Do not induce vomiting because of aspiration pneumonia hazard.
IF IN EYES: Flush eyes with plenty of water. Call a physician if irritation persists.
IF ON SKIN OR CLOTHING: Remove contaminated clothing and wash before reuse. Wash skin with soap and warm water. Get medical attention if irritation persists.
IF INHALED: Remove victim to fresh air. If not breathing, give artificial respiration, preferably mouth to mouth.

DISTRIBUTED BY

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

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.

APPLICATION AND DILUTION DIRECTIONS: Consult the following table for examples of various dosage rates using a swath width of 300 feet for acreage calculations. This product should be used in cold aerosol generators capable of producing a fog in which the majority of droplets are in the 5 to 25 micron range.

Dosage Rate lbs.A.I./acre	Flow Rates in fluid oz./minute at truck speeds of:			
	5MPH	10MPH	15MPH	20MPH
0.0036	9.3 oz.	18.6 oz	28.2 oz	37.5 oz
0.0024	6.2 oz	12.4 oz	18.8 oz	25.0 oz
0.0012	3.1 oz	6.2 oz	9.4 oz	12.5 oz

ANVIL 2 + 2 ULV may be applied undiluted with a non-thermal ULV portable "backpack" spray unit capable of delivering particles in the 5 to 25 micron range. Apply at a walking speed 2 mph, making sure that the same amount of A.I. is applied per acre.

ANVIL 2+2 ULV may be applied with suitable thermal fogging equipment. Do not exceed the maximum rate listed above. May be applied at speeds of 5 to 20 mph.

Prohibition on aerial use: Not for aerial application in Florida unless specifically authorized by the Bureau of Entomology, Florida Department of Agriculture and Consumer Services.

The use and specially designed aircraft capable of applying Ultra Low Volumes at above recommended rates may be considered necessary when conducted at the discretion of Public Health Officials, Mosquito Abatement Districts and other trained personnel engaged in outdoor mosquito and biting fly control programs when these insects threaten to become a public health hazard.

ANVIL 2 + 2 ULV can not be diluted in water. Dilute this product with light mineral oil if dilution is preferred.

STORAGE & DISPOSAL

Do not contaminate water, food or feed by storage or disposal.
STORAGE: Store in a cool, dry place. Keep container closed.
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.
PESTICIDE DISPOSAL: Wastes resulting from the use of this product may be disposed of on site or at an approved waste disposal facility.

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

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Appendix F Acres Treated with Control Materials Used by MMCD for Mosquito and Black Fly Control for 1993-2001. The actual geographic area treated is smaller because some sites are treated more than once.

Control Material	1993	1994	1995	1996	1997	1998	1999	2000	2001
Altosid® XR Briquet 150-day	10,537	8,557	7,303	422	501	371	533	533	589
Altosid® XR Briquet 90-day	0	0	0	0	0	961	0	0	0
Altosid® Sand-Products	630	678	871	712	1,096	1,868	3,968	786	1,889
Altosid® Pellets 30-day	5,562	5,374	8,212	10,654	8,851	10,432	13,775	11,121	14,791
Altosid® SR-20 liquid	15	13	668	565	1,645	529*	355	29	91
Bti Corn Cob granules	126,778	102,860	131,589	68,355	106,755	113,539*	118,733	84,521	90,527
Bti Liquid Black Fly (gallons used)	5,090	4,047	3,606	3,025	5,445	4,233	4,343	821	4,047
Permethrin Adulticide	8,261	10,499	6,305	5,914	6,340	6,164	4,865	4,066	3,444
Resmethrin Adulticide	53,345	40,687	61,858	120,472	106,065	65,356	51,582	42,986	41,311
Sumithrin Adulticide	0	0	0	0	0	0	0	0	8,423

* These values are updated, therefore some values may differ from similar values in earlier publications.

Appendix G 2001 Control Materials: Percent Active Ingredient (AI), AI Identity, Per Acre Dosage, AI Applied Per Acre and Field Life

Material	AI	Percent AI	Per acre dosage	AI per acre	Field life
Altosid® briquets	Methoprene	2.10	220 briquets [a]	0.4481 lb	150 days
			330 briquets [a]	0.6722 lb	150 days
			440 briquets [a]	0.8963 lb	150 days
Altosid® pellets	Methoprene	4.25	2.5 lb	0.1063 lb	30 days
			4 lb	0.1700 lb	30 days
Altosid® SR-20	Methoprene	20.00	20 ml [b]	0.0091 lb	10 days
Altosid® XR-G	Methoprene	1.50	5 lb	0.0750 lb	20 days
Altosand	Methoprene	0.05	5 lb	0.0025 lb	10 days
Vectobac® G	*Bti*	0.20	5 lb	0.0100 lb	1 day
			8 lb	0.0160 lb	1 day
Permethrin 57%OS	Permethrin	5.70	25 fl oz [c]	0.0977 lb	5 days
Scourge®	Resmethrin	4.14	1.5 fl oz [d]	0.0035 lb	<1 day
Anvil®	Sumithrin	2.00	3.0 fl oz [e]	0.0035 lb	<1 day

[a] 44 g per briquet total weight (220 briquets=21.34 lb total weight)
[b] 1.72 lb ai per 128 fl oz (1 gal); 0.45 lb ai per 1000 ml (1 liter)
[c] 0.50 lb ai per 128 fl oz (1 gal) (product diluted 1:10 before application, undiluted product contains 5.0 lb AI per 128 fl oz)
[d] 0.30 lb AI per 128 fl oz (1 gal)
[e] 0.15 lb AI per 128 fl oz (1 gal)

Appendix H Meeting Minutes

Meeting of the Technical Advisory Board
Friday, January 25, 2002 12:30 p.m.

TAB members in Attendance:
Dave Neitzel (Chair), MN Department of Health (MDH)
Roger Moon, University of Minnesota Department of Entomology (UM)
Larry Gillette, Hennepin County Parks
Gary Montz, MN Department of Natural Resources (MnDNR)
Susan Palchick, Hennepin County Department of Health
Bob Sherman, Statistician
Danny Tanner, US Environmental Protection Agency (EPA)
Geir Frisoe, MN Department of Agriculture
Terry Schreiner, US Fish and Wildlife Service

MMCD Staff in Attendance:

Joseph Sanzone	Cara Hansmann	Stephen Manweiler	Mark Smith
Sandy Brogren	Janet Jarnefeld	Michael McLean	Jim Stark
Diann Crane	Kirk Johnson	Nancy Read	Chris Stevens

Guests:
Judy Belairs, Sierra Club Scott Seys, MDH

Dave Neitzel called the meeting to order at 12:35 p.m.

Welcome, introduction and overview -- Joe Sanzone

Joe Sanzone, MMCD Director, gave a brief welcome and outlined District activities in 2001, and plans for 2002. Joe welcomed Danny Tanner, a fisheries biologist from the EPA Duluth office, as a new TAB member. In 2001 Eastern Equine Encephalitis (EEE) appeared in Minnesota for the first time in recent history. A key vector is *Culiseta melanura*. EEE is very virulent with an overall human case fatality rate of about 30%. We do not know if we will have human cases. It is hard to predict if there will be additional horse cases. Western Equine Encephalitis (WEE) was detected in a sentinel chicken. West Nile Virus (WNV) is a major concern. Joe stressed that in 2002 MMCD will work closely with MDH to respond to concerns about increased arboviral activity. MMCD will consider modifying its program to survey for mosquito species that recently have been identified as being potential health risks to humans and animals in MN.

Overview: Mosquito Vectors
Kirk Johnson, MMCD Vector Ecologist, gave an overview of District activities in 2001. There were 12 cases of La Crosse Encephalitis (LAC) reported in 2001 in Minnesota. Two were residents of the District and six were from nearby counties. MMCD responded to seven cases (two in the District and five nearby in western Carver, LeSueur, Rice and Wright counties), and

worked to reduce mosquito-breeding containers in neighborhoods and other areas of probable exposure to reduce potential for further transmission.

This season was unique in that the first case of LAC was reported June 18, one of the earliest on record in Minnesota. The final reported case of the season was delivered on September 27. The age group affected by LAC was 18 months to 30 years.

The District continues to stress prevention as the best way to reduce risk of mosquito-borne illness. The percentage of vacuum aspirator samples testing above threshold for tree hole mosquitoes was lower overall than in past years, probably because tree hole mosquito levels were lower later in the season. Fourteen percent of aspirator samples resulted in treatments, compared to 20 to 25 percent in recent seasons.

Three equine cases of EEE were identified in Minnesota including one in Anoka County. These are the first EEE cases recorded in Minnesota. MMCD worked with MDH on investigations both in Minnesota and Wisconsin. Early-season flooding extended through mid-July in these areas. An EEE epizootic in Wisconsin appears to have expanded resulting in the cases in Minnesota and one in Iowa. *Cs. melanura* adults were found at two of the three Minnesota case locations. This species larval habitat is primarily tamarack bogs and hardwood swamps, which were found near the two northern cases. The southern site was near riparian wetlands and some cattail mosquito sites. In 2002 we plan to focus larval surveillance in *Cs. melanura* larval habitat in northern Anoka Co. and bog and woodland pool sites in other areas of the district, as well as adult sampling for this species with CO_2 traps, aspirators, and possibly resting boxes.

In 2001 a new team was formed to focus on vector-borne disease issues in MMCD.

WEE was detected in a sample taken from one sentinel chicken at the site in western Hennepin County on Sept. 5. MMCD responded with additional surveillance but found no *Culex tarsalis* at that time; no control treatments were applied. MMCD notified the public but indicated to them that risk was low. *Cx. tarsalis* populations had peaked in early July but dropped off through the rest of the summer.

Questions and Comments

Larry Gillette: How much time passes between LAC human infection and symptoms, diagnosis?
Kirk Johnson: Five to fifteen days typically, the onset of symptoms is more often during the early part of that incubation range.
Larry Gillette: Many cases seem to be reported in Sept. There does not seem to be much you can do at that time to reduce adult mosquitoes. Is general prevention important?
Kirk Johnson: An immediate response may help prevent overwintering of the virus by eliminating habitats where infected *Ochlerotatus triseriatus* eggs have been deposited.
Roger Moon: Could you report an estimate of field exposure date for LAC cases as it helps clarify whether timing of field surveillance is appropriate? What you are currently reporting is not as useful.
Kirk Johnson: We can report the date of onset of symptoms of the illness and we can estimate the date of exposure based upon conversations with the patient and the patient's parents.
Gary Montz: What was Wisconsin's Response to EEE outbreak? Surveillance, larval control, any

human cases?
Kirk Johnson: In Wisconsin there were no human cases. Wisconsin had no mosquito surveillance network in place, and for this reason asked MDH for help. MDH asked MMCD to assist. We are not aware of their preparations for mosquito surveillance next year.
Roger Moon: What is routine in the East Coast endemic area?
Kirk Johnson: There are surveillance networks set up for *Cs. melanura*, and viral tests can be performed. An increased number of *Cs. melanura* is an alert that EEE risk might be increased.
Dave Neitzel: *Cs. melanura* is not a bridge vector (in this case a vector that carries virus from birds to humans and horses). It builds up virus in birds. Bridge vectors are targeted in control but I had not heard of anybody focusing on *Cs. melanura* control.
Joe Sanzone: Upstate New York has done and still may be doing larval control for *Cs. melanura*. They found they could get larvicides into *Cs. melanura* breeding sites.
Gary Montz: Did environmental conditions play a large role in cases occurring this year?
Kirk Johnson: Most likely in the EEE outbreak, not so much for LAC. We do not know if the EEE virus has recently been introduced in the area or if birds introduce virus frequently and conditions are not usually right for transmission to horses and people.
Gary Montz: Do they vaccinate horses against EEE?
Kirk Johnson: A vaccine does exist for horses. The infected horses had not been vaccinated previously because horse owners and/or their veterinarians felt the risk of EEE was low. MMCD recommends vaccinating horses.
Roger Moon: A trivalent vaccine against EEE, WEE and Venezuelan Equine Encephalitis is available. The vaccination rate goes up and down relative to news reports of virus. Not sure points of equine cases on map tells us much about human risk.
Kirk Johnson: As the proportion of horses vaccinated increases, equine EEE cases become less of an indicator of risk. There was one human fatality in Michigan without any indications of the virus detected either in horses or through other sentinel surveillance.
Bob Sherman: Is any evidence of unreported, sub-clinical cases available?
Dave Neitzel: Most arboviruses have many asymptomatic or mild cases, and we typically only hear about the severe cases. In prior serological studies with LAC and other arboviruses there are always more people out there with evidence of infection (antibodies) than those that were diagnosed with the disease. I have not seen data on EEE specifically.

Kirk Johnson reviewed the current status of WNV in the USA and described how MMCD is preparing to deal with WNV. Current states with WNV activity reported were shown, including Wisconsin and Iowa. In 2001, a total of 416 equine and 55 human cases were reported to date including eight human fatalities. A WNV vaccine is available for horses in areas with WNV problems.
MMCD is testing the CDC gravid trap which uses an oviposition medium that targets *Culex* spp. Results in 2001 were useful. MMCD also worked on larval surveillance tests at the neighborhood level, including areas in Roseville (urban), Eagan (suburban), and Sand Creek (rural). Larvae were collected from wetlands, artificial sources (tires, buckets, containers), and storm water systems. Larvae were not found in storm water systems. CO_2 and gravid traps were placed in neighborhoods to compare with larval collections. Water temperature was evaluated to see if it helps predict species. No obvious relationship was detected. Results showed *Culex territans* predominant, plus *Culex pipiens* later in season. A review of historic larval collection data available revealed patterns similar to those observed in 2001 larval habitat study. Historic data

should be helpful in identifying which sites are most likely to produce *Culex* larvae and will provide a starting point for developing larval control programs if needed. MMCD also examined the production potential of containers. Very few *Cx. pipiens* were found in samples from containers collected for LAC surveillance; *Culex restuans* was more common.

Plan for 2002:

1. Dead bird surveillance (assist MDH), especially crows
2. Adult mosquito surveillance; some additional surveillance for virus analysis
3. Continue to identify larval habitat in preparation for control efforts

If WNV detected:

1. Additional adult mosquito surveillance, viral analysis
2. Additional larval mosquito surveillance
3. Public Education to reduce public exposure to virus
4. Media contacts (coordinated with MDH)

WNV mosquito control response

1. Situation-dependent response
2. Control decisions based on surveillance data and control area conditions.
3. Extent of control determined by risk to human health
4. Several risk criteria and possible responses
    a. Remote likelihood of human exposure: WNV not detected in Minnesota
        i. Continue with current mosquito control activities
    b. Low: WNV detected in or near District, sporadic, avian epizootic only
        i. Respond with neighborhood inspection for larvae, notify residents
        ii. Possible backpack or fog adult control in location of positive sample
    c. Moderate: WNV in mammals, bridge vectors
        i. Aggressive larval and adult control against bridge vectors, based on surveillance
        ii. Consider control against amplifying vectors
    d. High: Many reports of WNV positive birds, horses, mosquitoes or human cases at time of year with additional mosquito populations expected
        i. Aggressive larval and adult control (backpack) against bridge or human vectors
        ii. Evening adult mosquito control
        iii. Consider additional larval control of amplifying vectors
    e. Human outbreak
        i. Aggressive larval and adult control of bridge vectors
        ii. Evening adult mosquito control
        iii. Larval control of amplifying vectors
        iv. Aerial adult control <u>if no other control method feasible</u>
5. Remaining questions

    In our area what mosquito species are of greatest concern as bridge, amplifying and human vectors?

    What are most effective and environmentally sound methods for controlling these species?

    What are most important criteria for risk?

    Dead birds, mosquito surveillance, veterinary and medical reports of animal and human cases

What funding sources are available for small and large scale responses?
What WNV concerns do District residents have, and how do we respond?

Questions and Comments

Bob Sherman: When outbreaks occur, how large are they likely to be (restricted to a township, fraction of a county or throughout seven county area)?

Kirk Johnson: Have seen both small and large scale outbreaks, some sporadic and some in Florida that were much more widespread.

Bob Sherman: What do you need to be prepared for a big splash? If big, how could MMCD possibly respond?

Kirk Johnson: MMCD is prepared for a number of different scenarios including an expanding capability to address larval control. However there could be an outbreak requiring a response greater than our resources will support.

Roger Moon: Is the air force tactical unit used in 1983 still available?

Kirk Johnson: Do not know but MMCD has stipulated in the helicopter contract to include aerial adulticing capabilities.

Joe Sanzone: MMCD is not planning on using C130s, only helicopters if absolutely necessary.

Roger Moon: Geographic distribution maps suggest widespread occurrence of WNV although not that continuous. In a case-control study of equine cases in New York, the geographical distribution of 60 dead horses was very patchy (available on web). It is way too early to tell endemic nature of WNV.

Bob Sherman: If control measures we normally have in place are what we need for these vectors, that's one thing. Then we just need more resources. On the other hand, if we have an outbreak, do we have to address with a regional adulticide? Is the outbreak patchy: is it something new, widespread? We will need data to distinguish.

Gary Montz: When you establish risk levels of low, moderate etc., is this decision made by MMCD or by a working group [of more agencies]?

Kirk Johnson: Control decisions [hence risk levels] in the district will be made by the district in close communication with MDH, MDA etc.

Dave Neitzel and Roger Moon: Is MMCD considering bringing the Minnesota Arboviral Surveillance Committee (MASC) back if needed?

Bob Sherman: Consider using the C130 if needed. Responses given under various levels of WNV threat is good. The calibration of "Low" risk and response could be reviewed.

Roger Moon: MDH wrote a history of previous responses. We should urge MMCD to reconvene MASC and review previous control efforts and implications for WNV response. Our conclusion was we would have been better off spending $2 million on video coupons to keep people indoors. No WEE outbreak occurred that year.

Danny Tanner - How many people in US got WNV last year?

Kirk Johnson: Fifty-five human cases of WN encephalitis were diagnosed including eight fatalities in 2001, although two of the fatalities may be attributed to other illnesses.

Danny Tanner: So MMCD will monitor and treat if high numbers of mosquitoes are detected? Is there a human vaccine? Should we recommend that [vaccination] for persons in high risk area?

Dave Neitzel: We can identify high risk groups and target them. When a vaccine becomes available, we'll need to determine who would benefit from it (It would not be for everybody). Currently, older folks would appear to be the best group. We'd have to see if this product generates a decent antibody response in this group before recommending it widely.

Gary Montz: How does your response compare with what has been, and currently is being done in East Coast?
Kirk Johnson: MMCD wants to rely less on adult control. We already have an established larval program to work with.
Dave Neitzel: Eastern states moving more toward larval control
Dave Neitzel: WNV serologic survey in Queens revealed that 2.6% of the population had been exposed although few showed any symptoms. This is similar to LAC in that only a small percentage of infected people show symptoms
Roger Moon: I would like MDH to do some survey of sera for arbovirus to get prevalence of antibodies. Are tests sufficiently sensitive and specific?
Susan Palchick: In either New York City or New York State was WNV declared a public health emergency?
Dave Neitzel: I am not sure if the WNV situation was technically declared that.
Susan Palchick: What would it take for MDH commissioner to declare a public health emergency?
Roger Moon: Human cases have occurred before horse cases of WNV.

Overview: Tick Surveillance Program

Janet Jarnefeld, MMCD Technical Services tick specialist, gave a recap of 2001 activity in the District's tick surveillance program. No results were yet available from 2001 (data are still being analyzed), but data from 2000 suggest a correlation between high tick numbers and higher than average human cases numbers. The El Niño effect could carry over to 2001 and might again mean higher numbers of ticks.

The District will continue to survey the North Oaks area in cooperation with the University of Minnesota. In 2001, there appeared to be Human Granulocytic Ehrlichiosis (HGE) in a sample collected in North Oaks, but there were flaws in the lab results. Repeat tests found no HGE.

In 2002 MMCD is planning a drag cloth study that was delayed from 2001. The distribution study will also be continued in 2002.

Janet explained that most funding for collaborative tick research comes from sources other than MMCD.

Questions and Comments

Roger Moon: To clarify (funding for tick research). UM gets NIH money.
Bob Sherman: Should a serious Lyme outbreak occur, what could be done?
Janet Jarnefeld: The most successful control is public education, other controls tried in other areas do not appear to be cost effective or environmentally sound. We try to give advice to homeowners if needed.
Dave Neitzel: CDC is doing a cooperative project with Northeastern states looking at control options in several communities and is trying to develop regional control options.

Mosquito Surveillance

Sandy Brogren, MMCD entomologist, gave an overview of the 2001 mosquito season. It was a lopsided season with the wettest spring in history including much snow melt. The latter half was very dry. Overall precipitation was well below the average for a total year. Surveillance includes up to 145 weekly home collections (sweep, CO_2). MMCD added new CO_2 traps. The most abundant pest was *Aedes vexans* followed by *Coquillettidia perturbans*. We expect lower *Cq. perturbans* in 2002 because of dry fall in 2001. Because of the extremely wet early season conditions, higher than usual numbers of spring species were caught in 2001. The first collection (May 14) was the high for season.

Questions and Comments

Roger Moon: Add a line [from May 14 to May 28] so you can see the point on graph (refers to unclear graph in mailer in which peak mosquito counts on May 14 were not connected to a point for May 21 because weather caused a cancellation of trapping on May 21.)
Sandy: Mosquito populations dropped after that [May 14]. One trap in North Oaks captured an all time high of 22,000 adult mosquitoes. The final report will have more details from other traps. The first larval collection of *Cs. melanura* was a big deal.
Danny Tanner: How do you count [large mosquito catches]? Subsample?
Sandy Brogren: Yes.
Gary Montz: Is the new CO_2 trap design still comparable with previous years?
Sandy Brogren: MMCD did a comparative study of the new and old CO_2 traps and found no difference. The new traps are more standardized and easier to handle.
Larry Gillette: Every year I look at averages and they all look the same, but every year is really totally different. I have difficulty relating averages to what really happened. Is there some way to present the information that better depicts what was going on in the year, some way to convey more about the magnitude of the job that you had to face last year? It was huge.
Susan Palchick: Maybe show cumulative trap catch through the season.
Larry Gillette: Weekly counts show big difference between years; averages makes last year and this year look identical.
Stephen Manweiler: Getting everything into a figure while keeping it simple enough to easily understand is quite difficult. We did try sequential [weekly] maps last year.
Roger Moon: What's the point of summarizing surveillance? What is TAB looking for?
Stephen Manweiler: Is TAB asking how mosquito numbers line up with control operations?
Roger Moon: You are not reporting control on weekly scale.
Larry Gillette: I try to hold you accountable as to why you use more adulticide one year versus another. I am pleased to see that adulticide acreage did not go up that much even given large numbers of mosquitoes.
Roger Moon: Do not use cumulative, by week maybe. Does surveillance show there were a lot of mosquitoes and you responded in a timely manner?
Bob Sherman: We have tried various displays before and have to recognize that some presentations are going to be hard to do.
Roger Moon: A more useful measure would be the percentage of collectors that had an above threshold count on a given night. Public becomes annoyed at over two mosquitoes in five minutes while this (the graph of weekly mosquito trap catches) reports mosquitoes per trap night. I cannot tell how to equate the two.
Susan Palchick: You are willing to propose that given emerging diseases?

Roger Moon: MMCD should be measuring effectiveness, what the public experiences.
Diann Crane: Mosquito abundance maps are made with categories based on tolerance levels.
Roger Moon: Add that to information given to TAB, not map, but proportion of sites above threshold.
Larry Gillette: When you get complaints from public, do you note or try to do something? Two years ago I had a big mosquito problem and found out I was outside control area. This past year I didn't have much of a problem. If you get requests for additional treatment, do you tell them about rainfall, local problems, or how do you respond?
Stephen Manweiler: The front desk collects caller information (name, address, phone number, etc.) and routes the call to field. Field staff let people know what they can do for them based on where they are.
Larry Gillette: A key issue is how the public perceives your response. It is important to let them know why they see a problem at a particular time.

Mosquito Control

Stephen Manweiler, MMCD Technical Services Coordinator, outlined the District's mosquito control season. Overall, acreage treated with larvicides and adulticides was up slightly in 2001. There was a large brood in April (much earlier than usual) because of high water levels and early warm temperatures. MMCD had very little time to react early in the season when it is short-handed. We will review time line of preparedness for 2002. There was a high amount of larval and adult control early in the season but less later.

An agreement was reached with the MnDNR in May, 2001 to survey and treat portions of Fort Snelling State Park. Stephen Manweiler noted that, from the District's perspective, the agreement worked well in helping to coordinate surveillance and control. Sampling helped determine larval breeding patterns that will be useful in the future.
Gary Montz said that there are some areas [in Ft. Snelling] not open for treatment and other areas where some treatments can be made, dependant upon sampling that is different from routine in District. He had not heard from park personnel.

Stephen also reported on continued interest in the Icy Pearl formulation of *Bti*. While there are problems disbursing the frozen pellets (under-slung buckets are not legal in Minnesota) the District is continuing to work on ways to test the product.

Questions and Comments

Gary Montz: I would like MMCD to take out statements from mailer (p. 11) about significance of adult mosquitoes in Ft. Snelling until we examine the data in the report recently submitted to MnDNR by MMCD.

Susan Palchick left the TAB meeting at this point.

GPS Unit Testing

Chris Stevens and Nancy Read gave a recap of District efforts to incorporate Global Positioning System (GPS) technology into surveillance and control operations. The District is looking for inexpensive, easy-to-use units that would assist applicators in recording adulticide application location information. Tests in 2001 showed that GPS units purchased with new cold fog

equipment met accuracy requirements. The inexpensive handheld units were not reliable enough in heavy tree cover for recording ATV treatments, but were adequate for work such as recording sampling and could be used to record treatments in open areas. Additional tests of other units are planned for 2002. The District expects to work closely with the Department of Agriculture on how location data recorded by GPS can be used in treatment records.

Questions and Comments
Terry Schreiner: USFW uses Trimble GPS, has PDOP, works well.

Adulticide non-target issues
Nancy Read, MMCD Technical Leader, discussed a study of purple loosestrife beetle release success in relation to District adulticide sites, done by MMCD staff in cooperation with UM and MnDNR staff. Results suggested there were some sites where adult mosquito treatments might have reduced the success and spread of beetle populations, but most of these had some beetles surviving. On the other hand, many locations with poor beetle success were not close to adult mosquito treatments. Communication between MMCD and MnDNR staff coordinating releases has improved, resulting in fewer potential problems with releases near treatments.

Questions and Comments
Roger Moon: Try setting up beetles at distances from treatment for tests in 2002.
Terry Schreiner: USFW refuge has many release sites that could be used for control sites for comparison.

Stephen Manweiler reported two recommendations that were the outcome of a meeting with Roger Moon and Karen Oberhauser (16 April 2001) on possible directions to take regarding additional non-target studies. They were (1) to identify insects of public concern (butterflies, fireflies, moths) and insects that might indicate food chain effects and (2) to compare results published in the literature in terms of standard dosages. Stephen presented a sample of published lab and field studies and calculated dosage in standard units for comparison. Some of these showed mortality at a dose similar to what MMCD uses whereas others detected mortality only at doses higher than those used by MMCD. Stephen asked if TAB found this review useful, if TAB recommended a more exhaustive review and for feedback from TAB on what additional adulticide non-target research MMCD should conduct.

Questions and Comments
Gary Montz: A review including comparative dosages is helpful.
Bob Sherman: A standardized way of describing dose is helpful. It is not as good as actually testing against the same dose, but allows you to use work done.
Danny Tanner: I have never seen mg/cm^2, usually mg/L. Normally with water you can estimate dose in water. It is tough with a surface to figure out what actually reaches organisms.
Bob Sherman: It has been suggested that you put caged organisms out, but before you go through that effort the literature review helps to know what has been done. I would like to see some experimental work done.
Danny Tanner: We have an extensive database that would help identify sensitive organisms you could use.

Bob Sherman: Looking at insects of concern such as butterflies, ladybirds, and bees would be helpful.
Geir Friisoe: Although dose is important, formulation and time of application makes a big difference, especially for bees.
Larry Gillette: Do other parts of country use permethrin as an aerial application? I am most concerned about ULV resmethrin; not as concerned about permethrin because it stays put.
Roger Moon: I agree, cold fogging is of greater concern. More acres are treated. Also the public is more concerned about cold fogging.
Larry Gillette: When studies are done on mortality, is that related to life history of insect, (e.g. univoltine, multivoltine) and how fast can population recover? How do you relate that to long term effects?

Terry Schreiner left the TAB meeting at this time (3:20PM).

Black Fly Program
Stephen Manweiler gave a brief overview of the District's black fly control program, noting that the amount of control material used was at or below average. 2001 had extensive flooding early in the year. MMCD made few applications in small streams this year because few reached threshold. Small streams were very swollen, so when treatments were made, more material was required. Large river applications were similar to but lower than some previous years.
The control product (Aquabac liquid *Bti*) was switched when material failed. MMCD returned to a material (Vectobac liquid *Bti*) successfully used in other years.
Adult monitoring was similar to previous years.
Non-target monitoring samples have been collected and are being processed.
Research: MMCD is developing a protocol to evaluate black fly annoyance. We could not test this protocol because mosquito numbers were too high in 2001. We will try again in 2002.

Gary Montz left the TAB meeting at this time. It was 3:30PM, the scheduled adjourn time for the meeting.

TAB Discussion of Public Comments
As recommended by TAB in January 2001, MMCD solicited comments about its operations from seven environmentalist groups. MMCD received comments on its 2000 Operational Review from three environmental groups: Ducks Unlimited, Isaac Walton, and Sierra Club. Comments from the first two were distributed to TAB members by MMCD. The Sierra Club forwarded its comments directly to TAB members.
Roger Moon: What TAB members received in mailing from MMCD is what environmental groups should have received. Environmental groups should receive drafts, clearly marked as such, at the same time as TAB members, and should be able to comment prior to TAB.
Bob Sherman: Sierra Club comments were most critical and asked for extensive documentation. I think asking MMCD to do that is a bit much. Seems hypercritical. However, MMCD could give them more information on background materials that are available.
Geir Friisoe: Another common thread was questioning whether the disease threat is being overstated, namely "is cure worse than disease?"

Dave Neitzel: There is a fine line regarding what should be done. The "sky is not falling" (total case numbers are typically low), but arboviral encephalitis can be very serious or life threatening. These diseases are preventable, and there is much that the public can do to reduce the risks (personal protection, container removal, etc..). However, it is good to have trained mosquito control staff to identify potential problem areas, and provide more timely and effective vector control..
Bob Sherman: During the swine flu epidemic, thousands were given shots and no epidemic occurred. The shots might have stopped epidemic but one cannot tell. If such programs are successful, they are criticized as unnecessary.
Danny Tanner: If people died from WNV, could families sue for not treating?
Joe Sanzone: Yes, this is currently happening.
Roger Moon: It may be better to try to prevent disease occurrence.
Bob Sherman: Although notification is important, MMCD cannot knock on every door.
Roger Moon: One of the letters sounded like the critic was unaware of what is currently being done for notification.
Jim Stark: We have web site, daily information line for adult mosquito control, also notify list of people who are called, advertisement at beginning of year, media releases informing people of what we are doing.
Bob Sherman: A proper response to the Sierra Club letter is probably to explain some of these things questioned in the letter. Some of the questions are too ambiguous to worry about.
Roger Moon: We asked for comment as a Board. We should thank them for giving their input but we do not have to respond as a Board point by point. District could do response.
Dave Neitzel: Should letters be included in annual report?
Roger Moon: That is up to the district. Is other correspondence included?
Stephen Manweiler: We included the Legislative Auditor's comments.
Roger Moon: I was not looking at setting up a paper battle for TAB to referee. I just wanted to get the views on the table.
Bob Sherman: I suggest that criticisms of operations be used by MMCD internally to check to see if there are things that can be done easily. Examine the criticisms relative to ongoing operations and make improvements made where feasible.

David Neitzel led a discussion of TAB recommendations that included all remaining TAB members (Roger Moon, Larry Gillette, Bob Sherman, Danny Tanner and Geir Friisoe).

Resolutions
Motion: To commend the district for its efforts to get objective measures of impacts and ways to improve programs. Made by Roger Moon, second by Bob Sherman.
Approved without dissent.

Motion: That the District explore the historical record and consider what efforts are needed to reactivate the Minnesota Arbovirus Surveillance Committee. Made by Roger Moon, second by Bob Sherman.
Note: The intention is to coordinate with MDH and other agencies such as UM, MDA, USFW, State Climatologist, US Army.
Approved without dissent.

Motion: To commend the MMCD for acting professionally and responsibly and trying to adapt its program appropriately to changing conditions. Made by Bob Sherman, second by Roger Moon.
Approved without dissent.

Motion: To recommend that MMCD continue its review of the literature on adulticide non-target effects. Made by Larry Gillette, second by Roger Moon.
Approved without dissent.

Motion: To urge the MMCD to choose at least one important non-target species and pursue field studies in 2002 to evaluate potential effects of its resmethrin applications. Made by Roger Moon, second by Bob Sherman
Note: TAB would like to see results of a field study on an insect of some sort by this time next year.
Approved without dissent.

Motion: To recommend that MMCD continue to try to refine how it presents data on mosquito surveillance and control to make it easier to compare among years and within a season.
Made by Larry Gillette, second by Roger Moon
Approved without dissent.

Next (2003) TAB Chair MDA (year after that will be UM)

The meeting was adjourned at 4:30 p.m. by Dave Neitzel, TAB Chair.

Stephen Manweiler

From: Tom Landwehr <tlandwehr@ducks.org>
To: <mmcd_sam@visi.com>
Cc: <david.neitzel@health.state.mn.us>; <kendu@ll.net>
Sent: Thursday, November 29, 2001 11:49 AM
Subject: Request for comments, mosquito & black fly control

Dear Mr. Manweiler:
Thank you for the opportunity to comment on the proposed MMCD control program. We have not reviewed the 2001 program summary, but offer the following general comments. Ducks Unlimited is comprised of 50,000 members in Minnesota, all of whom have an interest in the health of our wetland resources. A critical component of that is the invertebrate community. While all of us in the metro area recognize the value in pest control, we would be concerned about the indirect impact of control efforts on non-target species such as waterfowl. As you know, invertebrates are a key component of the diet of breeding hens and young ducklings. Control programs that reduce this food source or cause secondary effects in waterfowl would be of high concern to DU and its members. In any event, we would encourage that any control be directed as specifically as possible at problem sites, and not as a blanket effort, to reduce the likelihood of unintended results. Thank you very much for the opportunity to comment, and we'll reserve the right to comment further if additional concerns become evident.

Tom Landwehr
IA/MN State Conservation Director
Ducks Unlimited, Inc.
5824 Churchill St.
Shoreview, MN 55126
Phone: 651-283-3838
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The Izaak Walton League of America

DEFENDERS OF SOIL, WOODS, WATER, AIR, AND WILDLIFE

MINNESOTA DIVISION

December 10, 2001
Mr. David Neitzel
Minnesota Department of Health
717 SE Delaware St.
Minneapolis, MN 55440

Dear Mr. Neitzel as Chair and Members of the MMCD TAB;

Thank you for soliciting comments from a number of the conservation groups in the metro area regarding the annual operations review of the MMCD.

First, the Executive Summary spends most of the text discussing several health related issues, purple loosestrife, and black flies with very little comment on the major operation of the MMCD - nuisance mosquito work. We wonder what the relationship is with the Dept. of Health and County Health agencies and the MMCD? The first Chapter is about vector born diseases, again placing prominence to a small part of the operations. What does the MN Dept. of Health have as a protocol on each of the diseases mentioned in Chapter One and how does a statewide approach differ from the metro approach? We commend the District on its most recent educational efforts, which rely on removing the sources of possible infestations, but again wonder at the proportion of time and text spent on this versus nuisance control.

Regarding the West Nile virus, is it any worse or unusual in comparison to the endemic encephalitis? Many people feel that the actions of some east coast governments to do broad adulticide applications was more a sop to political pressures and less a meaningful tool and that the spraying could have harmed the natural ecosystem in a long term way. We hope that none of the disease tracking parts of the operations are used in a scare tactic meant to garner support for the other operations of the District.

Who funds the collaborations that are listed for several of the insect vector programs? Do District property taxes pay for basic research? Are there students who work with the MMCD for their training? Have there been reports to the legislative cmtes. on the research aspect of the programs? To the County Commissioners? I remember testimony in which MMCD employees have stated that the District is NOT a research program, that it is ONLY an operational agency. Has that changed?

Again the surveillance data seems to confirm that the amount of rainfall is the predictor of mosquito numbers. What plans does the District have to deal with the dry year when control methods are not needed? In personnel? In amount of chemicals used?

All of the surveillance information is interesting and

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valid if it really does determine the use of chemicals. If there is not a tie to the amount of chemicals especially when people call to request adult spraying, then the work done in checking numbers is meaningless.

Chapter 3, which should be Chapter 1, discusses the main work of the District in fewer pages than even blackfly control. We would like to see more information on the larval control. Perhaps a history of the District policy, comparisons with other Districts, and most important of all we need to see how the NRRI study for the SEIS on the effects of larval control has caused the District to modify its applications. That study was peer reviewed and was credible. Until another study with those qualities is published how can the District ignore the impacts on nontargets in wetlands that were discovered? Or, is the District making decisions knowing that nontargets are also impacted?

What happens to the briquets that are put down for the cattail mosquitoes when a dry spring produces few mosquitoes? Is there a residual effect?

In the text on BTi granule treatment, it is mentioned that enough supplies will be kept for disease control. What kind of disease control would require that application?

We commend the District for using the phone line and the Website for info on adult treatments. Have you ever done a survey of the sites that you treat by location and date? It seems as though several of the sites are the same throughout the summer. And they seem to be the same sites year to year.

Can the MMCD share with the TAB which areas of the metro are off limits for treatment? Which jurisidctions have policies on chemical usage? Does the District comply with state law on notification of chemical treatments on school properties? This probably should apply to summer recreation programs where children are present. The federal proposed legislation similar to this state law lists a couple of pyrethroids and piperonyl butoxide as chemicals of concern.

On page 33, a statement is made about the use of aerial adulticiding for disease outbreaks. This is a policy that should be in discussion by the public, legislators, county commissioners, health professionals, and biologists at all levels. It is alarming to think that the District feels that a drastic approach like this would be contemplated without full public input and discussions of efficacy and harmful effects.

On page 42 a reference is made to surveying parks to determine the insect base as a comparison for adulticide work. We would suggest that the effects on other insects may be more pronounced in neighborhoods where a lot of people are gardening for wildlife and butterflies. Why are your studies of nontarget work centered on night flying insects only? The residual effect of dawn applications can hit many more daytime insects. And even the nighttime applications can find the resting spots for insects.

On pages 49-50 the MMCD discusses studying the possible harmful effects of adulticiding on the purple loosestrife beetles. Our question is this - why were there ANY adult treatments that close to wetlands? Are you concerned about other wetland species?

In the reference to the Wright County study site on page 50, two years were noted, 1997-98. If any more studies are published they should inlude the data from the entire study duration (1991-1999) and be peer reviewed. Thank you for doing the deformed frog study. We look forward to reading it in detail.

Finally, concerning the labels of the adulticide sprays, we are still very alarmed that the MMCD has the ability to use these sprays without fully informing a neighborhood or school. There are precautions about covering pet watering bowls, closing windows,etc. that are serious concerns to many people, according to your own survey. IN FACT, during the West Nile scare in New York, the communities that chose to use sprays did so with a wide dissemination of information to the public so that they could take precautions. Look at the info provided by the New York Dept of Health to all citizens. We also believe that people should have the right to have no treatment on their property without FIRST getting permission of the owner on record with the MMCD. This includes any larval control as well.

Comments on the TAB comments:
page 80 - Roger Moon similar comment on butterfly gardens
page81 - Keep looking at wetland loosestrife sites re beetles
page 82 - Similar comments on school notification issues - What has happened?
page 83 - Yes, we have been on MANY DNR citizens groups
The Minnesota Environmental Partnership has over 70 groups and is a way to disseminate material to many citizens
We hope that the timing of this request for comments is

sufficient for groups to comment.

NOTE:

It would be advantageous for the environmental and citizen groups to also see the financials. The TAB report does not tell the whole tale relative to the monies spent on various parts of the MMCD program. Most environmental and and nonprofit groups want to see how tax payer money is spent relative to priorities. That is how they work at the legislature and in the county board rooms. Then the effectiveness of the results can truly be known.

Also, have various groups that deal with the outdoors, like the Wood Duck Society or Ducks Unlimited been contacted to comment? Have the various bluebird or butterfly garden groups, garden groups, or bee keepers? There are even groups now who watch and appreciate dragonflies.

Thanks for the opportunity to comment. Please have a lively TAB discussion and share all of the thoughts with the governing County Commissioners

Chas Brooker

Charlotte Brooker, National Director, Chair, National Board Writing for the Minnesota Division, IWLA

c.c. Gary Montz/ Kathleen Wallace MNDNR
Rep. Mindy Greiling
Sen. Jane Krentz
Don Arnosti, Minnesota Environmental Partnership (MEP)

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TO: MEMBERS OF THE TECHNICAL ADVISORY BOARD OF THE METROPOLITAN MOSAUITO CONTROL DISTRICT

SIERRA CLUB COMMENTS ON 2000 OPERATIONAL REVIEW
January 15, 2002

1. Untimely review. We are unsure why we have been asked to comment on the 2000 Operational Review, which is now two years old. Where is the review of 2001 operations? Commenting on operations from 2 years ago does not seem to be very relevant. The TAB and other commentors should have the opportunity to comment on the immediately preceding year and the program for the upcoming season.

2. Questions about effectiveness. The 1999 Program Evaluation by the Legislative Auditor made several recommendations with respect to evaluating effectiveness of adult mosquito control:

"The District should assign a high priority to measuring the effectiveness of adult control materials in scientifically designed and supervised field studies in 1999 and use the results of these studies to evaluate the role of adult mosquito treatments in its overall mosquito control program." (page 93)

Have these scientific studies been conducted and has the District evaluated the role adult mosquito treatments should play in its overall mosquito control program?

The Auditor was critical of using pre- and post-treatment data as a measure of effectiveness. "Comparison of the pre- and post-treatment adult mosquito counts shows a 90 percent reduction in the number of adult mosquitoes following treatment. However, these data were not collected as part of a designed, supervised research study. One of our concerns with the 1998 pre- and post-treatment data is that the majority of counts used the "slap test" sampling method, a subjective method of obtaining adult mosquito counts... Other concerns with using the 1998 pre- and post-treatment data as a measure of effectiveness include that apparently there were no written procedures on how to select a treatment to sample or the timing and location of the post-treatment collections and technical service staff did not supervise the collection process." (page 93)

The Auditor went on to say that "Based on District-sponsored studies, the effectiveness of resmethrin and permethrin in killing adult mosquitoes does not compare favorably with the effectiveness achieved with some laval insecticides. While permethrin appears to kill mosquitoes for up to five days, the effectiveness of resmethrin at controlling mosquitoes following immediate exposure has been called into question by the District's own research." (page 93)

As suggested by the Legislative Auditor, scientific field studies should be done to measure the effectiveness of adult mosquito control treatments. The results of these studies should be used to evaluate the role of adult mosquito treatments in the overall mosquito control program.

3. Need for non-target monitoring. In it's 1999 report, the Legislative Auditor stated that the District "has not conducted any research on the effects of resmethrin and permethrin on other insects not targeted for control, such as bees." (page 93)

It is our understanding that the District recently has conducted some studies that it considers "Adulticide Non-target research." (page 44 of 2000 report) However, in our view, those studies are needlessly cumbersome and their results ill-defined. The 2000 report states that "The number of non-target insects caught in adjacent UV-traps did not decrease after adulticide applications the way mosquitoes decreased which suggests that non -targets were not affected the way mosquitoes were." (page 44, emphasis added)

In our opinion, a better, more direct way to test the impact of mosquito treatments on non-targets would be to place butterflies/moths and larva, bees and other beneficial non-targets in an area being treated for mosquito control and see what happens to them. (At the last Technical Advisory Board meeting, one of the members suggested this type of study as well.) We think this is especially important because of the massive monarch butterfly kill in the summer of 2000 in Gaylord, Minnesota. Many thousands of monarch butterflies were killed after that city hired a contractor to spray a synthetic pyrethroid insecticide for adult mosquito control. The District also uses synthetic pyrethroids for adult mosquito control, so there is certainly a possibility that its adult spraying program is harming butterflies and other beneficial non-targets.

Studies on non-target impacts should be re-designed and supervised by independent scientists. At the very least, they should be peer reviewed if done by District personnel.

4. Need for better notification. According to the District's 2000 report only 7% of respondents to a survey reported seeing the ad in their local newspaper informing them that mosquito spraying could occur in their community during the summer. (page 52) The Legislative Auditor also surveyed 248 people, and "only 9 percent responded that they were aware of the District's telephone information line and web site informing people about adult mosquito applications." (page 113)

In response to the West Nile virus on the East Coast, Suffolk County, New York, adopted a law creating notification procedures for alerting the public about mosquito pesticide spraying. (See enclosure) Those procedures included a web site, e-mail, automated fax and a telephone mosquito hotline to alert legislators, appropriate agencies and residents of affected communities. There is no such notification when pesticides are routinely sprayed for nuisance control within the District.

The New York State Health Department developed recommendations for citizens' potential exposure to pesticide spraying for West Nile mosquitoes. The insecticides used in the New York area were synthetic pyrethroids, which are also used by the District.

Some of the recommendations were:

a. If possible, remain inside whenever spraying takes place.
b. Keep children inside during spraying and for about one hour after spraying.
c. Close windows and doors and turn off air conditioning.
d. Rinse homegrown fruits and vegetables thoroughly with water before cooking or eating.
e. Cover outdoor tables and play equipment or wash with soap and water after they have been sprayed.
f. Bring pets inside and cover ornamental fish ponds to avoid direct exposure.

(see enclosure for other recommendations)

The Minnesota State Health Department, in a letter to the District, said that "Brief inhalation exposure to the pesticides should not pose a health risk. Nevertheless, children should be prevented from having prolonged inhalation exposure to the pesticides. Children should not be permitted to follow the pesticide applicators as they work or to play in the sprayed areas... Because some of the spraying will be in public areas, these areas should be clearly posted at all entrances with signs that inform potential users that they have been sprayed and that children and sensitive individuals should not use this facility until a date and time certain... Without this information many people may unwillingly subject themselves and/or their children to exposure." (Letter dated May 7, 1998)

Given these recommendations, and the fact that very few citizens are aware of when the spraying occurs, the District should do a more complete job of public notification. The District's practice of publishing one newspaper ad in local newspapers and notifying public officials once in the early summer about possible treatment for adult mosquitoes is clearly insufficient. The Legislative Auditor cited three states that make telephone calls to people who request to be notified about mosquito control--Delaware, Maryland and Connecticut. The Auditor also found that of

the 40 cities in Minnesota that spray for mosquitoes, about half use local newspaper and/or radio announcements to provide notice of treatment, about one-third use local cable television and one-fourth post notices and/or make telephone calls to provide citizens with notice of treatment.

The District's $10+ million budget should allow it to do a more comprehensive job of notification. In addition, prior to adulticiding in any given year, the District should put in writing its procedures for notification and submit them to the Minnesota Department of Health for review and comment to ensure that the procedures adequately protect human health and sensitive individuals.

5. Lack of financial information. The District should include financial information in its annual operational reviews so that expenditures can be evaluated in terms of how they related to delivery of the programs.

6. Attempting to alarm the public by overemphasizing disease control in the media. The Legislative Auditor noted that the District "might have contributed to feelings of mistrust by making claims that are hard to support, such as the assertion that requests for no treatment impair its ability to protect public health and prevent LaCrosse encephalitis. While we have observed that MMCD provides valuable disease prevention services, we have also observed that most of the District's adult mosquito treatments are directed at nuisance mosquitoes. . . We think MMCD should make more of an effort to present balanced, accurate information to the public." The auditor also found that disease prevention accounted for "fewer than 3 percent of the District's adult mosquito treatments."

At its August board meeting, there was substantial discussion about how the outbreak of West Nile virus could be used to bolster the image of the District and the need for its operations. Commissioner Opat suggested that "West Nile is a hook now--everyone knows about it. Now we can convince people we really do something. LaCrosse doesn't grab people like West Nile does." Commissioner Steele said that the executive committee "has extensively discussed this and the need to use it with legislators." Mr. Sanzone indicated that he met with the District's lobbyist "to see how the issue can be brought to the legislature."

The District also attemps to use dog heartworm as a way to justify its programs. It circulates a brochure about dog heartworm which states: "The Metropolitan Mosquito Control District (MMCD) controls mosquitoes that transmit dog heartworms in the metro area, thereby reducing you dog's risk." There is no evidence that the District's activities reduce the rate of heartworm, and it is irresponsible to suggest such a thing. If anything, this type of rhetoric could discourage pet owners from giving their dogs heartworm medication, which is the only real way to prevent heartworm.

The District should assure that it does not overstate disease threats from LaCrosse encephalitis and West Nile virus to the public, and should cease claims that its programs decrease heartworm risk. As noted by an opponent of spraying in New York City, "2600 people died of the flu in this city last year, compared with only seven deaths from West Nile virus, yet Mayor Giuliani did not order a mass program of flu shots for every New Yorker." (See enclosure)

I have also included in this packet an excellent article from Audubon's September/October 2001 issue about mosquito control, as well as an article from the Star Tribune indicating that a number of insect repellents tested by scientists "managed to ward off bugs completely." This suggests personal repellants would be an effective way to reduce mosquito annoyance.

Thank you for considering these comments to the District's 2000 Operational Review.

Sincerely,

Judy Bellairs for Sierra Club North Star Chapter