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State Reclamation and Mosquito Control Board
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TO: Commissioner Douglas P. Gillespie (DAR)
Commissioner Stephen Burrington (DCR)
Acting Commissioner Arleen O'Donnell (DEP)

FROM: State Reclamation and Mosquito Control Board (SRMCB)

DATE: Monday, September 11, 2006

RE: EEE AERIAL ADULTICIDE SPRAYING (Round 2)

As outlined in the State Reclamation and Mosquito Control Board (SRMCB) Mosquito- Borne Disease Response Plan, the Board submits this summary report on the aerial spray operation that began on the evening of Tuesday, August 22nd, commencing at sunset and ending on Thursday evening, August 24th, 2006 at 9:58 PM. Although there were dramatic reductions in mosquito populations in areas treated on August 8th and 9th, a secondary application was determined to be necessary since the area of risk had expanded beyond the initial treatment areas with additional isolations of mosquitoes found positive for EEEv. As a result, this second application was performed in response to a declaration of Public Health Emergency by the Governor regarding an outbreak of mosquito-borne Eastern Equine Encephalitis virus (EEEv) in the region.

Description of Second Spray

As accomplished in the previous aerial application, calibration and characterization of the aerial spraying equipment was conducted on August 22-24, 2006 at the Plymouth County Massachusetts Municipal airport. This was accomplished for three (3) aircraft deployed for aerial application of Anvil 10+10 ULV. Calibrations and characterizations were conducted by Clarke Mosquito Control and Dynamic Aviation staff and overseen by Fran Krenick, National Technical Service Manager, for Clarke Mosquito Control in the presence of John Kenney of MDAR and former Chair of the SRMCB, other SRMCB members, and personnel from the Plymouth County Mosquito Control Project (PCMCP) and Northeastern Massachusetts Mosquito and Wetlands Management District (NMMWMD). The details and documentation of this procedure will be reported in a final post spray report.

The SRMCB and Department of Agricultural Resources (DAR) supervised the aerial spraying that covered an area of approximately 410,296 acres, as calculated by the navigational flight system of the aircraft. The area treated encompassed the municipalities previously treated during the evenings of August 8th and 9th including Middleboro, Lakeville, Carver, Kingston and Plympton, plus parts of the communities of New Bedford, Taunton, Raynham, Freetown, Duxbury, Halifax, Plymouth, Rochester and Acushnet. Other areas treated during this second round of spraying included the municipalities of Abington, Attleboro, Avon, Berkley, Braintree, Bridgewater, Brockton, Dartmouth, Dighton, East Bridgewater, Easton, Fairhaven, Fall River, Hanover, Hanson, Hingham, Holbrook, Mansfield, Mattapoisett, Norwell, Norton, Pembroke, Randolph, Rehoboth, Rockland, Sharon, Stoughton, Wareham, West Bridgewater, Weymouth, and Whitman. (See map on page 8).

Three (3) -twin turbines Beechcraft King Air, Model A90 aircraft were deployed from Dynamic Aviation Company in Virginia. Based on the area treated and the rate of application, 0.62 oz/acre (the maximum allowable amount permitted by the pesticide product label), the aircraft dispensed approximately 1,987 gallons of Anvil 10 +10 ULV EPA # 1021-1688-8329, (a Clarke Mosquito Control product) at a height of 300 feet above the ground, average airspeed of 172.5 mph and an aerosol swath width of 1,000 feet. In addition to the actual amount of product used to reduce the mosquito population, 96 additional gallons of Anvil 10 +10 ULV was used to test droplet sizes and calibrate the delivery apparatus of the aircraft prior to the operation. Thus, the total amount of product used for the entire second aerial spray operation was 2,083 gallons.

Weather conditions during the August 22 – 24, 2006 aerial application ranged from optimal to acceptable. All weather parameters remained within ranges compatible with the product label. These weather conditions also reflected conditions favorable to mosquito activity during the application window. On Tuesday, 8/22/2006 optimal conditions existed during the entire spray window. Those conditions included temperatures ranging from the mid-sixties to the low seventies. Light winds prevailed during the application.

On Wednesday, 8/23/2006 optimal weather conditions occurred at the start of the application window including temperatures in the mid-sixties and light winds. During the latter half of the spray window weather conditions were acceptable with temperatures ranging from 59 degrees to the low sixties with calm wind conditions. The application was halted at approximately 11:50 when temperatures dropped to 58 degrees. On Thursday, 8/24/2006 optimal weather conditions including temperatures in the mid-sixties and light winds were present at the start of the application. The aerial application was completed at approximately 9:50 with acceptable weather conditions including temperatures near sixty degrees with calm conditions.

Results of Second Spray

Overall, the results of the aerial operation, round 2, were very good. Mosquito populations in the treated areas were significantly reduced, and risk to the general public was reduced. Bristol and Plymouth County Mosquito Control Projects staff reported large reductions in mosquito abundance in areas that were treated. Overall, Bristol and Plymouth Counties reported reductions of 88.6% and 60.15%, respectively, in mosquito abundance. Also, trap collections in Norfolk County showed a significant decrease in mosquitoes reporting reductions ranging from 57% to 97%. ***In adjacent areas, a lesser reduction occurred. In non-sprayed areas, the numbers rose.***

These reductions included mosquitos' species that are important as maintenance vectors of EEEv amongst birds and those that are aggressive human biters and suspected to be the bridge vectors of EEEv to people. For example, MDPH State Laboratories Institute reported overall reductions of 79.5 % with noted reductions of mosquito species of concern especially *Cq. perturbans,* a human-biting species. The discrepancies and variability of the measured reductions are attributable to differing methods of analysis as well as confounding factors such as weather changes between pre and post collections, terrain, locations and kinds of traps utilized, and mosquito species. More details of efficacy results can be found on pages 5-7.

Similar results were obtained as reported in the summary report for aerial spraying that took place August 8th and 9th, in that significant impacts to the environment have not been observed as a result of the aerial application during August 22nd through 24th. Water sampling analysis by the Massachusetts Pesticide Analytical Laboratory (MPAL) indicate there were no detectable residues of sumithrin (pyrethroid active ingredient in Anvil 10+10) in surface water and drinking water supplies tested. The synergist Piperonyl Butoxide (PBO) was detected at a very low concentration in a raw water supply and in a finished water supply, but at a concentration below the level of quantification. PBO was not detected in any of the surface water samples after the second spraying. PBO levels were below the expected environmental concentrations (EEC) as estimated by both the Massachusetts Department of Environmental Protection (MDEP) and the U.S. Environmental Protection Agency (EPA). Neither the MDEP nor the EPA has established a maximum contaminant level (MCL) or State drinking water guideline for residues of PBO in drinking water. The levels found do not violate any federal or State laws.

Moreover, the analytical results of the sampling conducted following two rounds of aerial spraying are summarized below by the Massachusetts Department of Environmental Protection, Office of Research and Standards.

- Sumithrin was not detected in any water body sampled.
- Piperonyl butoxide (PBO) was only found in one finished drinking water supply sampled, at a concentration below the limit of quantitation.
- PBO was found at very low concentrations in raw water in Elder's Pond on the 8/10/06 sampling date (0.10 μg/L) and in the Taunton raw water supply on both the 8/24/06 and 8/25/06 sampling dates (0.13 - 0.14 μg/L).
- PBO was found at very low concentrations in three surface water samples on the 8/9/06 sampling date (0.07 - 0.12 μg/L).
- All of these concentrations were well below the health-based drinking water guidance concentration for PBO of 600 μg/L by several orders of magnitude and thus exposure to these concentrations would not produce adverse health effects.

Additionally, there have been no reported unintended effects regarding fish, birds, and or bees. However, no quantitative assessment was performed for these non-target species. The DPH Center for Environmental Health has indicated that there have been reports received by their office but are still in the process of compiling and verifying the details at this point in time. No objective findings have been reported of any alleged adverse effects to the environment to date. The details and documentation of this analysis will be reported in a final post spray report.

Analysis and Recommendations

Mapping: Operationally, problems that occurred in the aerial application of August 8th and 9th 2006 related to GIS mapping for areas to be treated and those to be excluded in the operation. This issue needs to be addressed for future aerial operations with clear responses on how to proceed to improve the process and function of applications. Specifically, these refinements include, but are not limited to, better coordination and communication between all agencies responsible in developing maps for aerial application including exclusion areas. Final maps must be completed and reviewed by all agencies in a timely fashion before being sent to the aerial applicator contractor. Once again there were delays in finalizing GIS mapping which affected the general operational preparation-taking place at the staging area at the Plymouth County Municipal Airport.

Exclusion areas: Again, there was no clear agreement by all agencies to treat or exclude areas that overlap with, or were in very close proximity to, "hot spots" where EEEv was currently and/or historically found even though the Governor signed a declaration of public health emergency. Once again, the SRMCB and DAR, given their responsibility for controlling mosquitoes continued to have significant concerns about the ability to reduce and/or prevent the risk of infection when such areas (priority habitat areas) designated by the Department of Fish and Game were excluded from the spray zone. In addition, the designation of these areas as no-spray zones impacted again on the timely preparation of final GIS mapping for the aerial applicator contractor.

Buffer zones: Some refinements to the process did occur during the second aerial application that included, but was not limited to, insuring correct buffer zones in the final GIS mapping of excluded areas. Additionally, pilot and team briefing occurred before each flight to insure that pilots strictly adhered to no spray/exclusion zones via the AGNAV navigational software. Various state agency representatives were present before the first evening of operation to clarify concerns to minimize and avoid errors.

In sum, the operation was successful in obtaining a positive public health outcome and provided the most meaningful response to this public health emergency.

Aerial Intervention August 22-24, 2006 Efficacy Results

Reported by, Wayne Andrews, Superintendent
Bristol County Mosquito Control Project

Trapping results pre and post adulticide

Species	Total outside spray area		Total inside spray area	
	Pre	Post	Pre	Post
Overall	68	85	184	21
Cs. melanura	16	17	92	9
*Culex**	ND	ND	ND	ND
*Ae. vexans**	ND	ND	ND	ND
*Cq. perturbans**	ND	ND	ND	ND
*Oc. canadensis**	ND	ND	ND	ND

*No Data – Too few collected

Efficacy:

Overall: 88.6%
Culiseta melanura: 90.8%

Traps were set away from the edge of treated zones and priority habitats that were excluded for this aerial application.

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Aerial Intervention August 22-24, 2006 Efficacy Results

Reported by: Ellen Bidlack, Entomologist
Plymouth County Mosquito Control Project

Species	Total outside spray area		Total inside spray area	
	Pre	Post	Pre	Post
Overall	143	55	647	98
Cs. melanura	24	31	430	28
Culex	10	12	157	35
Ae. vexans	35	5	6	6
Cq. perturbans	34	2	23	24
Oc. canadensis	15	0	21	3

There were four traps in the treatment area and 5 outside.

I have figured out our efficacy for the last treatment that began on 22 Aug 06. I have also attached a map of the trap locations used. For this analysis I used collections made on 21 and 25th of August. I did not have enough traps to do the analysis for each night of the spray. I collected from some of the same

areas again on Monday and the overall number of mosquitoes has continued to stay low in the spray area unlike the first treatment on the 8th.

Overall: 60.15%

Cs. melanura: 95%
Culex: 81.4%
Oc. canadensis: no control
Ae. vexans: no control
Cq. perturbans: no control

The above data was analyzed by Fran Krenick (National Technical Service Manager for Clarke Mosquito Control) who stated that the numbers of Cq. *perturbans* inside treatment area are very low for both pre and post. Just not enough of a population to have a statistical impact. Twenty-three (23) mosquitoes are not very many. Counts with numbers over 100 all showed significant reduction as the populations were larger pre-treatment and would have greater exposure resulting in a statistically significant reduction in the counts. It appears that the both *Ae. vexans* and *Oc. canadensis* populations were not high enough pre-treatment to be statistically detectible. Overall, it looks very good!!

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Aerial Intervention August 22-24, 2006 Efficacy Results

Reported by, John J. Smith, Director
Norfolk County Mosquito Control Project

Trapping results for 24-hour post-aerial adulticide
of August 23, 2006 through August 25, 2006:

The traps positioned for this efficacy study collected predominately *Culex* species and *Culiseta melanura*.

Outside Treatment Areas:

	% *Culex* (pre/post)	%*melanura* (pre/post)	%Overall (pre/post)
Trap #7 (Medway)	+11(64/71)	+108(36/75)	+61(103/166)

Inside Treatment Areas:

	% *Culex* (pre/post)	%*melanura* (pre/post)	%Overall (pre/post)
Trap #1 (Avon)	-100(5/0)	-100(62/0)	-97(78/2)
Trap#2 (Holbrook)	-81(37/7)	-52(61/29)	-62(109/41)
Trap#3 (Holbrook)	N/A	-90(20/2)	-70(30/9)
Trap#4 (Holbrook)	-100(6/0)	-57(89/38)	-57(106/46)
Trap#5 (Holbrook)	-40(67/40)	-56(198/67)	-66(284/124)
Trap#6 (Weymouth)	N/A	-73(60/17)	-68(72/23)

Trap #1 was well within the treatment zone on day two of the application and showed the highest efficacy. Traps #2 through #5 were within the treatment zones on day two or three of the application but were proximate to the edge of that nights treatment area (within several thousand

feet) which may have resulted in the lower efficacy numbers. Traps #2 and #5 were also proximate (@1,000 feet) to a larger exclusion zone (Weymouth Great Pond), which may have also negatively influenced efficacy. Trap#5 was right on the edge of the northern most extend of the treatment area (200 feet south) on day three of the application but showed good reductions in spite of this. Minor collections of *Aedes vexans, Aedes cinereus , Coquilletidia perturbans*, and *Ochlerotatus canadensis* were also observed in the collections (numbers too low for statistical review) and most showed declines 24 hours post treatment.

It is important to note that 24 hours post treatment mosquito collections at the untreated site showed an increase in both *Culex* (+11%) and *Culiseta melanura* (+108%) with an overall mosquito species increase of +61% which further demonstrates the positive impact of this aerial application within the treated area.

Overall the trap collections in Norfolk County showed a significant decrease in mosquitoes collected within the treated zone post application.

The data support a conclusion that the spray led to dramatic reductions in abundance where the spray was actually deployed. In adjacent areas, a lesser reduction occurred. In non-sprayed areas, the numbers rose. We can speculate that the increase was due to either/both immigration from outside the spray zone and/or emergence of new mosquitoes. (R. Pollack)

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Aerial Intervention August 22-24, 2006 Efficacy Results

Reported by Matthew Osborne
Department of Public Health State Laboratories

We collected on 8/25. We had five trap sites within and seven outside the spray zone.

Overall: 79.5 % control

Cq. perturbans: 94.1 % control
Oc. canadensis: 58.2 % control
Cs. melanura: 81.3 % control
* *Ae. vexans*: 0 % control
**Culex spp* 0 % control

* Our numbers for *Culex spp* and *Ae. vexans* were very low in and out of the zone. With such low numbers the collection of a few individuals skewed the results.

Map showing areas treated by date