Product Performance Study Review
by
Kevin J. Sweeney, Entomologist
Insecticides Branch
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Kevin J Sweeney 3/30/01

Reviewer: Tracy Keigwin

Product Manger: George LaRocca

Submission No. S586953

DP # D269843

EPA Registration Nos. 432-796

Product Name: Aqua-Permanone/Aqua-Resilin

Registrant: Aventis Environmental Science

Active Ingredients: 20% permethrin and 20% piperonyl butoxide.

OPPTS Guideline: 810.34

The registrant, Aventis Environmental Science, responded to the Agency's letter dated September 11, 2000 and submitted new mosquito control data for the subject formulation. I have responded to their comments below and have reviewed the submitted studies.

EPA Conclusions/Recommendations for the subject product:

I. The product performance submitted and reviewed for the Aqua-Permanone formulation to date support a GROUND ULV label rate of 0.00128 lbs. permethrin/PBO per acre up to 0.007 lbs./acre when DILUTED from 1:1.5 to 1:10.5 with water. The studies demonstrated that Aqua-Permanone can be used with gas powered ULV and Electric (with rotary atomizers) sprayers. The use of ground ULV sprayer pressures below 4.0 psi needs to be supported by data. The study rated as supplementary (see review) was conducted while spraying at 3.0 psi.

II. Change the 1:12 dilution instructions to 1:10 or 1:10:5 or submit a study for 1:12 dilution.

III. Remove the undiluted application instructions or submit data (see response to the AES letter below).

IV. Explain why Teflon slides are listed on the Aqua-Permanone label for droplet collection instead of magnesium oxide. Submit data to justify the selected 0.61 spread factor for Teflon slides. If magnesium slides are not to be used for droplet collection, state it on the label. If they are to be used, state the spread factor for droplet measurement. In addition, none of the studies submitted to date have described the optimum range of droplet sizes. Submit data and list the optimum range of droplet sizes bracketed by percentile on the label for Ground ULV AND aerial applications.

V. These data support the AERIAL application of Aqua-Permanone at the rate of 0.0035 lbs/acre to 0.007 lbs./acre when applied by fixed wing aircraft with T-jet nozzles spraying at low nozzle pressure (less than 50 lbs. at the nozzle tip) or Microaire nozzles (Submit a bridging argument to Beecomist nozzles or submit Beecomist use data); while spraying at the flow rate of 1.6 to 1.7 gallons/min at an altitude of 100-150 feet and airspeeds of 110-150 mph. This product may be diluted 1:1.5 to 1:10.6 with water. State the optimum swath width and instructions on how to calculate it. Express the application rate in lbs/acre active ingredient and fl.oz./acre of finished spray/acre. This formulation can ONLY be sprayed by fixed wing aircraft. No reference to a helicopter (rotary aircraft) application can be made on the label without submitting data to support this type of application. If you want to bridge data from the fixed wing aircraft to the helicopter, submit a justification explaining why such a bridge is acceptable. Note that many helicopters may not travel fast enough to create the desired droplet size/spectrum and swath width. It may be necessary to exclude/include only certain types/models of rotary aircraft on the label or adjust other spray specifications to meet label requirements.

VI. The data support the claim of quick knockdown with this formulation.

VII. Submit the optimum droplet size range for aerial applications and explain why such a range of MMD sizes are acceptable. Justify use of the VMD measurement and explain how the data collected with MMD droplet measurement are equivalent to a corresponding VMD for label use.

VIII. Explain how to do the ground ULV and aerial equipment calibrations for this product.

IX. Many of the studies lacked 24 hour mortality data. These data are necessary since mosquitoes can recover from pyrethroid applications, especially at low rates per acre. See response to AES letter.

On October 4, 2000, Aventis Environmental Science (AES) responded to the Agency's letter dated September 11, 2000 by addressing each bullet in the Agency's letter. Below I have articulated my response to the AES letter, bullet by bullet.

1. **Label application rates**: Based on the recently submitted and accepted efficacy studies, the application rate on the label can be as low as 0.00128 lbs/acre based. Remove label rates lower than 0.00128 lbs/acre or submit data to support their retention.

2. **Aerial Spray data submitted in response to EPA request**. The submitted aerial application data support this use pattern and it may retained on the label provide the changes described by this reviewer are incorporated on the label.

3. **Data were not submitted to support the undiluted application directions.** I challenge AES's assertion that when applied undiluted, AquaPermanone will provide equivalent efficacy to those applications made when diluted with water. I believe that the efficacy of the concentrate may not be equivalent to the water diluted mix because when undiluted, the flow rate (fl.oz./min) and amount of spray/acre will be less. As a result, fewer droplets are available for contact with mosquitoes; and the size and spectrum of spray droplets could differ (from the diluted with water spray). Remove the undiluted application directions or submit data within 75 days of receipt of this letter demonstrating the efficacy of the undiluted formulation.

My comments about the Permanone 31-66 (Permanone Insecticide Concentrate) formulation were in error because I based them on the 432-1150 label instead of 432-1168 label.

5. **Data must be collected/cited and submitted to support control of labeled biting flies.** Submit or cite the data requested in the Agency's letter dated September 11, 2000.

6. **Delete the 100 from the phrase "100-200" from the label.** Submit a label with the change requested in the Agency letter dated September 11, 2000.

7. **Droplet size should be expressed as MMD not VMD**. AES states that the VMD is the prevalent measurement for droplet size. I do not agree. Despite the AES assertion that the VMD is a better measurement, they did not direct all of their cooperators to use this droplet size measurement in the calibration of their ground and aerial sprayers. Instead, most of the data submitted to support product performance were collected using the MMD instead of the VMD as the droplet measurement. If AES insists on using the VMD, then AES needs to submit to EPA a brief describing the relationship between VMD and MMD, such as, "a MMD of __ is equivalent to a VMD of ___ for the following reasons...".

The Aqua-Permanone label requires the applicator to collect spray droplets using Teflon slides instead of the magnesium oxide slide usually used for water based formulations. Is Teflon preferred because the results are more consistent and/or because magnesium oxide slides are not commercially available? Document why the spread factor is 0.61 and submit the data to support it. In addition, what droplet size range is acceptable for product performance? None of the submitted studies looked at this parameter and its effect on efficacy.

8. Explain the 24 hour mortality data from the November, 1997 Merced County study. the 24 hour mortality standard should be used and future data collection should adhere to this guideline to compare the results to the efficacy data of other products and formulations and the historical product performance data base on pyrethroids - and to remain in concert with EPA guidelines and WHOPES recommendations.

9. EPA agrees with the AES response.

Submitted Studies: MRID 45230001 entitled " Compilation of Ground and Aerial Application Efficacy Trials of Permanone Formulations Against Mosquitoes" by Jing Zhai of Aventis Environmental Science, Montvale, NJ. This submission consists of eight field studies, four of these studies evaluate aerial application and four evaluate ground ULV application. Each study review is itemized below.

STUDY #1 Results of the Evaluations of Permanone 31-66 and Aqua-Permanone as ULV against *Aedes taeniorhynchus* by Charles Apperson, North Carolina State University, Department of Entomology. The study was conducted in Beaufort, Carteret County, NC near the Beaufort Airport. October, 1995.

Mosquito species tested: laboratory reared *Aedes taeniorhynchus*

Application type: truck mounted cold ULV fogging

Products tested: Permanone 31-66 and Aquapermanone

Permanone 31-66 Application:
Application rate: 0.00128 lbs/acre at 1:15.8 dilution with Orchex oil

Flow rate: 6 oz/min at 10 mph

Droplet sizes: MMD = 28.12 microns at the 100 foot test cage based on 40 drops collected on Teflon slides. By waving slide through spray cloud before application the MMD was 15.7 microns. Number of drops was not specified but label says 100-200 are to be counted. By waving the slide though the spray cloud immediately after application, the MMD was 10.71 microns. he label recommends a VMD of and not a MMD.

Spread Factor droplet size calculations for drops collected on a Teflon slide = 0.69

Sprayer Pressure: 6.0 psi

Aquapermanone Application

Application rate: 0.00128 lbs./acre diluted 1:9 with tap water

Flow rate: 6.0 oz./min at truck speed of 10 mph

Droplet size: MMD = 16.6 microns based on collection and counting 108 droplets on magnesium oxide slides 100 feet from the sprayer. When collected from the spray cloud behind the truck the MMD when the treatment began was 28.9 microns and at the end of the treatment it was 23.87 microns. The author noted that the "self made" slides may not have had a uniform thickness of magnesium oxide and small drops may not have been counted because they did not impress the thicker potions of the coating on the slide.

Spread factor for magnesium oxide slide = 0.86 (label says Teflon slide with 0.61 spread factor)

Sprayer pressure = 6.0 psi

Experimental Design: Field test consisting of 15 treatment replicates and 5 control replicates. Replicates were arranged in groups of five cages set at distances of 100, 200, and 300 feet, respectively, from the path of the spray truck. Each replicate consisted of 20 caged female *Aedes taeniorhynchus*. The age of the adult mosquitoes was not stated, nor was there any indication as to whether they had been previously blood fed. 10% sucrose was made available in cotton dental wicks. All ULV insecticide applications were made downwind at wind speeds of 1-5 mph. Temperature during the spray applications was 61-69 degrees F. All applications were made in the morning during September, 1995 at the airport located in Beaufort, NC.

Results: Excellent knockdown (100%) at 2 hours post-treatment and 100% 24 hour mortality at the application rate of 0.00128 lbs permethrin/0.00128 lbs. piperonyl butoxide per acre (1:1 ratio insecticide-permethrin:synergist-PBO).

EPA conclusion: These data are ACCEPTABLE and support the GROUND ULV label rate of 0.00128 lbs. permethrin/PBO per acre when diluted 1:9 with water for the Aquapermanone formulation and 1:16 with Orchex oil with the Permanone 31-66 formulation.

Comment to the registrant: Please explain why Teflon slides are listed on the Aquapermanone label for droplet collection instead of magnesium oxide. Otherwise, change the slide type to magnesium oxide and list the appropriate spread factor. In addition, the study did not describe the optimum range of droplet size or a definitive MMD.

Study #2 Effect of flow rates of AquaResilin with an application rate remaining equal for control of caged *Aedes taeniorhynchus* and *Culex quinquefasciatus* in an open field test site by James Dukes and Michael Greer, Florida A & M University, John A. Mulrennan, Sr. Arthropod Research Laboratory, Panama City, Florida 1997.

Mosquito species tested: Laboratory reared *Aedes taeniorhynchus* and *Culex quinquefasciatus* adult females were tested.

Application type: truck mounted cold ULV fogging

Product tested: AquaResilin 20-20

Application rate: 0.00175 lbs AquaResilin (permethrin/PBO)/acre diluted with water (ratio)

Flow rates: 6 oz./min and 12 oz./min at 10 mph

Droplet size: Not stated

Slide type for MMD/VMD measurement: not stated

Spread factor: Not stated

Sprayer Pressure: 4.0 psi

Experimental design and methods: This was open field test consisting of 9 treatment and 3 control replicates (cages with adult mosquitoes) for each species. For the test there were 3 rows of wooden stakes (3 stakes to a row) from which a cage of each species was suspended. The rows were spaced at 100 foot intervals, 100, 200, and 300 feet from the path of the truck mounted sprayer. Each replicate consisted of 25 adult females of the same age/species. The study does not state if slides were located at each replicate to collect spray droplets. Cages were left exposed 30 minutes post-treatment and evaluated for knockdown (KD)/mortality at 1 and 24 hours post-treatment. The collected data were transformed (arcsine transformation) to convert the percentage results (binomially distributed) to a data set conforming to a normal distribution in order to satisfy the assumptions of the F-test used in the ANOVA. The statistical analyses tested a number of hypothesis to see if the four variables: post-treatment time, flow rate, species tested, and distance from the sprayer influenced or affected the outcome of the experiment, thus, the efficacy of the application. The experiment was repeated at two different time intervals.

Results and Evaluation:

The results showed that for this test, *Culex quinquefasciatus* was less susceptible to AquaResilin 20-20 when compared to *Aedes taeniorhynchus* in side-by-side field testing at label rates of 6 and 12 oz./min. at a truck speed of 10 mph. Likewise, *Ae. taeniorhynchus* was knocked-down more quickly compared to *Cx. quinquefasciatus* when sprayed with AquaResilin at the same flow rate. Flow rate did not appear to affect the efficacy of the product against *Ae. taeniorhynchus* but did affect the ability of the product to kill *Cx. quinquefasciatus*.

EPA Conclusion: The study is ACCEPTABLE and the data support the GROUND ULV label rate of 0.00175 lbs./acre when diluted with water. However, the study should have included MMD/VMD and range of droplet size measurements and ratio of insecticide to water.

STUDY #3 Ground application of Aqua-Permanone 20-20 and Permanone 31-66 in controlling of *Anopheles quadrimaculatus* and *Culex quinquefasciatus* by Max Meisch, Professor, University of Arkansas

Mosquito species tested: Wild caught adult *Anopheles quadrimaculatus* and *Culex quinquefasciatus* mosquitoes.

Application type: truck mounted cold ULV fogging (Leco HD)

Products tested: Aqua-Permanone 20-20 diluted in water and Permanone 31-66 diluted in Orchex oil. Dilution ratio not stated.

Application rates: 0.002 and 0.0035 lbs permethrin/acre tested for both products.

Flow rates: 9.4 oz./min at 10 mph

Droplet size: VMD ranged from 26 to 32 microns for Aquapermanone diluted in water. VMD ranged from 10 to 21 microns for Permanone 31-66 diluted in Orchex oil. Note slides collected at 100, 200 and 300 feet from sprayer path.

Slide type/measuring device for MMD/VMD measurement: Teflon coated slides

Spread factor: Not stated

Sprayer Pressure: 3.0 psi

Experimental design and methods: Three rows of cages of each species containing an unknown number of adults each were hung from stakes at 100, 200, 300 feet perpendicular to the path of the sprayer (The number of cages, number of adult mosquitoes per cage, and sex of tested adult mosquitoes was not stated.). Ten minutes after treatment, mosquitoes were transferred to clean cages and fed 10% sucrose. Mosquito knockdown and kill was measured at 1, 12 and 24 hours post-treatment. No mention of control replicates is made in the description of the experiment nor is there reference to correction by Abbott's Formula or a discussion of statistical analyses, if any, performed on these data. The air temperature and wind speed and direction are not listed.

Results: Permanone 31-66 outperformed Aqua-Permanone against both species at both application rates. Efficacy of both formulations was poor at 0.0002 lb./acre and well below the OPPTS Guideline performance standard. Performance of Aqua-Permanone at the 0.0035 lbs permethrin/acre was also below the performance standard while Permanone 31-66 was acceptable when the results for both species were pooled.

EPA Conclusion: This study is rated SUPPLEMENTARY and does not fulfill the guideline requirement due to deficiencies in reporting a variety of study parameters and lack of efficacy

with AquaResilin. These data are more evidence that the Permanone 31-66 label rate of 0.0035 lbs./acre or higher is effective.

STUDY #4 Efficacy of Aqua-Resilin applied by electramist sprayer against saltmarsh mosquitoes, *Aedes sollicitans*, in Cape May County, New Jersey by Cape May County Mosquito Control Commission.

Mosquito species tested: Wild caught adult female *Aedes sollicitans* mosquitoes.

Application type: truck mounted cold ULV fogging (Electramist)

Product tested: Aqua-Resilin diluted in water.

Application rate: 0.0035 lbs permethrin/acre diluted in water at 1:4.5

Flow rate: 9.1 oz./min at 10 mph

Droplet size: MMD was 13.5 microns directly in front of the nozzle. Droplet range not provided.

Slide type/measuring device for MMD/VMD measurement:
AIMS - CD III (Army Insecticide Measuring System)

Spread factor: None due to measuring device used.

Sprayer Pressure: none, because the electric unit uses a rotary atomizer. The number of revolutions per minute was not listed.

Experimental design and methods: Three rows of cages were hung five feet above the ground from stakes at 100, 200, 300 feet perpendicular to the path of the sprayer. Each cage contained 14 to 32 female mosquitoes. The number of cage replicates in this test was not stated. Knockdown/mortality was measured at 1, 2 and 24 hours post-treatment. Control cages were placed upwind from path of the truck mounted sprayer.

EPA Conclusion: This study is ACCEPTABLE and supports the GROUND ULV label rate for Aqua-Resilin applied at 0.0035 lbs./acre diluted 1:4.5 in water. It provided excellent control and knockdown against the saltmarsh mosquito *Ae. sollicitans*. This study also demonstrated the compatibility of this formulation with the rotary atomizer of an electric sprayer.

STUDY #5 Efficacy of Aqua-Resilin applied by airplane at low temperature (< 60^0 F) in Chambers County, Texas by Tom Janousek, Pest Consulting Services, Omaha, NE and Jing Zhai, Aventis.

Mosquito species tested: Wild caught adult female *Culex salinarius*.

Application type: Aerial. Pawnee fixed wing aircraft flown at an altitude of 100' with offsets of 500 feet and 1000 feet from the treatment target to compensate for wind and drift

Product tested: Aqua-Resilin diluted in water.

Application rate: 0.0035 lbs permethrin/acre diluted in water at 1:1.5

Flow rate: 1.6 gal/min at flight speed of 150 mph.

Droplet size: MMD ranged from 8.8 microns at 500 feet from flight path and declined to 4.26 microns and 5.05 microns at 1500 and 2000 feet from the flight path. This was based on the results of only one test since the slide spinner batteries died during the second test.

Slide type/measuring device for MMD/VMD measurement: Teflon coated slides on mounted on spinners 500 to 2000 feet from the flight path.

Spread factor: 0.61 per Jim Dukes and label.

Sprayer Pressure: At the boom - 50 lbs. with T-jet 110-015 nozzles, 10 nozzles spraying

Air temperature was higher at 15 feet than at the ground (temperature inversion existed). Temperature was low for aerial application and mosquito activity although *Cx. salinarius* tend to be active even at low temperatures. Wind speed was 7-11 mph. Humidity was high - 85-95%

Experimental design and methods: Two rows of cages were placed 500 feet apart. Along each row, at 500 foot intervals perpendicular to the flight path, two round cages covered with nylon mesh were hung from stakes. Mosquito cages were hung up to 3500 feet from the flight path. Slide spinners were placed near the cage stand frame at each interval up to 2000 feet from the flight path (a diagram of the test plot was included in the study). An untreated control grid containing four cages was established upwind from the test plot. Mortality was observed at 1, 2, and 12 hours after treatment.

In order to show how much permethrin reached each cage location, ten feet of common knitting yarn was woven along the hooks on the frames of the cage stand to collect permethrin droplets. Yarn samples were analyzed by a method capable of detecting trace levels of permethrin (This method is being forwarded to EPA chemists for their review and comment to determine if use of

such a method for field detection and recovery of trace amounts of permethrin is valid.)

Results: Mortality was 95 % or greater in both tests with the exception of the 500 foot interval in test one where it was only 69% at 24 hrs. Recovery of permethrin at each collection site was variable but did decline as the distance from flight path increased. The data were plotted on a linear scale, not a log scale, so it is not clear whether the relationship between permethrin recovery and distance from the flight path is a linear one or not. Slope was not calculated and no other mathematical/statistical analyses performed on the collected data. PBO levels were not measured in this experiment and would be interesting to know if permethrin and PBO deposit together as has always been assumed. From these data, the authors conclude that even at very low levels, permethrin is efficacious.

EPA Conclusion: This study is ACCEPTABLE and supports the AERIAL application of Aqua-Resilin at the rate of 0.0035 lbs/acre or greater when applied by aircraft with T-jet nozzles at low nozzle pressure spraying at 100 feet altitude at an airspeed of 150 mph. The flow rate is 1.6 gallons per minute when diluted 1:1.5 with water. Th application rate also needs to be expressed as amount of finished mix applied per acre - (oz. or gals./acre)The application was successful at an MMD of approximately 5-9 microns. No droplet size range was provide and this needs to be determined. The data suggest, based on yarn samples, that at low rates this product may be effective. No residue data were collected for PBO. The study should have included 24 hr. mortality data.

Efficacy of Aqua-Resilin applied by airplane at low temperatures (< 65^0 F) in Gunnison, Colorado by Tom Janousek, Pest Control Consulting Services, Omaha, NE and Jing Zhai, Aventis Environmental Science.

Mosquito species tested: Wild caught adult female *Aedes dorsalis*. 10 females per cage.

Application type: Aerial. Cessna Ag truck 402B flown at an altitude of 150'. Unlike the above study the wind speeds were negligible and an offset from the plot was not used. Swath width was 500 feet.

Products tested: Aqua-Resilin diluted in water at 1:4.4

Application rates: 0.0035 lbs permethrin/acre diluted in water at 1:4.4

Flow rates: 1.7 gal/min at flight speed of 150 mph.

Droplet size: MMD ranged from 11.30 to 19.30 microns. This was based on the results of only one test plot since the slide spinner batteries died during the second test.

Slide type/measuring device for MMD/VMD measurement: Teflon coated slides on mounted on

spinners placed adjacent to test cages. The aircraft flew an 11,000 acre treatment block. The slide spinners were within the treatment block.

Spread factor: 0.61 per Jim Dukes (unpublished)

Sprayer Pressure: At the boom - 50 lbs. with t-jet 110-015 nozzles, 10 nozzles spraying

Air temperature was higher at 15 feet than at the ground. Temperature was low for aerial application and mosquito activity in one test and mild in the other. Wind speed was 0-2 mph.

Experimental design and methods: Two columns of cages were placed 200 feet apart in a 3x3x3 grid perpendicular to the flight path. Two round cages covered with nylon mesh were hung from stakes in each column. Cages with mosquitoes were hung. Slide spinners were placed near the cage stand frame at each interval. An untreated control grid containing four cages was established 2 miles upwind from the test plot. Mortality was observed at 2,3, and 12 hours after treatment. Landing rates with human baits (4 persons) at two sites were also utilized to assess the efficacy of the application. The collection time was one minute and mosquitoes landing on the lower half of the body.

Results: The aerial spray application provided good control of *Aedes dorsalis*. At 2 hrs.>85% of the mosquitoes were knocked down; at 3 hrs., knockdown increased to 90% and this level of control continued to12 hrs. post-treatment although there was a slight recovery in the treatments (typical at low application rates for most pyrethroids). Unfortunately, this study did not include 24 hr. mortality results and therefore, it is not known whether or not more mosquitoes recovered from the treatment. Landing rate tests confirmed the above results.

EPA Conclusion: This study is ACCEPTABLE and supports the AERIAL application of Aqua-Resilin at the rate of 0.0035 lbs/acre or greater when applied by aircraft with T-jet nozzles at low nozzle pressure spraying at 150 feet altitude at an airspeed of 150 mph. The flow rate is 1.7 gallons per minute when diluted 1:4.4 with water, however, this needs to also be expressed as volume/acre. The application was successful at an MMD of approximately 12-20 microns. No droplet size range was provided and this needs to be determined and added to the label. The sample size for mosquitoes should have been larger.

Aerial application of AquaResilin 20-20 against mosquitoes in Salt Lake City, Utah. By Sammie Lee Dickinson, Salt Lake City Mosquito Abatement District, Salt Lake City, Utah and Gary Hatch, Davis County Mosquito Abatement District, Kaysville, Utah.

Mosquito species tested: Wild caught adult female mosquitoes consisting of *three* species: *Culex tarsalis* (95%); *Aedes dorsalis* (4%), and *Culex erythrothorax* (1%). Twenty to 68 mosquitoes were used per cage raw data not provided.

Application type: Aerial. Cessna Ag truck 402B flown at an altitude of 100'. Airspeed was slow - 110 mph. The cooperator claimed that the swath width was maintained at 500 feet.

Products tested: Aqua-Resilin diluted in water 1:8

Application rates: 0.0035 lbs permethrin/acre diluted in water at 1:8 equivalent to 2.5 oz./acre

Flow rates: unknown

Droplet size: MMD was 16.2 microns for Aqua-Resilin; not determined for Fyfanon due to rainfall.

Slide type/measuring device for MMD/VMD measurement: Teflon coated slides mounted on BioQuip spinners adjacent to the test cages.

Spread factor: not provided

Sprayer Pressure: At the boom - not provided - but 3 Microaire AU 4000 nozzles were located on each wing.

Air temperature at the ground was 70-72^{0}F. The sky was overcast and wind speed 5-9, gusting to 12 mph. The authors noted that these conditions were not acceptable for aerial spraying in their districts but they sprayed under less than optimal conditions. Humidity was 5%. The terrain was flat and wide-open.

Experimental design and methods: Nine cages were placed 200 feet apart in rows of three in the middle of the treatment block. Five control cages were placed in an untreated field (location unknown) for 10 minutes and transferred to the laboratory. Mortality was assessed at 1, 2, and 12 hrs. after treatment. On the night following the application, field populations of mosquitoes were monitored with CDC baited traps to better evaluate the collected data.

The cage results showed excellent knockdown (>95%) against the species tested. Mortality at 12 hours was 99%. However, the CDC baited traps showed only 58.6% control. It appears from the field population monitoring post-treatment that permethrin susceptibility may be widely variable and differ between species. In this case, Aedes dorsalis populations appear to be largely unaffected while *Culex* and *Culiseta* species appear susceptible. The authors do not attempt to explain this result but reported the observation only. Therefore, it is clear that the application is not residual but it is unclear if *Ae. dorsalis* populations moved from the Salt Lake region to the treatment in the evening.

EPA Conclusion: This study is ACCEPTABLE and supports the AERIAL application of Aqua-Resilin at the rate of 0.0035 lbs/acre or greater when applied by aircraft with 3 Microaire AU 4000 nozzles were located on each wing spraying at 100 feet altitude at an airspeed of 110 mph.

The flow rate was 1.7 gallons per minute when diluted 1:8 with water and this was expressed as 2.5 oz./acre. The application was successful at an MMD of approximately 16.2 microns. No droplet size range was provided and this needs to be determined. The study also demonstrated that even at very low relative humidity, the water based AquaResilin formulation was able to reach the target and kill mosquitoes.

Aerial Application of AquaResilin against caged mosquitoes in Georgetown, South Carolina by Todd Gwinn, Georgetown Mosquito Control, Georgetown, South Carolina.

Mosquitoes tested: Four species were field collected: *Aedes sollicitans* (56.25%); *Ae. taeniorhynchus* (37.5%); *Psorophora columbiae (*4.25%*); and Aedes vexans (*2%*)*. Cages containing a 20 adult mosquitoes (a mixture of the four species) were field tested.

Application type: Aerial. Type of aircraft not reported. Application made at an altitude of 150'. Airspeed was not reported.

Products tested: Aqua-Resilin diluted in water 1:10.6
Fyfanon (96% malathion) applied undiluted at 3.0 oz./acre (0.1 lbs.)

Application rates: 0.0035 lbs permethrin/acre diluted in water at 1:10.6. Equivalent to application rate of 3.1 oz. diluted product/acre

Flow rates: not stated

Droplet size: MMD was not determined for malathion due to rain. For AquaResilin, the MMD were 10, 8.1, and 10.1 microns. Up to114 drops were counted.

Slide type/measuring device for MMD/VMD measurement: Teflon coated slides mounted on BioQuip spinners adjacent to the test cages. However, rain on slides made malathion unreadable.

Spread factor: not provided

Sprayer Pressure: At the boom-38-40 psi. T-jet 8003 nozzles used (# of nozzles was not stated).

Air temperature was not stated. The skies were overcast and it was raining lightly at the beginning of the application, wind speed was 0, and RH = 96-99%.

Experimental design and methods: Twenty adult mosquitoes consisting of four species but with 94% of the caged mosquitoes consisting of *Ae. sollicitans* and *Ae. taeniorhynchus* - both saltmarsh mosquitoes were evaluated against malathion and AquaResilin in three different canopy types with four replicates per type. Canopy types were determined by amount of canopy coverage and consisted of open, moderate, and heavy canopy. Mortality was assessed at 24 hrs.

post-treatment

Results: These data are supplemental but show that equivalent results are obtained with Aqua-Resilin and Fyfanon against saltmarsh mosquitoes under similar environmental conditions and pest pressure. Applications made to open areas resulted 83-85% mortality. Mortality declined as canopy became more dense. This was probably due to rainfall and protection offered mosquitoes from foliage at the site.

EPA Conclusion: This study is ACCEPTABLE and supports the AERIAL application of Aqua-Resilin at the rate of 0.0035 lbs a.i./acre or greater when applied by aircraft with T-jet nozzles located on each wing spraying at 150 feet altitude. AquaResilin was diluted 1:10.6 with water and applied at 3.1 oz. finished solution/acre. The application was successful at an MMD of approximately 8-10 microns. No droplet size range was provided and this needs to be determined. The study also demonstrated that even at very low relative humidity, the water based AquaResilin formulation was able to reach the target and kill mosquitoes. However, the cage test was not indicative of success over the entire area over time. The time of application may have been when field populations of mosquitoes were not active and exposed to descending droplets.