**APPENDIX 3-3: Spray Drift Considerations for Malathion**

Spray drift estimates were derived to reflect the most recent offsite deposition guidance[[1]](#footnote-1),[[2]](#footnote-2) and considered the currently labeled buffer restrictions [25 ft. (aerial non-ULV), 50 ft. (aerial ULV)] for aquatic water bodies included on all agricultural malathion labels. These buffers were stipulated in the 2006 RED mitigations. The Boll Weevil Eradication Program is exempted from this buffer requirement and applicable spray drift fractions are presented below.

Using AgDRIFT (version 2.1.1) drift fractions (proportion of spray drift deposition relative to application rate) were calculated for each aquatic bin for each application method, corresponding buffer distance, and droplet size distribution. The results of this analysis are presented in **Table B 3-3.1**. These results are used in deriving aquatic estimate environmental concentrations (EECs).

**Table B 3-3.1. Spray Drift Estimates for Aquatic Bins and Various Aquatic Buffer Combinations**

|  |  |
| --- | --- |
| **Bin** | **Spray drift fraction of the application rate (unitless)****Application Method and Buffer** |
| **Generic Habitat** | **Depth (m, ft)** | **Width (m, ft)** | **Aerial non-ULVa** | **Aerial ULVb** | **Boll Weevil Eradication Program – Aerialc** | **Ground** |
| **25 ft Buffer** | **50 ft Buffer** | **No Buffer** | **No Buffer** |
| 2- low-flow | 0.1, 0.33 | 2, 6.6 | 0.17 | 0.13 | 0.437 | 0.22 |
| 3- Moderate-flow | 1, 3.3 | 8, 26.2 | 0.15 | 0.12 | 0.32 | 0.08 |
| 4- High-flow | 2, 6.6 | 40, 131.2 | 0.09 | 0.07 | 0.167 | 0.02 |
| 5 -Low-volume | 0.1, 0.33 | 1, 3.3 | 0.18 | 0.14 | 0.469 | 0.33 |
| 6- Moderate-volume | 1, 3.3 | 10, 32.8 | 0.15 | 0.11 | 0.297 | 0.07 |
| 7-High-volume | 2, 6.6 | 100, 328.1 | 0.05 | 0.04 | 0.093 | 0.01 |
| 1. Aerial non-ULV: ASAE Medium (dv0.5 = 294 µm); release height = 10 feet; application efficiency = 0.95
2. Aerial ULV; ASAE Medium (dv0.5 = 294 µm); release height = 10 feet; application efficiency = 0.95
3. BWEP, ASAE Fine to Medium droplet spectrum (dv0.5 = 255 µm); release height = 10 feet; application efficiency = 0.95
4. Ground, fine to medium coarse droplet spectrum
 |

Adulticide applications for malathion are unique in that the pesticide is applied as an ultra-low volume (ULV) spray designed to target the flying adult mosquito vector. The spray droplets must be small enough to be produced in sufficient numbers for probability of contact and large enough to impact or impinge readily on the surface of adult mosquitos (Mount, 1970). As a result, the purpose of adulticide applications is for the pesticide to reside in the air, causing the pesticide to drift.

Spray drift for adulticide applications (*e.g.*, aerial ultra-low volume applications at release heights of > 100 ft) are evaluated using the AGDISP version 8.26 model. The input parameters provided in **Table B 3-3.2** are used to model estimated environmental concentrations (EECs) for malathion.

**TableB 3-3.2. Input Parameters for Modeling ULV Adulticide Applications in AGDISP**.

|  |
| --- |
| **Malathion** |
| **Parameter** | **Value** |
| Product | Fyfanon ULV Mosquito (Reg. No. 67760-34) |
| Aircraft type | Air Tractor AT-401 |
| Aircraft speed (mph) | 120 |
| Percent active ingredient | 96.5 |
| Pounds active ingredient per gallon of product | 9.9 |
| Application rate (lbs ai/A) | 0.23 |
| Minimum release height (ft) | 100 |
| Minimum wind speed (mph) | 1 |
| Temperature (°F) / Relative humidity (%) | 65 / 50 |
| Canopy | None |
| Surface roughness length (ft) | 0.0246 |
| Stability | Overcast |
| Number of nozzles | 1, oriented along center of craft |
| Volume, diameter, 50th percentile DV50 (µm) | 60 |
| Volume, diameter, 90th percentile DV90 (µm) | 100 |
| Spray volume (gal/A) | 0.023 (0.23 lbs ai/A ÷ 9.9 lbs ai/gallon product)  |
| Active fraction | 0.965 |
| Nonvolatile fraction | 1.0 |
| Specific gravity, carrier and active+additive | 1.23 (9.9 lbs ai/gallon product ÷ 0.965 lbs ai/lb product ÷ 8.34 lbs water/gallon water) |
| Number of swaths | 1 |
| Swath width (ft) | 168 |
| Swath displacement (ft) | 0 |
| Swath offset | 0 swath |

Typical aerial ULV adulticide applications employ a 500-1500 ft swath width (Florida Coordinating Council on Mosquito control, 2009). For the aquatic and terrestrial modeling, an initial swath width of 500 ft was selected in order to generate conservative application efficiencies (*e.g.*, a measure of how much active material lands on the spray block) and spray drift fractions to nearby waterbodies. When running the AGDISP model, point deposition fractions (*e.g.*, the fraction of the amount applied that deposits at a specific location) much greater than 1 (approximately 3-4) were estimated when a 500 ft swath was used. Believing this to be an error, swath widths were adjusted to 168 ft for malathion in order to generate a maximum deposition fraction close to 1 and then the deposition versus distance calculations were adjusted for a 500 ft swath. Deposition fractions starting from the edge of the treatment block (*e.g.*, the area immediately below the application swath) are generated by using linear interpolation between the adjusted values. For instance, for malathion the deposition fraction at the edge of the treatment block (0 ft) is estimated using linear interpolation between the deposition value at -3.92 ft (0.079069) and the deposition value at 2.6416 ft (0.076224) (slope of -0.0043 and intercept of 0.077369). The deposition values are then averaged over the width of the 500 ft swath to estimate an application efficiency and averaged over the width of the waterbody bins to estimate aquatic deposition values. Deposition values from the AGDISP model are provided in **Supplement B 3-3.1**.

Malathion can also be applied via ground application. Labeled specifications for drop size distributions for ground applications require a DV50 of 30 µm and DV90 of 50 µm. The labels also indicate an effective swath width for ground applications of 300 ft. EPA has yet to approve the use of the ground modeling algorithm, available in the AGDISP model, for use in assessing ground applications of pesticides. Therefore modeling of ground applied adulticides could not be conducted. However, in 2013, EPA (DP Barcode 407817, 3/28/2013) conducted a comparison of ground and aerial applications of adulticides using open literature information and other modeling and concluded that the maximum deposition was similar between the two methods of application. Based on this analysis, a summary of which is provided in **Supplement B 3.3-2**, aerial deposition fractions are considered to be the same as those expected for ground applications.

Subsequent to the development of these estimates and late in the BE development process, discussions with AGDISP developers at the US Forestry Service indicated that point deposition fractions indeed could exceed 1. During the public comment period, EPA solicited recommendations for improving the AGDISP model values used to derive deposition and application efficiency values (see **Table B 3-3.2**) and for appropriate, protective estimates of the deposition in terrestrial and aquatic environments for use in exposure estimations from stakeholders, the scientific community, and the public. During the public comment period, several commenters recommended reviewing a study conducted by Mickle *et al*, 2005, for use in assessing drift from ground and aerial adulticide applications. EPA reviewed the study and found it provided information for qualitative use in the BE, as the application conditions used in the study (*e.g.*, release height, drop size distribution, *etc.*) do not reflect approved label conditions that would result in peak exposure. Results of the study indicated the following:

* Peak deposition from the ground and aerial applications were equivalent despite a 4-fold application rate increase for aerial spraying.
* For ground trials, ca. 10-50% of the malathion spray was recovered within the 500 m sampling grid, depending on the wind speed, with recoveries of 35-50% within the 5 km grid for aerial trials.
* For aerial applications, peak depositions predicted by AGDISP were shifted 300-400 m further downwind from the observed measurements. For ground applications, in low wind conditions, AGDISP accurately predicted peak values similar to those seen in the field trials.

From the study, EPA concludes that deposition fractions are similar for ground and aerial applications and that AGDISP provides deposition estimates in line with those observed in monitoring studies.

**Table B 3-3.3** provides the spray drift deposition estimates for the aquatic bins for malathion and the application efficiency for associated ULV applications. The spray drift deposition values reflect waterbodies at the edge of the treatment block and reflect the average deposition across the width of the waterbody. Unlike agricultural applications of malathion, there are no buffer zones for adulticide applications.

**Table B 3-3.3. Spray Drift Deposition and Application Efficiency Estimates for ULV Adulticide Applications**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Aquatic bin | 2 | 3 | 4 | 5 | 6 | 7 | Application Efficiency |
| Width (m) | 2 | 8 | 40 | 1 | 10 | 100 |
| Width (ft) | 6.56 | 26.24 | 131.2 | 3.28 | 32.8 | 328 |
| Chemical | Deposition Fraction |
| Malathion | 0.076 | 0.072 | 0.053 | 0.077 | 0.071 | 0.035 | 0.29 |

In order to determine terrestrial exposure in the TED tool due to offsite deposition resulting from ULV applications, deposition data were fitted to the following curve equation, similar to what is done for ground applications in AgDRIFT:

$Deposition fraction= \frac{c}{\left(1+ax\right)^{b}}$

where x is distance in feet.

Using the adjusted distance and deposition parameters provided in **Supplement B 3-3.1**, the following parameters were developed:

|  |  |  |  |
| --- | --- | --- | --- |
| Active Ingredient | a | b | c |
| Malathion | 4.00E-05 | 123 | 0.077 |

**Figure B 3-3.1** below depicts the fit of the curve for malathion. While there is not perfect agreement between the estimated deposition curve based on the regression analysis and the deposition data generated using AGDISP, the curve provides conservative estimates for use in the TED tool (*i.e.*, does not underestimate the contribution of drift).



**Figure B 3-3.1. Deposition Curve Fir for Malathion ULV Applications**

**Reference**

1. Florida Coordinating Council on Mosquito Control. 2009. Florida Mosquito Control 2009. <http://mosquito.ifas.ufl.edu/Documents/Florida_Mosquito_Control_White_Paper.pdf>
2. Mickle, R.E., G. Rosseau, and O. Samuel. 2005. Direct Comparison of Deposit from Aerial and Ground ULV Applications of Malathion with AGDISP Predictions. Unpublished study performed by REMSpC Consulting, Ontario, Canada; sponsored and submitted by Cheminova A/S, Denmark. REMSpC Report No: 2005-02
3. Mount, G.A. 1970. Optimum droplet size for adult mosquito control with space sprays or aerosols of insecticides. Mosquito News, 30, 70–75.
4. USEPA. 2013. Spray Drift Analysis for the Etofenprox Label Amendment (Petition No. 1E7925). DP Barcode 407817. March 28, 2013.

**Supplement B 3-3.1. AGDISP Deposition Estimates**

Table B 3-3.1.1 Deposition Data, Malathion

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Distance (ft) | Dep Frac | Dist Dif | Adj Distance (ft) | Dep Frac |  |  |  |  |
| -168 | 0 | 332 | -500 | 0 |  |  |  |  |
| -161.5385 | 0 |  | -493.5385 | 0 |  |  |  |  |
| -155.0769 | 0 |  | -487.0769 | 0 |  |  |  |  |
| -148.6154 | 0 |  | -480.6154 | 0 |  |  |  |  |
| -142.1539 | 0 |  | -474.1539 | 0 |  |  |  |  |
| -135.6923 | 0 |  | -467.6923 | 0 |  |  |  |  |
| -129.2308 | 0 |  | -461.2308 | 0 |  |  |  |  |
| -122.7692 | 0 |  | -454.7692 | 0 |  |  |  |  |
| -116.3077 | 0 |  | -448.3077 | 0 |  |  |  |  |
| -109.8461 | 0 |  | -441.8461 | 0 |  |  |  |  |
| -103.3846 | 0 |  | -435.3846 | 0 |  |  |  |  |
| -96.92307 | 0 |  | -428.92307 | 0 |  |  |  |  |
| -90.46153 | 0 |  | -422.46153 | 0 |  |  |  |  |
| -83.99999 | 0 |  | -415.99999 | 0 |  |  |  |  |
| -77.53846 | 0 |  | -409.53846 | 0 |  |  |  |  |
| -71.07693 | 1.42E-16 |  | -403.07693 | 1.42E-16 |  |  |  |  |
| -64.61539 | 2.80E-13 |  | -396.61539 | 2.8E-13 |  |  |  |  |
| -58.15385 | 2.48E-12 |  | -390.15385 | 2.48E-12 |  |  |  |  |
| -51.69232 | 3.73E-08 |  | -383.69232 | 3.73E-08 |  |  |  |  |
| -45.23079 | 5.68E-05 |  | -377.23079 | 5.68E-05 |  |  |  |  |
| -38.76925 | 5.57E-03 |  | -370.76925 | 0.00557 |  |  |  |  |
| -32.30769 | 4.30E-02 |  | -364.30769 | 0.04297 |  |  |  |  |
| -25.84616 | 1.03E-01 |  | -357.84616 | 0.10282 |  |  |  |  |
| -19.38462 | 0.205554 |  | -351.38462 | 0.205554 |  |  |  |  |
| -12.92308 | 0.32749 |  | -344.92308 | 0.32749 |  |  |  |  |
| -6.461539 | 0.471163 |  | -338.461539 | 0.471163 |  |  |  |  |
| 0 | 0.628023 |  | -332 | 0.628023 |  |  |  |  |
| 6.5616 | 0.767823 |  | -325.4384 | 0.767823 |  |  |  |  |
| 13.1232 | 0.870475 |  | -318.8768 | 0.870475 |  |  |  |  |
| 19.6848 | 0.942678 |  | -312.3152 | 0.942678 |  |  |  |  |
| 26.2464 | 0.984955 |  | -305.7536 | 0.984955 |  |  |  |  |
| 32.808 | 0.995654 |  | -299.192 | 0.995654 |  |  |  |  |
| 39.3696 | 0.984485 |  | -292.6304 | 0.984485 |  |  |  |  |
| 45.9312 | 0.959069 |  | -286.0688 | 0.959069 |  |  |  |  |
| 52.4928 | 0.92343 |  | -279.5072 | 0.92343 |  |  |  |  |
| 59.0544 | 0.881028 |  | -272.9456 | 0.881028 |  |  |  |  |
| 65.616 | 0.83559 |  | -266.384 | 0.83559 |  |  |  |  |
| 72.1776 | 0.78652 |  | -259.8224 | 0.78652 |  |  |  |  |
| 78.7392 | 0.737833 |  | -253.2608 | 0.737833 |  |  |  |  |
| 85.3008 | 0.688347 |  | -246.6992 | 0.688347 |  |  |  |  |
| 91.8624 | 0.640358 |  | -240.1376 | 0.640358 |  |  |  |  |
| 98.424 | 0.598272 |  | -233.576 | 0.598272 |  |  |  |  |
| 104.9856 | 0.558268 |  | -227.0144 | 0.558268 |  |  |  |  |
| 111.5472 | 0.518861 |  | -220.4528 | 0.518861 |  |  |  |  |
| 118.1088 | 0.484572 |  | -213.8912 | 0.484572 |  |  |  |  |
| 124.6704 | 0.455194 |  | -207.3296 | 0.455194 |  |  |  |  |
| 131.232 | 0.425694 |  | -200.768 | 0.425694 |  |  |  |  |
| 137.7936 | 0.395171 |  | -194.2064 | 0.395171 |  |  |  |  |
| 144.3552 | 0.3673 |  | -187.6448 | 0.3673 |  |  |  |  |
| 150.9168 | 0.344417 |  | -181.0832 | 0.344417 |  |  |  |  |
| 157.4784 | 0.324967 |  | -174.5216 | 0.324967 |  |  |  |  |
| 164.04 | 0.305908 |  | -167.96 | 0.305908 |  |  |  |  |
| 170.6016 | 0.286114 |  | -161.3984 | 0.286114 |  |  |  |  |
| 177.1632 | 0.266827 |  | -154.8368 | 0.266827 |  |  |  |  |
| 183.7248 | 0.249766 |  | -148.2752 | 0.249766 |  |  |  |  |
| 190.2864 | 0.235544 |  | -141.7136 | 0.235544 |  |  |  |  |
| 196.848 | 0.223357 |  | -135.152 | 0.223357 |  |  |  |  |
| 203.4096 | 0.211789 |  | -128.5904 | 0.211789 |  |  |  |  |
| 209.9712 | 0.199959 |  | -122.0288 | 0.199959 |  |  |  |  |
| 216.5328 | 0.187961 |  | -115.4672 | 0.187961 |  |  |  |  |
| 223.0944 | 0.176402 |  | -108.9056 | 0.176402 |  |  |  |  |
| 229.656 | 0.165841 |  | -102.344 | 0.165841 |  |  |  |  |
| 236.2176 | 0.156583 |  | -95.7824 | 0.156583 |  |  |  |  |
| 242.7792 | 0.148678 |  | -89.2208 | 0.148678 |  |  |  |  |
| 249.3408 | 0.141897 |  | -82.6592 | 0.141897 |  |  |  |  |
| 255.9024 | 0.135765 |  | -76.0976 | 0.135765 |  |  |  |  |
| 262.464 | 0.129758 |  | -69.536 | 0.129758 |  |  |  |  |
| 269.0256 | 0.123584 |  | -62.9744 | 0.123584 |  |  |  |  |
| 275.5872 | 0.117288 |  | -56.4128 | 0.117288 |  |  |  |  |
| 282.1488 | 0.1111 |  | -49.8512 | 0.1111 |  |  |  |  |
| 288.7104 | 0.105227 |  | -43.2896 | 0.105227 |  |  |  |  |
| 295.272 | 9.98E-02 |  | -36.728 | 0.099766 |  |  |  |  |
| 301.8336 | 9.47E-02 |  | -30.1664 | 0.094731 |  |  |  |  |
| 308.3952 | 9.01E-02 |  | -23.6048 | 0.090124 |  |  |  |  |
| 314.9568 | 8.60E-02 |  | -17.0432 | 0.085961 |  |  |  |  |
| 321.5184 | 8.23E-02 |  | -10.4816 | 0.082279 |  |  |  |  |
| 328.08 | 7.91E-02 |  | -3.92 | 0.079069 | Dist (ft) | Dep Frac | Slope | Intercept |
| 334.6416 | 7.62E-02 |  | 2.6416 | 0.076224 | 0 | 0.077369 | -0.00043 | 0.077369 |
| 341.2032 | 7.35E-02 |  | 9.2032 | 0.073543 | 6.5616 | 0.074622 | -0.00041 | 0.077303 |
| 347.7648 | 7.08E-02 |  | 15.7648 | 0.070846 | 13.1232 | 0.071932 | -0.00041 | 0.077324 |
| 354.3264 | 6.81E-02 |  | 22.3264 | 0.06806 | 19.6848 | 0.069182 | -0.00042 | 0.077541 |
| 360.888 | 6.52E-02 |  | 28.888 | 0.065229 | 26.2464 | 0.066369 | -0.00043 | 0.077695 |
| 367.4496 | 6.24E-02 |  | 35.4496 | 0.062441 | 32.808 | 0.063563 | -0.00042 | 0.077501 |
| 374.0112 | 5.98E-02 |  | 42.0112 | 0.059768 | 39.3696 | 0.060844 | -0.00041 | 0.076882 |
| 380.5728 | 5.72E-02 |  | 48.5728 | 0.057243 | 45.9312 | 0.05826 | -0.00038 | 0.075933 |
| 387.1344 | 5.49E-02 |  | 55.1344 | 0.054862 | 52.4928 | 0.055821 | -0.00036 | 0.074869 |
| 393.696 | 5.26E-02 |  | 61.696 | 0.0526 | 59.0544 | 0.053511 | -0.00034 | 0.073873 |
| 400.2576 | 5.04E-02 |  | 68.2576 | 0.050443 | 65.616 | 0.051311 | -0.00033 | 0.072877 |
| 406.8192 | 4.84E-02 |  | 74.8192 | 0.048401 | 72.1776 | 0.049223 | -0.00031 | 0.071686 |
| 413.3808 | 4.66E-02 |  | 81.3808 | 0.046567 | 78.7392 | 0.047306 | -0.00028 | 0.069312 |
| 419.9424 | 4.48E-02 |  | 87.9424 | 0.04483 | 85.3008 | 0.045529 | -0.00026 | 0.068116 |
| 426.504 | 4.32E-02 |  | 94.504 | 0.043171 | 91.8624 | 0.043839 | -0.00025 | 0.067068 |
| 433.0656 | 4.16E-02 |  | 101.0656 | 0.041633 | 98.424 | 0.042252 | -0.00023 | 0.065315 |
| 439.6272 | 4.03E-02 |  | 107.6272 | 0.040281 | 104.9856 | 0.040825 | -0.00021 | 0.062465 |
| 446.1888 | 3.91E-02 |  | 114.1888 | 0.039099 | 111.5472 | 0.039575 | -0.00018 | 0.059657 |
| 452.7504 | 3.80E-02 |  | 120.7504 | 0.037993 | 118.1088 | 0.038439 | -0.00017 | 0.058344 |
| 459.312 | 3.69E-02 |  | 127.312 | 0.036878 | 124.6704 | 0.037327 | -0.00017 | 0.058523 |
| 465.8736 | 3.57E-02 |  | 133.8736 | 0.035744 | 131.232 | 0.036201 | -0.00017 | 0.05887 |
| 472.4352 | 3.46E-02 |  | 140.4352 | 0.034624 | 137.7936 | 0.035075 | -0.00017 | 0.058608 |
| 478.9968 | 3.35E-02 |  | 146.9968 | 0.033519 | 144.3552 | 0.033964 | -0.00017 | 0.058257 |
| 485.5584 | 3.24E-02 |  | 153.5584 | 0.032401 | 150.9168 | 0.032851 | -0.00017 | 0.058573 |
| 492.12 | 3.13E-02 |  | 160.12 | 0.031254 | 157.4784 | 0.031716 | -0.00017 | 0.059255 |
| 498.6816 | 3.01E-02 |  | 166.6816 | 0.030107 | 164.04 | 0.030569 | -0.00017 | 0.059237 |
| 505.2432 | 2.90E-02 |  | 173.2432 | 0.02901 | 170.6016 | 0.029451 | -0.00017 | 0.057981 |
| 511.8048 | 2.80E-02 |  | 179.8048 | 0.027986 | 177.1632 | 0.028398 | -0.00016 | 0.056034 |
| 518.3664 | 2.71E-02 |  | 186.3664 | 0.027056 | 183.7248 | 0.02743 | -0.00014 | 0.053472 |
| 524.928 | 2.62E-02 |  | 192.928 | 0.026223 | 190.2864 | 0.026558 | -0.00013 | 0.050725 |
| 531.4896 | 2.55E-02 |  | 199.4896 | 0.025471 | 196.848 | 0.025773 | -0.00011 | 0.048333 |
| 538.0512 | 2.48E-02 |  | 206.0512 | 0.024773 | 203.4096 | 0.025054 | -0.00011 | 0.046691 |
| 544.6128 | 2.41E-02 |  | 212.6128 | 0.024097 | 209.9712 | 0.024369 | -0.0001 | 0.046003 |
| 551.1744 | 2.34E-02 |  | 219.1744 | 0.023412 | 216.5328 | 0.023688 | -0.0001 | 0.046271 |
| 557.736 | 2.27E-02 |  | 225.736 | 0.0227 | 223.0944 | 0.022987 | -0.00011 | 0.047213 |
| 564.2976 | 2.20E-02 |  | 232.2976 | 0.021958 | 229.656 | 0.022256 | -0.00011 | 0.048224 |
| 570.8592 | 2.12E-02 |  | 238.8592 | 0.021207 | 236.2176 | 0.021509 | -0.00011 | 0.048537 |
| 577.4208 | 2.05E-02 |  | 245.4208 | 0.020482 | 242.7792 | 0.020774 | -0.00011 | 0.047603 |
| 583.9824 | 1.98E-02 |  | 251.9824 | 0.019815 | 249.3408 | 0.020084 | -0.0001 | 0.045424 |
| 590.544 | 1.92E-02 |  | 258.544 | 0.019224 | 255.9024 | 0.019462 | -9E-05 | 0.042508 |
| 597.1056 | 1.87E-02 |  | 265.1056 | 0.01871 | 262.464 | 0.018917 | -7.8E-05 | 0.039499 |
| 603.6672 | 1.83E-02 |  | 271.6672 | 0.018259 | 269.0256 | 0.01844 | -6.9E-05 | 0.03691 |
| 610.2288 | 1.79E-02 |  | 278.2288 | 0.017852 | 275.5872 | 0.018016 | -6.2E-05 | 0.035113 |
| 616.7904 | 1.75E-02 |  | 284.7904 | 0.017462 | 282.1488 | 0.017619 | -5.9E-05 | 0.034394 |
| 623.352 | 1.71E-02 |  | 291.352 | 0.01706 | 288.7104 | 0.017222 | -6.1E-05 | 0.034908 |
| 629.9136 | 1.66E-02 |  | 297.9136 | 0.016621 | 295.272 | 0.016798 | -6.7E-05 | 0.036559 |
| 636.4752 | 1.61E-02 |  | 304.4752 | 0.016129 | 301.8336 | 0.016327 | -7.5E-05 | 0.038948 |
| 643.0368 | 1.56E-02 |  | 311.0368 | 0.015583 | 308.3952 | 0.015803 | -8.3E-05 | 0.041457 |
| 649.5984 | 1.50E-02 |  | 317.5984 | 0.014997 | 314.9568 | 0.015233 | -8.9E-05 | 0.043361 |
| 656.16 | 1.44E-02 |  | 324.16 | 0.014399 | 321.5184 | 0.01464 | -9.1E-05 | 0.043965 |
| 662.7216 | 1.38E-02 |  | 330.7216 | 0.013823 | 328.08 | 0.014055 | -8.8E-05 | 0.042849 |

**Supplement B 3-3.2. Summary of Findings from DP Barcode 407817, 3/28/2013**

IR4 submitted eight published articles documenting studies on droplet deposition following ground ULV applications of pesticides. The literature was provided to support IR4’s contention that aerial drift data can be extrapolated to represent ground drift for ULV applications. Such an extrapolation would allow for deposited residues on crops, measured following aerial ULV application, to also represent deposited residues following ground ULV applications for risk calculation purposes.

**Table 1** below presents a summary of the peak deposition rates reported in the 8 published studies submitted by IR4. Peak deposition rates in these articles range from 2.92 to 14,389 ng/cm2, or 2 to 33% of the amount applied. Most of the studies indicated a decrease in deposition as the distance from the source increased. It should be noted that the studies used dosimeters of widely-varying construction and application (*e.g.*, filter paper on the ground, aluminum paper on mannequins, sod, etc.) to measure deposition, and conducted the studies in a variety of application surroundings (mosquito impoundment, communities, open fields), so direct comparison of measured deposition rates between studies may not be appropriate. Nevertheless, consensus of the studies indicates that ground deposition of ULV-applied pesticides is similar to that from aerially-applied ULV pesticides (*i.e.*, deposition rates of 0-33% of the applied pesticide).

Table 1. Summary of peak deposition rates reported in literature studies

| **Reference / Number** | **Material** | **Peak deposition (ng/cm2)** | **Peak deposition (% applied)1** | **Distance from application source to peak deposition (m)** | **Wind speed (mph)** |
| --- | --- | --- | --- | --- | --- |
| Tucker *et al* 1987 | Fenthion | 2.92 | 2 | 8 | Not reported |
| Malathion | 85.8 | 15 | 8 | Not reported |
| Naled | 57.3 | 20 | 8 | Not reported |
| Moore *et al* 1993 | Malathion | 84.1 | 14 | 30.4 | 0.9 – 3.4 |
| Tietze *et al* 1994 | Malathion | 50 | 9 | 5 | 2.1 – 4.0 |
| Knepper *et al* 1996 | Malathion | 9,222 | NA | 7.6 | 1 |
| Permethrin | 14,389 | NA | 7.6 | 1 |
| Tietze *et al* 1996 | Malathion | 473 | NA | Unknown | 0 – 2.5 |
| Schleier and Peterson 2010 | Naled | 74 | 33 | 50 | 1.5 |
| Permethrin | 4.6 | 5.9 | 25 | 4.3 |
| Pierce *et al* 2005 | Permethrin | 5.1 | 10 | Unknown | 6 - 12 |
| Preftakes *et al* 2011 | Permethrin | 8 | 10 | 25-50 m | 4.8 |

1. NA – insufficient information to assess.

**References**

Tucker, J., Thompson, C., Wang, T., and Lenahan, R. 1987. *Toxicity of organophosphorus insecticides to estuarine copepods and young fish after field applications*. J Florida Anti-Mosquito Association 58:1-6

Moore, J.C., Dukes, J.C., Clark, J.R., Malone, J., Hallmon, C.F., Hester, P.G. 1993. *Downwind drift and deposition of malathion on human targets from ground ultralow volume mosquito sprays*. J Am Mosq Control Assoc 9:138-142

Tietze, N.S., Hester, P.G., and Shaffer, K.R.. 1994. *Mass recovery of malathion in simulated open field mosquito adulticide tests*. Archives of Environmental Contamination and Toxicology 26:473-477

Knepper, R.G., Walker, E.D., et al. 1996. *Deposition of malathion and permethrin on sod grass after single, ultra-low volume applications in suburban neighborhood in Michigan*. J Am Mosq Control Assoc 12:45-51

Tietze, N.S., Hester, P.G., Shaffer, K.R., and Wakefield, F.T. 1996. *Peridomestic deposition of ultra-low volume malathion applied as a mosquito adulticide.* Bulletin of Environmental Contamination and Toxicology. 56:210-218

Schleier, J. III and Peterson, R. 2010. *Deposition and air concentrations of permethrin and naled used for adult mosquito management*. Archives of Environmental Contamination and Toxicology. 58(1):105-111

Pierce, M.C., R.H., Henry, M.S., Blum, T.C., Mueller, E.M. 2005. *Aerial and tidal transport of mosquito control pesticides into the Florida Keys National Marine Sanctuary*. Revista de Biologia Tropical. 53:117-125

Preftakes, C.J., Schleier, J.J. III, Peterson, R.K.D. 2011. *Bystander exposure to ultra-low volume insecticide applications used for adult mosquito management*. International Journal of Environmental Research and Public Health, 8:2142-2152

1. U.S. Environmental Protection Agency, Brady, D. Guidance on Modeling Offsite Deposition of Pesticides via Spray Drift for Ecological and Drinking Water Assessments, December 20, 2013 [↑](#footnote-ref-1)
2. U.S. Environmental Protection Agency, White, K., Khan, F., Peck, C., Corbin, M. Guidance on Modeling Offsite Deposition of Pesticides via Spray Drift for Ecological and Drinking Water Assessments, December 19, 2013 [↑](#footnote-ref-2)