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Pesticide Application Site Monitoring for Chlorpyrifos and Chlorpyrifos-Oxon in Imperial County in October 2014

Prepared by

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Monitoring Report Approval

Report Title: Pesticide Application Site Monitoring For Chlorpyrifos and Chlorpyrifos-Oxon in Imperial County in October 2014

Project Lead: James Pham, Air Pollution Specialist

Approval: The following monitoring report has been reviewed and approved by the Air Quality Surveillance Branch.

Original signed by: - *12/01/2016*

Mac McDougall, Manager
Special Purpose Monitoring Section

Date

Original signed by: - *12/01/2016*

Kenneth R. Stroud, Chief
Air Quality Surveillance Branch

Date

Executive Summary

Pesticide Application Air Monitoring For Chlorpyrifos in Imperial County in October 2014

At the request of the Department of Pesticide Regulation (DPR), the Air Resources Board (ARB) conducted an air monitoring study for the insecticide O, O-diethyl O-3, 5, 6-trichloro-2-pyridyl-phosphorothioate (chlorpyrifos) and its oxygen analog (chlorpyrifos-oxon) in Brawley (Imperial County) from October 13th through 16th, 2014. The monitoring was conducted near an application of chlorpyrifos on a 96 acre field of sugarbeets. The application rate was 0.816 lbs/acre. This pesticide is used to control a variety of insects including beetles, fleas, and armyworms. Its CAS Registry Number is 2921-88-2.

A total of 73 samples which included 56 regular samples and 17 quality control samples [seven (7) collocated samples, seven (7) field spikes, one (1) trip spike, one (1) trip blank, and one(1) field blank] were collected by staff of the Air Quality Surveillance Branch (AQSB). One (1) sampler outfitted with a rotameter and pump, was located at each of the eight (8) sites, with one (1) collocated sampler at the downwind site (south east corner). Samples were collected on XAD-2 resin sorbent tubes with an air sampling flow rate of three (3) liters per minute (LPM). The resin sorbent tube air samples were analyzed by gas chromatography with a flame photometric detector (FPD) by ARB's Northern Laboratory Branch in Sacramento for both chlorpyrifos and chlorpyrifos-oxon.

Chlorpyrifos resin sorbent tube results: The reported chlorpyrifos results from 73 resin sorbent tube samples indicated concentrations of chlorpyrifos ranging from 0.025 ug/m^3 at the south west corner sampling location during the fourth post-application sampling period to a maximum of 3.32 ug/m^3 during the second post-application sampling period at the north east corner. During the second post-application sampling period, the wind was coming out of the south east. The highest overall concentrations for each sampling location were detected after the application during the second and third post-application sampling periods.

Chlorpyrifos-oxon resin sorbent tube results: The breakdown product, chlorpyrifos-oxon, was not detected in any of the samples.

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Appendix A: Use Information and Air Monitoring Recommendation For Chlorpyrifos In California

Appendix B: Sampling Protocol

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Appendix D: Laboratory Results Report

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Appendix G: Pesticide Use Recommendation and Product Labels

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1.0 Introduction

At the request of the Department of Pesticide Regulation (DPR) (January 2013 Memorandum, Reardon to Corey), the Air Resources Board (ARB) conducted air monitoring for the pesticide O, O-diethyl O-3,5,6-trichloro-2-pyridyl-phosphorothioate (chlorpyrifos) and the oxygen analog (chlorpyrifos-oxon). Chlorpyrifos is an organophosphate that is used on many crops throughout the state at various times throughout the year. This pesticide is generally used for controlling a variety of insects including beetles, fleas, and armyworms. Its Chemical Abstract Service (CAS) Registry Number is 2921-88-2.

From 2009 to 2011, the use of chlorpyrifos in the state increased about 5%. 2011 data generated by DPR shows that Kern County has the highest chlorpyrifos use, more than 60% higher than the second highest use county, Fresno. Imperial County, where this study was performed, was number seven (7) on the list of highest usage. Due to the difficulty of obtaining a monitoring site, finding a site in the higher use areas was attempted, but not accomplished. Statewide peak usage of chlorpyrifos generally occurs in July and August. Peak usage in Imperial County is in October (DPR, 2013, Appendix A).

Seventy air samples and ten quality control (QC) samples were collected at eight (8) locations around the field in Brawley. Monitoring for chlorpyrifos occurred over a period of four (4) days from October 13th to 16th, 2014. Monitoring was conducted to coincide with the use of chlorpyrifos on Sugar Beets. The "Sampling Protocol for O, O-diethyl O-3,5,6-trichloro-2-pyridyl-phosphorothioate (Chlorpyrifos) Application Study" dated October 13, 2014 is located in Appendix B.

2.0 Deviations from Protocol

During the initial background sampling period, the pump for the south side site failed due to unknown reasons (Sample Log #1). Although the pump and timer continued to run, the end flow was only 0.19 LPM. The flow rate was out of range given that it was not within 20% of 3.0 LPM. The sample was invalidated due to the low flow rate.

A delay in the application process caused an additional sampling time of about two (2) hours prior to the start of the actual application. The additional time may have affected the overall concentrations of chlorpyrifos found in the application samples. The cause of the delay is not known.

No other significant deviations occurred during this chlorpyrifos ambient study as stated in the "Sampling Protocol for [Chlorpyrifos] Application Study" (Appendix B).

3.0 Sampling Sites

The pesticide air monitoring site was located by finding a cooperative applicator and farmer through a collaboration with the Imperial County Agriculture Commissioner's Office. A viable field was located in Brawley, CA with the planned application date of October 13, 2014. The monitoring was conducted near an application of chlorpyrifos on a 96 acre field of sugarbeets.

Samplers were setup to gather air samplers from all sides and all corners of the field totaling eight (8) sites. Figure 1 shows an aerial view of the application site with the sampler locations and meteorological tower marked. The samplers were placed between 13 and 28 meters from the edge of the field. Sampler placement was dictated by the layout of the surrounding area and availability of space. Photos of the samplers at each site can be seen in Appendix H. A quality control (QC)

and a collocated sampler were placed on the downwind site.
Upon arrival, the downwind site was located on the south east corner of the field. The meteorological tower was also placed on the south east corner about 20 meters away from the samplers (Figure 2). Exact placement and details are given in Table 1 (Sampler Waypoints).

Table 1: Sampler Waypoints

Sampler Location	Waypoints
South	32° 59'57.00"N 115° 40'17.00"W
South west	32° 59'57.80"N 115° 40'31.30"W
West	33° 0'4.30"N 115° 40'31.40"W
North west	33° 0'9.70"N 115° 40'31.30"W
North	33° 0'10.10"N 115° 40'16.90"W
North east	33° 0'9.80"N 115° 40'2.50"W
East	33° 0'5.70"N 115° 40'2.70"W
South east	32° 59'57.70"N 115° 40'2.60"W
Met Tower	32° 59'56.60"N 115° 40'2.30"W

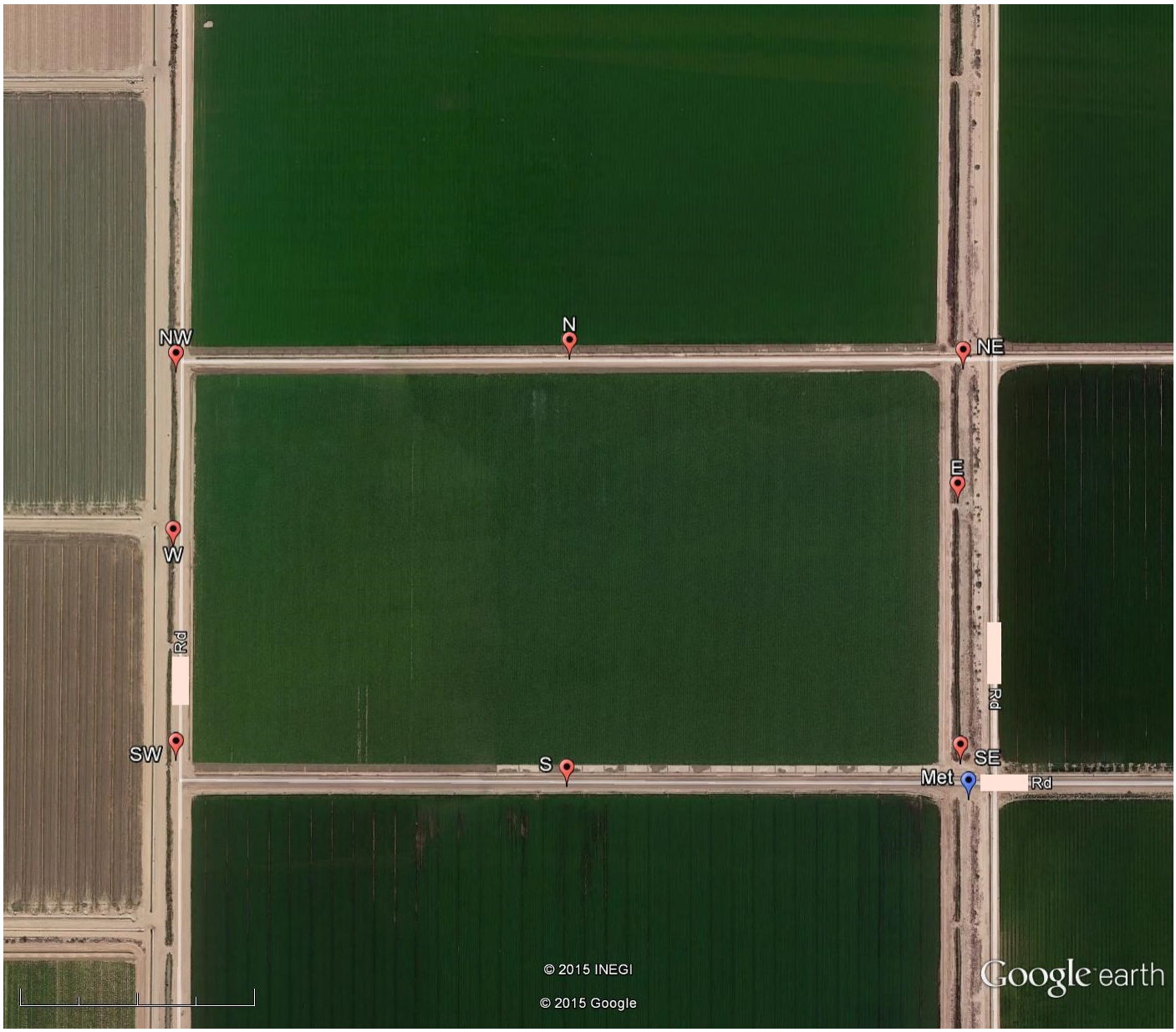


Figure 1: Aerial Overview of Monitored Area

Figure 2 – Meteorological Tower – Facing North

4.0 Methods

Typical pesticide application studies consist of a background, application, and post-application samples. The background sampling occurred approximately eighteen hours prior to the start of the application. The collection of application period samples occurred approximately 2.5 hours prior to the beginning of the application until approximately an hour after the application. Due to the time it takes to remove samples from all of the sampler locations, the one hour difference was split. Therefore, some samples were removed prior to the one hour post-application mark, and some were removed after one hour. Post-application samples were taken from approximately an hour after the application to the next sunset/sunrise. Five (5) post-application samples were collected on a sunset to sunrise and sunrise to sunset schedule.

A total of 73 air samples were collected during the study. Seventeen quality control (QC) XAD resin tube samples were collected consisting of seven (7) collocated samples, seven (7) field spikes, one (1) trip spike, one (1) trip blank, and one (1) field blank.

The sampling process was designed to collect both chlorpyrifos and chlorpyrifos-oxon on a single XAD-2 resin sorbent tube. The Monitoring and Laboratory Division (MLD) laboratory extracted and analyzed all of the samples from this pesticide application study.

Samples were collected by passing a measured volume of ambient air through one XAD-2 resin sorbent tube (SKC #226-30-06) which is mounted on a sampling tree. The inlet portion of the sampling tree is about 1.7 meters above the ground. A sampling flow rate of 3.0 liters per minute (LPM) was accurately measured using an Aalborg digital mass flow meter (0-5LPM) and the sampling system operated continuously for each sampling period with the exact operating interval recorded on the log sheet. At the end of each sampling period, the tubes were placed in culture tubes with an identification label affixed and placed in a dry ice cooler. At the end of the study, the

collected samples were transported on dry ice to ARB's MLD laboratory for analysis. The exposed XAD-2 resin sorbent tubes were stored in a freezer until extracted and analyzed in the laboratory.

Sample flow was controlled by an inline rotameter (flow range of 0-5 LPM). Collocated samples were collected during every sampling period at the south east corner sampling location. Prior to each sampling period, the sampler was leak checked with an unopened resin sorbent tube. After the sample resin sorbent tube was installed, the flow rate was set at 3.0 LPM using the digital mass flow meter. The flow rate was re-checked at the end of each sampling period just prior to removal. For the samples to be considered valid, the average flow rate must have been within $\pm$ 20% of 3.0 LPM ($\pm$ 0.6 LPM or between 2.4 and 3.6 LPM).

For details of the monitoring method, please refer to Appendix B, "Sampling Protocol for O, O-diethyl O-3,5,6-trichloro-2-pyridyl-phosphorothioate (Chlorpyrifos) Application Study" dated October 13, 2014.

The chlorpyrifos was applied aerially. A helicopter was used to spray the fields as depicted in Figures 3 and 4. Starting from the south west corner of the field, the helicopter flew in a west to east, south to north pattern to apply the chlorpyrifos. A large truck with attached trailer and container were used to transport the pesticide mixture to the application site (Figure 5). The helicopter would occasionally land to refill with the pesticide mixture. Field staff were observing the application from a distance just south of the meteorological tower. The product use recommendation and product labels of the pesticides can be seen in Appendix G. The calculated application rate was 0.816 lbs/acre for Chlorpyrifos.

The background samples were collected starting on October 13, 2014 at 1356 and removed on October 14, 2014 at 0600. The chlorpyrifos application started on October 14, 2014 at 0936 and ended at 1015. Meteorological data was collected using a Met-One auto-met portable weather station. Data was logged at 5-minute averages for wind speed, wind direction, ambient temperature, and relative humidity. Wind roses were plotted using the wind speed and wind direction for each sampling period.

Collected resin sorbent tube samples were analyzed using the laboratory method titled, "Method Development for the Sampling and Analysis of O, O-diethyl O-3,5,6-trichloro-2-pyridyl-phosphorothioate (Chlorpyrifos) and its Oxygen Analog (Chlorpyrifos-Oxon) in Application Air using Gas Chromatography/Flame Photometric Detector", located in Appendix C. Using this method, the resin tubes are extracted with three (3) milliliters of dichloromethane desorbed in an ultrasonic bath for 60 minutes. The sample extracts are analyzed using a gas chromatograph with a flame photometric detector. Appendix D contains the laboratory results report titled, "O, O-diethyl O-3,5,6-trichloro-2-pyridyl-phosphorothioate (Chlorpyrifos) and its Oxygen Analog (Chlorpyrifos-Oxon) Analytical Results for Application Air Monitoring Samples In Imperial County" dated November 2014. Please note that the spiked samples were spiked with 0.05 µg chlorpyrifos per mL with a total volume of 3 mL. The resultant values for the spikes are represented in µg per mL.

Figure 3 – Aerial Application (1)

Figure 4 – Aerial Application (2)

Figure 5 – Truck with Tanker Trailer

5.0 Results

The wind rose plots can be seen in Figures 6 through 12. Each wind rose represents a separate sampling period. The wind roses were plotted using the meteorological data captured by the auto-met at 5 minute averaged intervals.

Chlorpyrifos and chlorpyrifos-oxon sample resin sorbent tube results are presented in Table 2 and are sorted by site location. Appendix E contains the chlorpyrifos field log sheets which contain pertinent data covering the operations during the study.

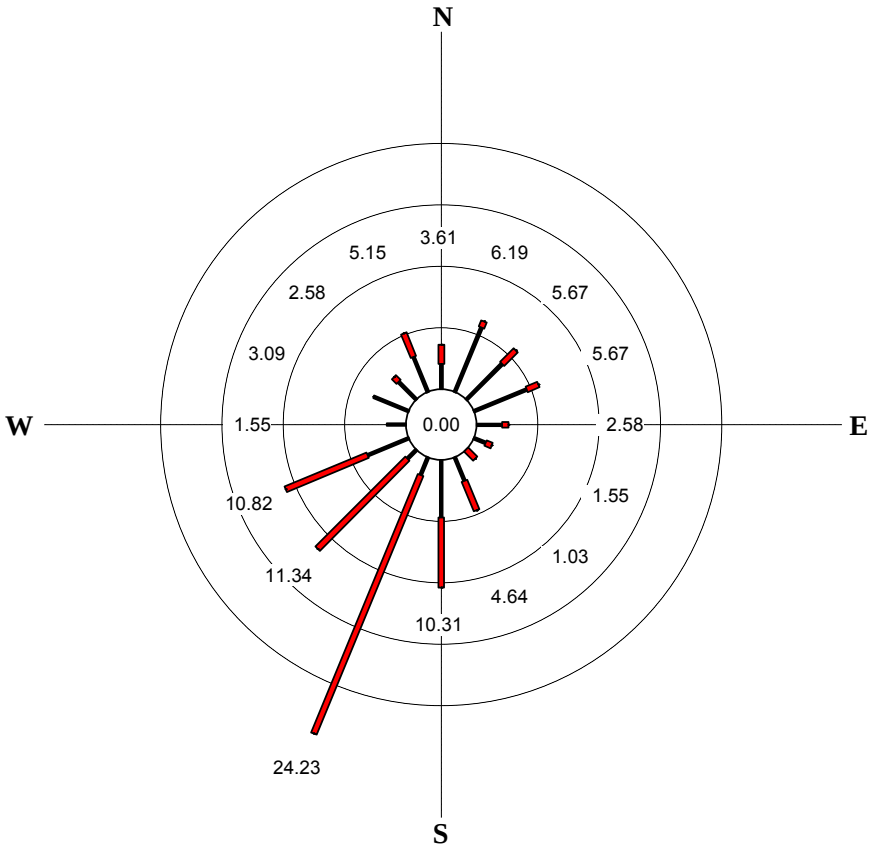
Site nomenclature for this study was based upon the location of each site and the sample period number. Additional letters were added to identify the type of sample collected (background, collocated, blank or spike).

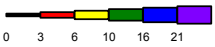
Examples:
BKG - S = Background, south side sampling site
NEC - 1 = North east corner sampling site, sample 1 (Application)
NEC - 2FS = North east corner sampling site, sample 2 (Post-Application), Field Spike
NEC - 2C = North east corner sampling site, sample 2, Collocated sample

For exact sampling dates and times refer to Appendix E.

Although the application was completed via helicopter, the meterological data did not seem affected by the draft. This is most likely due to placement of the meterological tower being greater than 40 meters away from the edge of the field.

Wind Rose
Imperial County Chlorpyrifos Application
Background Sample
From October 13 1355 to October 14 0600 (5 Minute Averaging)





Wind Speed (Knots)

Calms included at center.
Rings drawn at 5% intervals.
Wind flow is FROM the directions shown.
No observations were missing.

PERCENT OCCURRENCE: Wind Speed (Knots)
LOWER BOUND OF CATEGORY

DIR	0	3	6	10	16	21
N	2.06	1.55	0.00	0.00	0.00	0.00
NNE	5.67	0.52	0.00	0.00	0.00	0.00
NE	4.12	1.55	0.00	0.00	0.00	0.00
ENE	4.64	1.03	0.00	0.00	0.00	0.00
E	2.06	0.52	0.00	0.00	0.00	0.00
ESE	1.03	0.52	0.00	0.00	0.00	0.00
SE	0.00	1.03	0.00	0.00	0.00	0.00
SSE	2.06	2.58	0.00	0.00	0.00	0.00

TOTAL OBS = 194 MISSING OBS = 0

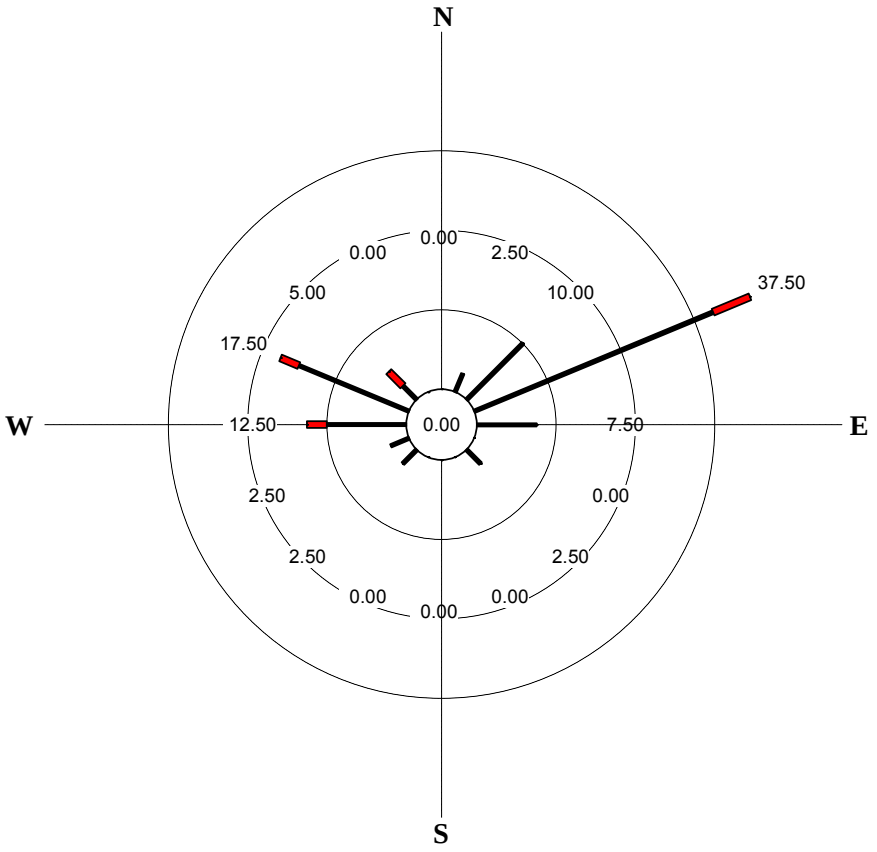
PERCENT OCCURRENCE: Wind Speed (Knots)
LOWER BOUND OF CATEGORY

DIR	0	3	6	10	16	21
S	4.64	5.67	0.00	0.00	0.00	0.00
SSW	1.55	22.68	0.00	0.00	0.00	0.00
SW	1.03	10.31	0.00	0.00	0.00	0.00
WSW	3.61	7.22	0.00	0.00	0.00	0.00
W	1.55	0.00	0.00	0.00	0.00	0.00
WNW	3.09	0.00	0.00	0.00	0.00	0.00
NW	2.06	0.52	0.00	0.00	0.00	0.00
NNW	3.09	2.06	0.00	0.00	0.00	0.00

CALM OBS = 0 PERCENT CALM = 0.00

Figure 6 – Wind Rose for Background Sample

Wind Rose
Imperial County Chlorpyrifos Application
Application Sample
October 14 From 0700 to 1015 (5 Minute Averaging)



Calms included at center.
Rings drawn at 10% intervals.
Wind flow is FROM the directions shown.
No observations were missing.

PERCENT OCCURRENCE: Wind Speed (Knots)
LOWER BOUND OF CATEGORY

DIR	0	3	6	10	16	21
N	0.00	0.00	0.00	0.00	0.00	0.00
NNE	2.50	0.00	0.00	0.00	0.00	0.00
NE	10.00	0.00	0.00	0.00	0.00	0.00
ENE	32.50	5.00	0.00	0.00	0.00	0.00
E	7.50	0.00	0.00	0.00	0.00	0.00
ESE	0.00	0.00	0.00	0.00	0.00	0.00
SE	2.50	0.00	0.00	0.00	0.00	0.00
SSE	0.00	0.00	0.00	0.00	0.00	0.00

TOTAL OBS = 40 MISSING OBS = 0

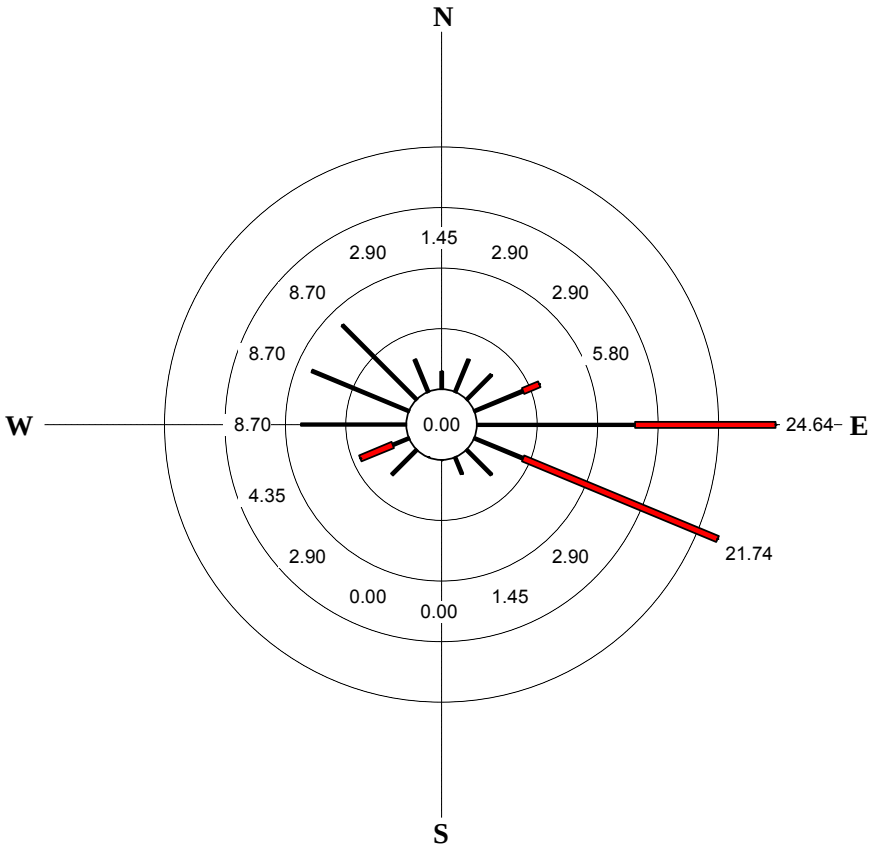
PERCENT OCCURRENCE: Wind Speed (Knots)
LOWER BOUND OF CATEGORY

DIR	0	3	6	10	16	21
S	0.00	0.00	0.00	0.00	0.00	0.00
SSW	0.00	0.00	0.00	0.00	0.00	0.00
SW	2.50	0.00	0.00	0.00	0.00	0.00
WSW	2.50	0.00	0.00	0.00	0.00	0.00
W	10.00	2.50	0.00	0.00	0.00	0.00
WNW	15.00	2.50	0.00	0.00	0.00	0.00
NW	2.50	2.50	0.00	0.00	0.00	0.00
NNW	0.00	0.00	0.00	0.00	0.00	0.00

CALM OBS = 0 PERCENT CALM = 0.00

Figure 7 – Wind Rose for Application Sample

Wind Rose
Imperial County Chlorpyrifos Application
First Post Application Sample
October 14 From 1020 to 1600 (5 Minute Averaging)



Calms included at center.
Rings drawn at 5% intervals.
Wind flow is FROM the directions shown.
No observations were missing.

PERCENT OCCURRENCE: Wind Speed (Knots)
LOWER BOUND OF CATEGORY

DIR	0	3	6	10	16	21
N	1.45	0.00	0.00	0.00	0.00	0.00
NNE	2.90	0.00	0.00	0.00	0.00	0.00
NE	2.90	0.00	0.00	0.00	0.00	0.00
ENE	4.35	1.45	0.00	0.00	0.00	0.00
E	13.04	11.59	0.00	0.00	0.00	0.00
ESE	4.35	17.39	0.00	0.00	0.00	0.00
SE	2.90	0.00	0.00	0.00	0.00	0.00
SSE	1.45	0.00	0.00	0.00	0.00	0.00

TOTAL OBS = 69 MISSING OBS = 0

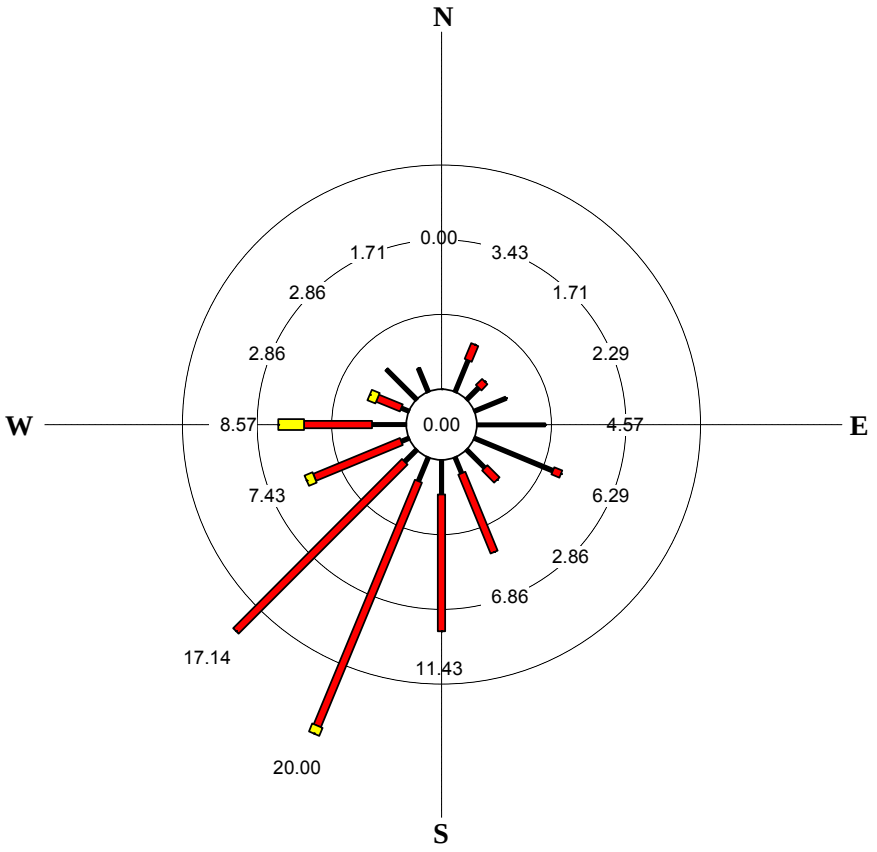
PERCENT OCCURRENCE: Wind Speed (Knots)
LOWER BOUND OF CATEGORY

DIR	0	3	6	10	16	21
S	0.00	0.00	0.00	0.00	0.00	0.00
SSW	0.00	0.00	0.00	0.00	0.00	0.00
SW	2.90	0.00	0.00	0.00	0.00	0.00
WSW	1.45	2.90	0.00	0.00	0.00	0.00
W	8.70	0.00	0.00	0.00	0.00	0.00
WNW	8.70	0.00	0.00	0.00	0.00	0.00
NW	8.70	0.00	0.00	0.00	0.00	0.00
NNW	2.90	0.00	0.00	0.00	0.00	0.00

CALM OBS = 0 PERCENT CALM = 0.00

Figure 8 – Wind Rose for First Post Application Sample

Wind Rose
Imperial County Chlorpyrifos Application
Second Post Application Sample
From October 14 1605 to October 15 0635 (5 Minute Averaging)



Wind Speed (Knots)

Calms included at center.
Rings drawn at 5% intervals.
Wind flow is FROM the directions shown.
No observations were missing.

PERCENT OCCURRENCE: Wind Speed (Knots)
LOWER BOUND OF CATEGORY

DIR	0	3	6	10	16	21
N	0.00	0.00	0.00	0.00	0.00	0.00
NNE	2.29	1.14	0.00	0.00	0.00	0.00
NE	1.14	0.57	0.00	0.00	0.00	0.00
ENE	2.29	0.00	0.00	0.00	0.00	0.00
E	4.57	0.00	0.00	0.00	0.00	0.00
ESE	5.71	0.57	0.00	0.00	0.00	0.00
SE	1.71	1.14	0.00	0.00	0.00	0.00
SSE	1.14	5.71	0.00	0.00	0.00	0.00

TOTAL OBS = 175 MISSING OBS = 0

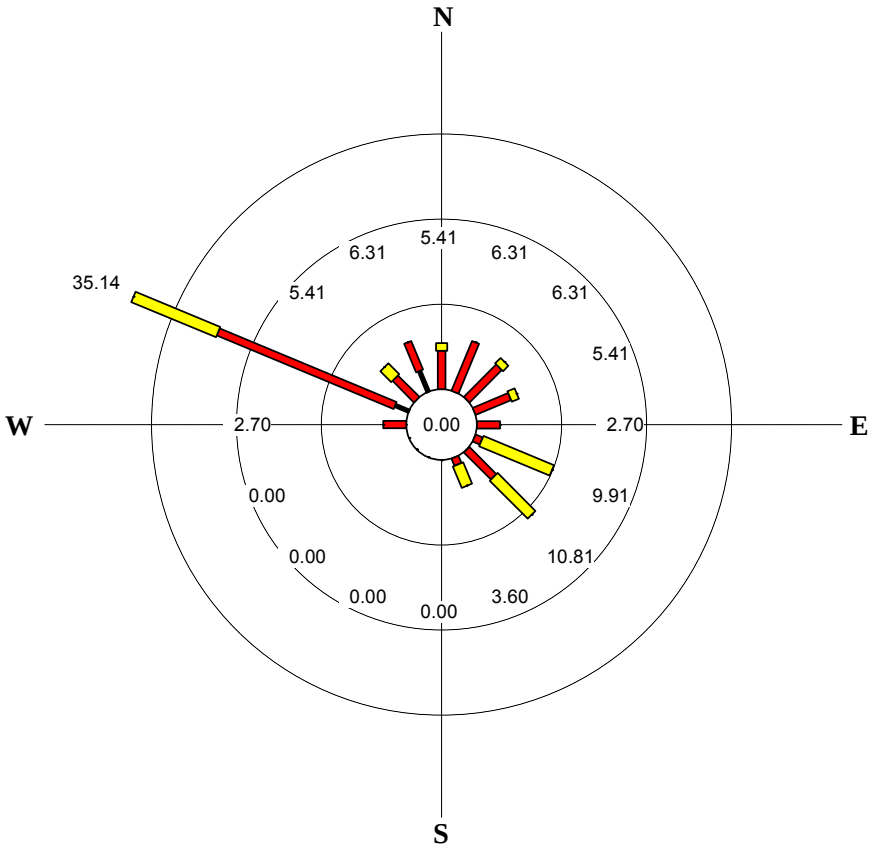
PERCENT OCCURRENCE: Wind Speed (Knots)
LOWER BOUND OF CATEGORY

DIR	0	3	6	10	16	21
S	2.29	9.14	0.00	0.00	0.00	0.00
SSW	1.71	17.71	0.57	0.00	0.00	0.00
SW	1.14	16.00	0.00	0.00	0.00	0.00
WSW	0.57	6.29	0.57	0.00	0.00	0.00
W	2.29	4.57	1.71	0.00	0.00	0.00
WNW	0.57	1.71	0.57	0.00	0.00	0.00
NW	2.86	0.00	0.00	0.00	0.00	0.00
NNW	1.71	0.00	0.00	0.00	0.00	0.00

CALM OBS = 0 PERCENT CALM = 0.00

Figure 9 – Wind Rose for Second Post Application Sample

Wind Rose
Imperial County Chlorpyrifos Application
Third Post Application Sample
October 15 From 0640 to 1550 (5 Minute Averaging)



Calms included at center.
Rings drawn at 10% intervals.
Wind flow is FROM the directions shown.
No observations were missing.

PERCENT OCCURRENCE: Wind Speed (Knots)
LOWER BOUND OF CATEGORY

DIR	0	3	6	10	16	21
N	0.00	4.50	0.90	0.00	0.00	0.00
NNE	0.00	6.31	0.00	0.00	0.00	0.00
NE	0.00	5.41	0.90	0.00	0.00	0.00
ENE	0.00	4.50	0.90	0.00	0.00	0.00
E	0.00	2.70	0.00	0.00	0.00	0.00
ESE	0.00	0.90	9.01	0.00	0.00	0.00
SE	0.00	4.50	6.31	0.00	0.00	0.00
SSE	0.00	0.90	2.70	0.00	0.00	0.00

TOTAL OBS = 111 MISSING OBS = 0

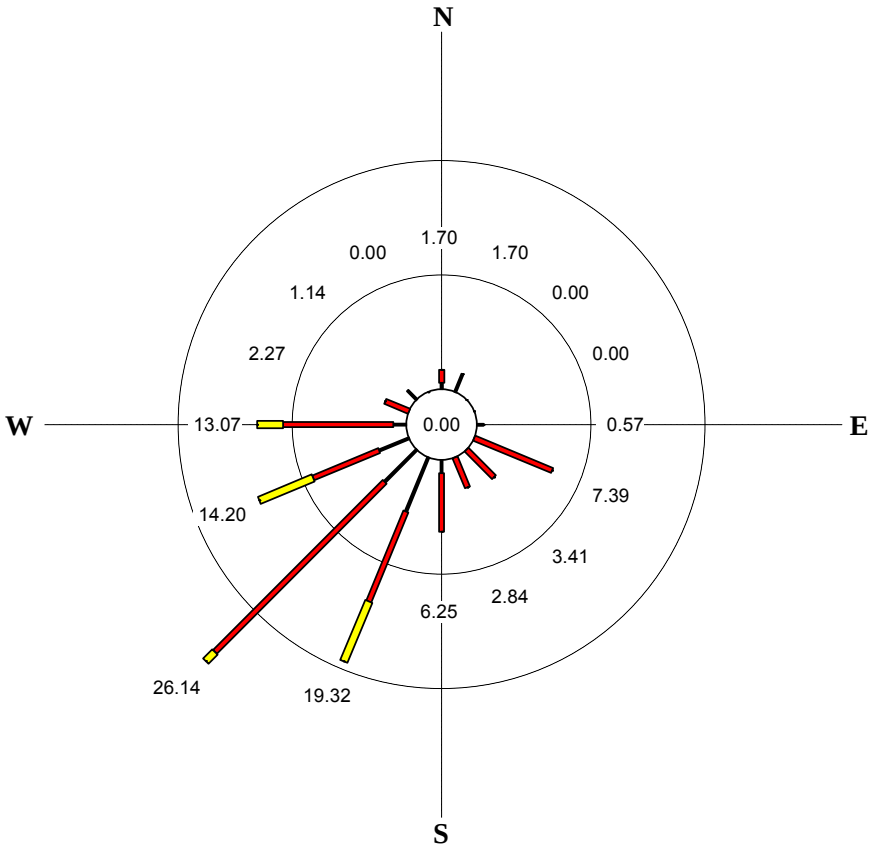
PERCENT OCCURRENCE: Wind Speed (Knots)
LOWER BOUND OF CATEGORY

DIR	0	3	6	10	16	21
S	0.00	0.00	0.00	0.00	0.00	0.00
SSW	0.00	0.00	0.00	0.00	0.00	0.00
SW	0.00	0.00	0.00	0.00	0.00	0.00
WSW	0.00	0.00	0.00	0.00	0.00	0.00
W	0.00	2.70	0.00	0.00	0.00	0.00
WNW	1.80	22.52	10.81	0.00	0.00	0.00
NW	0.00	3.60	1.80	0.00	0.00	0.00
NNW	2.70	3.60	0.00	0.00	0.00	0.00

CALM OBS = 0 PERCENT CALM = 0.00

Figure 10 – Wind Rose for Third Post Application Sample

Wind Rose
Imperial County Chlorpyrifos Application
Fourth Post Application Sample
From October 15 1555 to October 16 0630 (5 Minute Averaging)



Wind Speed (Knots)

Calms included at center.
Rings drawn at 10% intervals.
Wind flow is FROM the directions shown.
No observations were missing.

PERCENT OCCURRENCE: Wind Speed (Knots)
LOWER BOUND OF CATEGORY

DIR	0	3	6	10	16	21
N	0.57	1.14	0.00	0.00	0.00	0.00
NNE	1.70	0.00	0.00	0.00	0.00	0.00
NE	0.00	0.00	0.00	0.00	0.00	0.00
ENE	0.00	0.00	0.00	0.00	0.00	0.00
E	0.57	0.00	0.00	0.00	0.00	0.00
ESE	0.00	7.39	0.00	0.00	0.00	0.00
SE	0.00	3.41	0.00	0.00	0.00	0.00
SSE	0.00	2.84	0.00	0.00	0.00	0.00

TOTAL OBS = 176 MISSING OBS = 0

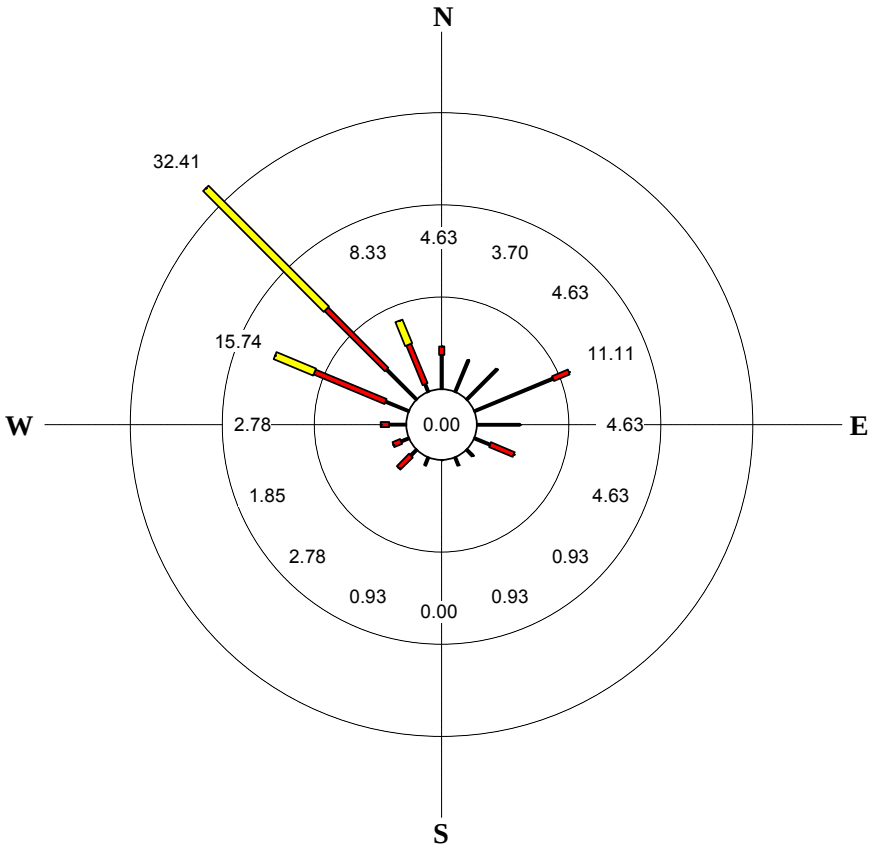
PERCENT OCCURRENCE: Wind Speed (Knots)
LOWER BOUND OF CATEGORY

DIR	0	3	6	10	16	21
S	1.14	5.11	0.00	0.00	0.00	0.00
SSW	5.11	8.52	5.68	0.00	0.00	0.00
SW	3.98	21.02	1.14	0.00	0.00	0.00
WSW	2.84	6.25	5.11	0.00	0.00	0.00
W	1.14	9.66	2.27	0.00	0.00	0.00
WNW	0.00	2.27	0.00	0.00	0.00	0.00
NW	1.14	0.00	0.00	0.00	0.00	0.00
NNW	0.00	0.00	0.00	0.00	0.00	0.00

CALM OBS = 0 PERCENT CALM = 0.00

Figure 11 – Wind Rose for Fourth Post Application Sample

Wind Rose
Imperial County Chlorpyrifos Application
Fifth Post Application Sample
From October 16 0635 to 1530 (5 Minute Averaging)



Calms included at center.
Rings drawn at 10% intervals.
Wind flow is FROM the directions shown.
No observations were missing.

PERCENT OCCURRENCE: Wind Speed (Knots)
LOWER BOUND OF CATEGORY

DIR	0	3	6	10	16	21
N	3.70	0.93	0.00	0.00	0.00	0.00
NNE	3.70	0.00	0.00	0.00	0.00	0.00
NE	4.63	0.00	0.00	0.00	0.00	0.00
ENE	9.26	1.85	0.00	0.00	0.00	0.00
E	4.63	0.00	0.00	0.00	0.00	0.00
ESE	1.85	2.78	0.00	0.00	0.00	0.00
SE	0.93	0.00	0.00	0.00	0.00	0.00
SSE	0.93	0.00	0.00	0.00	0.00	0.00

TOTAL OBS = 108 MISSING OBS = 0

PERCENT OCCURRENCE: Wind Speed (Knots)
LOWER BOUND OF CATEGORY

DIR	0	3	6	10	16	21
S	0.00	0.00	0.00	0.00	0.00	0.00
SSW	0.93	0.00	0.00	0.00	0.00	0.00
SW	0.93	1.85	0.00	0.00	0.00	0.00
WSW	0.93	0.93	0.00	0.00	0.00	0.00
W	1.85	0.93	0.00	0.00	0.00	0.00
WNW	2.78	8.33	4.63	0.00	0.00	0.00
NW	4.63	9.26	18.52	0.00	0.00	0.00
NNW	0.93	4.63	2.78	0.00	0.00	0.00

CALM OBS = 0 PERCENT CALM = 0.00

Figure 12 – Wind Rose for Fifth Post Application Sample

Table 2 – Sampling Results

Site Location	Log #	Sample Name	Sample Start Date	Elapsed Time (Hours)	Elapsed Time (Minutes)	Avg. Flow (LPM)	Volume (Liters)	Volume (m3)	Chlorpyrifos (µg/Sample)	Chlorpyrifos (µg/m3)	Oxon (µg/Sample)	Oxon (µg/m3)
South	1	BKG-S	10/13/14	16.1	966	1.68	INV	INV	INV	INV	INV	INV
	11	S-1	10/14/14	3.3	198	3.07	607.86	0.61	0.41	0.67	ND, <0.04	ND
	21	S-2	10/14/14	5.7	342	3.09	1056.78	1.06	0.30	0.28	ND, <0.04	ND
	31	S-3	10/14/14	14.6	876	3.16	2768.16	2.77	0.59	0.21	ND, <0.04	ND
	41	S-4	10/15/14	9.2	552	3.05	1683.60	1.68	2.64	1.57	ND, <0.04	ND
	51	S-5	10/15/14	14.7	882	3.18	2804.76	2.80	0.43	0.15	ND, <0.04	ND
	61	S-6	10/16/14	8.8	528	3.15	1663.20	1.66	1.19	0.72	ND, <0.04	ND
SW	2	BKG-SWC	10/13/14	15.9	954	3.16	3014.64	3.01	0.14	0.05	ND, <0.04	ND
	12	SWC-1	10/14/14	3.3	198	3.04	601.92	0.60	0.16	0.27	ND, <0.04	ND
	22	SWC-2	10/14/14	5.7	342	3.11	1063.62	1.06	0.87	0.82	ND, <0.04	ND
	32	SWC-3	10/14/14	14.6	876	3.16	2768.16	2.77	0.34	0.12	ND, <0.04	ND
	42	SWC-4	10/15/14	9.2	552	3.08	1700.16	1.70	0.70	0.41	ND, <0.04	ND
	52	SWC-5	10/15/14	14.7	882	3.14	2769.48	2.77	0.07	0.03	ND, <0.04	ND
	62	SWC-6	10/16/14	8.8	528	3.06	1615.68	1.62	0.17	0.11	ND, <0.04	ND
West	3	BKG-W	10/13/14	15.9	954	3.18	3033.72	3.03	0.19	0.06	ND, <0.04	ND
	13	W-1	10/14/14	3.3	198	3.05	603.90	0.60	0.16	0.26	ND, <0.04	ND
	23	W-2	10/14/14	5.7	342	3.08	1053.36	1.05	2.35	2.23	ND, <0.04	ND
	33	W-3	10/14/14	14.6	876	3.16	2768.16	2.77	1.45	0.52	ND, <0.04	ND
	43	W-4	10/15/14	9.3	558	3.10	1729.80	1.73	0.93	0.54	ND, <0.04	ND
	53	W-5	10/15/14	14.6	876	3.14	2750.64	2.75	0.52	0.19	ND, <0.04	ND
	63	W-6	10/16/14	8.9	534	3.06	1634.04	1.63	0.29	0.18	ND, <0.04	ND
NW	4	BKG-NWC	10/13/14	15.9	954	3.14	2995.56	3.00	0.24	0.08	ND, <0.04	ND
	14	NWC-1	10/14/14	3.4	204	3.06	624.24	0.62	0.33	0.53	ND, <0.04	ND
	24	NWC-2	10/14/14	5.7	342	3.10	1060.20	1.06	2.50	2.36	ND, <0.04	ND
	34	NWC-3	10/14/14	14.6	876	3.16	2768.16	2.77	2.31	0.83	ND, <0.04	ND
	44	NWC-4	10/15/14	9.2	552	3.06	1689.12	1.69	1.28	0.76	ND, <0.04	ND
	54	NWC-5	10/15/14	14.6	876	3.14	2750.64	2.75	1.05	0.38	ND, <0.04	ND
	64	NWC-6	10/16/14	8.9	534	3.09	1650.06	1.65	0.22	0.13	ND, <0.04	ND

Table 2 – Sampling Results (Continued)

Site Location	Log #	Sample Name	Sample Start Date	Elapsed Time (Hours)	Elapsed Time (Minutes)	Avg. Flow (LPM)	Volume (Liters)	Volume (m3)	Chlorpyrifos (µg/Sample)	Chlorpyrifos (µg/m3)	Oxon (µg/Sample)	Oxon (µg/m3)
North	5	BKG-N	10/13/14	15.8	948	3.04	2881.92	2.88	0.42	0.15	ND, <0.04	ND
	15	N-1	10/14/14	3.5	210	3.05	640.50	0.64	0.43	0.67	ND, <0.04	ND
	25	N-2	10/14/14	5.7	342	3.10	1060.20	1.06	2.31	2.18	ND, <0.04	ND
	35	N-3	10/14/14	14.6	876	3.16	2768.16	2.77	5.81	2.10	ND, <0.04	ND
	45	N-4	10/15/14	9.2	552	3.06	1689.12	1.69	1.45	0.86	ND, <0.04	ND
	55	N-5	10/15/14	14.6	876	3.11	2724.36	2.72	2.92	1.07	ND, <0.04	ND
	65	N-6	10/16/14	8.8	528	3.09	1631.52	1.63	0.34	0.21	ND, <0.04	ND
NE	6	BKG-NEC	10/13/14	15.7	942	3.15	2967.30	2.97	0.40	0.13	ND, <0.04	ND
	16	NEC-1	10/14/14	3.5	210	3.05	640.50	0.64	0.39	0.61	ND, <0.04	ND
	26	NEC-2	10/14/14	5.7	342	3.09	1056.78	1.06	0.58	0.55	ND, <0.04	ND
	36	NEC-3	10/14/14	14.7	882	3.17	2795.94	2.80	9.28	3.32	ND, <0.04	ND
	46	NEC-4	10/15/14	9.2	552	3.06	1689.12	1.69	0.14	0.08	ND, <0.04	ND
	56	NEC-5	10/15/14	14.6	876	3.14	2750.64	2.75	3.83	1.39	ND, <0.04	ND
	66	NEC-6	10/16/14	8.8	528	3.06	1615.68	1.62	0.25	0.15	ND, <0.04	ND
East	7	BKG-E	10/13/14	15.7	942	3.16	2976.72	2.98	0.39	0.13	ND, <0.04	ND
	17	E-1	10/14/14	3.5	210	3.06	642.60	0.64	0.88	1.37	ND, <0.04	ND
	27	E-2	10/14/14	5.7	342	3.10	1060.20	1.06	0.77	0.73	ND, <0.04	ND
	37	E-3	10/14/14	14.6	876	3.14	2750.64	2.75	5.71	2.08	ND, <0.04	ND
	47	E-4	10/15/14	9.2	552	3.06	1689.12	1.69	1.93	1.14	ND, <0.04	ND
	57	E-5	10/15/14	14.6	876	3.12	2733.12	2.73	3.46	1.27	ND, <0.04	ND
	67	E-6	10/16/14	8.8	528	3.06	1615.68	1.62	0.85	0.53	ND, <0.04	ND

Table 2 – Sampling Results (Continued)

Site Location	Log #	Sample Name	Sample Start Date	Elapsed Time (Hours)	Elapsed Time (Minutes)	Avg. Flow (LPM)	Volume (Liters)	Volume (m3)	Chlorpyrifos (µg/Sample)	Chlorpyrifos (µg/m3)	Oxon (µg/Sample)	Oxon (µg/m3)
SE	8	BKG-SEC	10/13/14	15.6	936	3.17	2967.12	2.97	0.21	0.07	ND, <0.04	ND
	9	BKG-SEC-C	10/13/14	15.6	936	3.14	2939.04	2.94	0.26	0.09	ND, <0.04	ND
	18	SEC-1	10/14/14	3.6	216	3.06	660.96	0.66	0.59	0.89	ND, <0.04	ND
	19	SEC-1C	10/14/14	3.6	216	3.01	650.16	0.65	0.67	1.03	ND, <0.04	ND
	28	SEC-2	10/14/14	5.7	342	3.10	1060.20	1.06	0.20	0.19	ND, <0.04	ND
	29	SEC-2C	10/14/14	5.7	342	3.12	1067.04	1.07	0.28	0.26	ND, <0.04	ND
	38	SEC-3	10/14/14	14.6	876	3.02	2645.52	2.65	0.95	0.36	ND, <0.04	ND
	39	SEC-3C	10/14/14	14.6	876	3.17	2776.92	2.78	1.32	0.48	ND, <0.04	ND
	48	SEC-4	10/15/14	9.1	546	3.09	1687.14	1.69	2.55	1.51	ND, <0.04	ND
	49	SEC-4C	10/15/14	9.1	546	3.06	1670.76	1.67	2.52	1.51	ND, <0.04	ND
	58	SEC-5	10/15/14	14.5	870	3.11	2705.70	2.71	0.94	0.35	ND, <0.04	ND
	59	SEC-5C	10/15/14	14.6	876	3.14	2750.64	2.75	0.97	0.35	ND, <0.04	ND
	68	SEC-6	10/16/14	8.9	534	3.06	1634.04	1.63	1.38	0.84	ND, <0.04	ND
	69	SEC-6C	10/16/14	8.8	528	3.06	1615.68	1.62	1.43	0.89	ND, <0.04	ND

The highest overall value of chlorpyrifos was in the second post-application sample at the north east corner (sample name NEC-3) with a value of 3.32 µg/m3. For the chlorpyrifos-oxon, all of the samples were less than the method detection limit (MDL) 0.050 µg/ml.

Further reference material can be found in Appendix E which presents the field log sheets and Appendix F which presents the calibration/certification reports.

6.0 Quality Control Results

Quality control field samples included seventeen (17) quality control (QC) XAD resin tube samples consisting of seven (7) field spikes, one trip spike, one trip blank, one field blank, and seven (7) collocated samples.

The Relative Percent Difference (RPD) of the collocated samples for chlorpyrifos ranged from -0.2% to +32.7% with an average of 14.7%. The RPD of the collocated samples for the chlorpyrifos-oxon were not calculable due to the non-detectable concentrations of the oxon. See Table 3 below (Collocated Relative Percent Difference For Chlorpyrifos).

The formula for calculating the RPD for Table 3 is as follows:

$$RPD = \frac{Collocated\ \mu g/m^3 - Sample\ \mu g/m^3}{(Collocated\ \mu g/m^3 + Sample\ \mu g/m^3) \div 2}$$

Table 3 – Collocated Relative Percent Difference for Chlorpyrifos

Log #	Sample Name	Chlorpyrifos (µg/m3)	Oxon (µg/m3)	Chlorpyrifos RPD	Oxon RPD
8	BKG-SEC	0.071	ND	22.2%	N/A
9	BKG-SEC-C	0.088	ND		
18	SEC-1	0.893	ND	14.3%	N/A
19	SEC-1C	1.031	ND		
28	SEC-2	0.189	ND	32.7%	N/A
29	SEC-2C	0.262	ND		
38	SEC-3	0.359	ND	27.9%	N/A
39	SEC-3C	0.475	ND		
48	SEC-4	1.511	ND	-0.2%	N/A
49	SEC-4C	1.508	ND		
58	SEC-5	0.347	ND	1.5%	N/A
59	SEC-5C	0.353	ND		
68	SEC-6	0.845	ND	4.7%	N/A
69	SEC-6C	0.885	ND		

The chlorpyrifos field spike recoveries ranged from -51% to +357% with an average of +142%. The wide range of recovery values may be attributed to the volatility of chlorpyrifos in the sample media. See Table 4 (Chlorpyrifos Field Spike Percent Recovery).

Field spike percent recoveries are shown in Table 4 for chlorpyrifos. No oxon results were reported above the MDL.

Spiked XAD resin sorbent tubes were prepared at the laboratory and placed in the freezer the Friday preceding the start of sampling (10/10/14). The laboratory spike values were 0.15 µg/Sample (0.05 µg/mL at 3mL) for chlorpyrifos. While viewing Field Spike Table 4, reference the below equations describing the calculations necessary to determine the percent recovery of each field spike.

$$Field\ Spike\ \frac{\mu g}{m^3} = Field\ Recovery\ \frac{\mu g}{sample}\ \div\ Total\ Volume\ \frac{sample}{m^3}$$

$$Net\ Spike\ \frac{\mu g}{m^3} = Field\ Spike\ Concentration\ \frac{\mu g}{m^3}\ -\ Primary\ Sample\ \frac{\mu g}{m^3}$$

$$Net\ Spike\ \frac{\mu g}{sample} = Net\ Spike\ \frac{\mu g}{m^3} \times\ Total\ Volume\ \frac{m^3}{sample}$$

$$Spike\ Percent\ Recovery\ \frac{\mu g}{sample} = Net\ Spike\ \frac{\mu g}{sample}\ \div Lab\ Spike\ Value\ \frac{\mu g}{sample}\ \times 100\%$$

Table 4 – Chlorpyrifos Field Spike Percent Recovery

Log #	Sample Name	Volume (m3)	Chlorpyrifos (µg/Sample)	Chlorpyrifos (µg/m3)	Primary Sample (µg/m3)	Field spike (µg/m3)	Net Spike (µg/m3)	Net Spike (µg/Sample)	Lab Spike Value (µg/Sample)	Dilution Factor	Spike Percent Recovery
8	BKG-SEC	2.97	0.21	0.07	0.07						
10	BKG-SEC-FS	2.87	0.39	0.14		0.14	0.07	0.19	0.05	3	124.5%
18	SEC-1	0.66	0.59	0.89	0.89						
20	SEC-1FS	0.75	0.75	1.00		1.00	0.11	0.08	0.05	3	55.0%
28	SEC-2	1.06	0.20	0.19	0.19						
30	SEC-2FS	1.06	0.42	0.39		0.39	0.21	0.22	0.05	3	146.2%
38	SEC-3	2.65	0.95	0.36	0.36						
40	SEC-3FS	2.80	1.23	0.44		0.44	0.08	0.23	0.05	3	150.7%
48	SEC-4	1.69	2.55	1.51	1.51						
50	SEC-4FS	1.65	3.03	1.84		1.84	0.32	0.54	0.05	3	356.9%
58	SEC-5	2.71	0.94	0.35	0.35						
60	SEC-5FS	2.72	0.87	0.32		0.32	0.03	-0.08	0.05	3	51.0%
68	SEC-6	1.63	1.38	0.84	0.84						
70	SEC-6FS	1.62	1.68	1.04		1.04-	0.20	0.32	0.05	3	210.3%

-

The chlorpyrifos trip spike recovery was 96%. See Table 5 (Trip Spike Recovery).

The formula for calculating the Recovery % for Table 5is as follows:

$$Recovery\,\% = \left(Measured\ \frac{ng}{sample} \div Expected\ \frac{ng}{sample} \right) \times 100\%$$

Table 5 – Trip Spike Recovery

Log #	Sample Name	Chlorpyrifos (µg/Sample)	Lab Spike Value (µg/Sample)	Spike Percent Recovery
71	Trip Spike	0.048	0.050	96.0%

Laboratory spike values can be seen Table 6.

Table 6 – Quality Control Laboratory Spike Recovery

QC Type	Laboratory ID	Date Analyzed	Chlorpyrifos Amount (µg/mL)	Lab Spike Value (µg/mL)	% Recovery
Lab Spike	LS001	11/12/2014	0.045	0.050	90.0%
	LS002	11/12/2014	0.047	0.050	94.0%
	LS003	11/12/2014	0.045	0.050	90.0%
	LS004	11/12/2014	0.047	0.050	94.0%
	LS005	11/12/2014	0.046	0.050	92.0%
	LS006	11/12/2014	0.047	0.050	94.0%
	LS007	11/12/2014	0.047	0.050	94.0%

7.0 Summary

The highest overall chlorpyrifos concentration reported was collected at the north east site during the second post-application sampling period. The concentration was 3.32 µg/m3. The wind was coming out of the south west during that sampling period.

The highest concentration reported during the application sampling period was 1.37 µg/m3 at the east side sampling location. The highest concentration values at the other sampling locations did not align with the application period; some high values were seen in the periods following the application.

During the post-application sampling period, the samples with the highest values were observed at different locations. The wind seemed to be a factor in determining which samples would have the highest concentrations for each sampling period. The highest concentrations during each sampling period were seen on the samplers located downwind. During each sampling period, the locations of the highest concentrations were as follows:

1. North west corner during the first post-application sampling period (2.36 µg/m3)
2. North east corner during the second post-application sampling period (3.33 µg/m3)
3. South east corner during the third post-application sampling period (1.51 µg/m3)
4. North east corner during the fourth post-application sampling period (1.39 µg/m3)
5. South east corner during the fifth post-application sampling period (0.885 µg/m3

APPENDIX A

Use Information and Air Monitoring Recommendation for Chlorpyrifos In California

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APPENDIX B

Sampling Protocol

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APPENDIX C

Laboratory Analysis Methods

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APPENDIX D

Laboratory Results Report

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APPENDIX E

Chlorpyrifos Field Log Sheets

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APPENDIX F

Calibration and Certification Reports

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APPENDIX G

Pesticide Use Recommendation and Product Labels

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APPENDIX H

Sampler Photos

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USE INFORMATION AND AIR MONITORING RECOMMENDATION FOR CHLORPYRIFOS IN CALIFORNIA

June 2013

Atac Tuli, Ph.D.
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1. INTRODUCTION

An addendum (DPR, 2013) to the California Department of Pesticide Regulation's (CDPR) original request (DPR, 2011) to the Air Resources Board (ARB) for monitoring Chlorpyrifos and chlorpyrifos oxygen analog breakdown product in 2013 was submitted. Due to its use on many crops makes this organophosphate a high priority for risk assessment (CDPR, 2013).
This recommendation contains general information regarding the physical and chemical properties of the pesticide active ingredient chlorpyrifos and its reported historical uses in California after evaluating 2009-2011 pesticide use data (CalPIP, 2013) The CDPR provides this information to assist the California Air Resources Board (CARB) in its selection of appropriate locations for conducting pesticide air monitoring operations.

2. CHEMICAL DESCRIPTION

Chlorpyrifos (CAS number: 2921-88-2) is a colorless to white crystalline solid and is the common name for the chemical with IUPAC name of *O, O*-diethyl *O*-3,5,6-trichloro-2-pyridyl-phosphorothioate (Figure 1). Chlorpyrifos has a mild mercaptan (thiol) odor, similar to the smell of sulfur compounds found in rotten eggs, onions, garlic and skunks. Chlorpyrifos is moderately toxic and chronic exposure has been linked to neurological effects, developmental disorders, and autoimmune disorders.

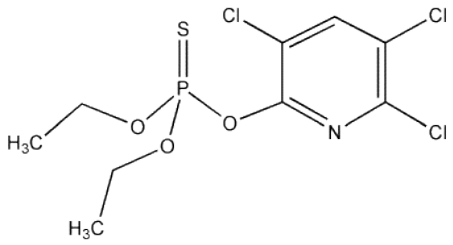

Figure 1. Chemical structure of chlorpyrifos.

2.1 Physical and Chemical Properties

The chemical and physical properties and some identifiers of Chlorpyrifos can be found in Table 1. Chlorpyrifos belongs to the chlorinated organophosphate (OP) chemical family. The value of K_{oc} has been shown to vary depending upon soil type and environmental conditions (DPR, 2010; IUPAC, 2013). Thus, its value ranges from 360-31000 ml/g (Table 1). The water solubility of chlorpyrifos is low. The CDPR determined that pesticides with a water solubility greater than 3 mg/L could be classified as having the potential to leach (Johnson, 1991). Thus, chlorpyrifos' potential to leach to groundwater is low, but contamination of groundwater would still be a possibility due to other environmental and soil factors. Typically, pesticides with high vapor pressure

(greater than 10^{-6} mm Hg) can readily volatilize. Based on its vapor pressure, chlorpyrifos can be classified as having moderate air pollution potential. Thus, chlorpyrifos is capable of volatilization and can potentially drift away from the application site.

Table 1. Physical and Chemical Properties of Chlorpyrifos (National Pesticide Information Center [NPIC], 2009; US EPA, 2002, Russell et al., 1978; The International Union of Pure and Applied Chemistry [IUPAC], 2013)

Common Name	Chlorpyrifos Dursban, Empire 20, Equity, Whitmire PT 270, Lorsban,
Chemical name (IUAPC)	*O*,*O*-diethyl *O*-3,5,6-trichloro-2-pyridyl phosphorothioate
CAS Registry Number	2921-88-2
Chemical Formula	$C_9H_{11}Cl_3NO_3PS$
Molecular Weight	350.59 g/mol
Physical form	white crystalline or irregularly flaked solid
Water Solubility	0.0014 g/L (25 ^oC) (Graebing and Chib, 2004) 0.00105 g/L (20 ^oC)
Density	1.398 g/cm^3 (43.5 ^oC) 1.49 g/cm^3 at (27 ^oC)
Octanol/water partition coefficient, Log K_{ow}	4.70 (Graebing and Chib, 2004; DPR, 2010)
Aqueous Photolysis Half-life	29.6 days (IUPAC, 2010)
Hydrolysis Half-life	35-78 days (pH 7.0; 25 ^oC) (Howard, 1991) 72.1 days (pH 7.0; 25 ^oC) DPR (2010) 72.8 days (pH 5.0; 25 ^oC) DPR (2010)
Vapor Pressure	1.87 x 10^{-5} mmHg (25 ^oC)
Boiling Point	108 ^oC
Melting Point	41.5-42.5 ^oC
K_{oc}	Ranges from 360 ml/g to 31000 ml/g, depending on soil type and environmental conditions
Henry's Law Constant	4.2 x 10^{-6} atm·m^3/mol at 25 ^oC and 6.7 x 10^{-6} atm·m^3/mol

3. ENVIRONMENTAL FATE

3.1 Fate in air

Henry's law constant, vapor pressure and volatilization are all interrelated for determining the fate of a pesticide in air. The best measure to describe a pesticide's fate in air is its half-life. The half-life is the time takes ½ amount of chemical to volatilize into the gas phase from any surface (Linde, 1994). The half-life of chlorpyrifos due to volatilization is 72 hours (Lyman et al., 1990). In their recent study, Hayward et al. (2010) found that the half-life of chlorpyrifos is 14 hours indicating that it is degraded more quickly in air and shows a much shorter atmospheric residence time. Howard (1991) reported that the degradation half-life of chlorpyrifos in air due to photolysis is 6.34 hours.

3.1.1 Air Monitoring Studies in California

The extensive use of chlorpyrifos on crops could result in detectable air concentrations due to its moderate volatility and drift from its application site. An initial study was conducted to determine the levels of chlorpyrifos in ambient air collected at residential sites in Salinas, Monterey County (Sawa, 1985). In this study, Sawa (1985) found very low levels of Chlorpyrifos (minimum detectable levels between 0.009-0.035 $\mu g/m^3$). Stein and White (1993) studied aerial movement of chlorpyrifos outside of the application area during a two week period during summer months in Fresno and Monterey counties. The maximum detected concentrations of chlorpyrifos were 0.0011 $\mu g/m^3$ and 0.0263 $\mu g/m^3$ for Fresno and Monterey counties, respectively. Mongar et al. (1998) reported the results of application and ambient air monitoring in Tulare County for chlorpyrifos during peak use period in May and June. Application site concentrations during seven sampling periods ranged from 2.6 – 47.2 $\mu g/m^3$ for the east side, 0.16-25.4 $\mu g/m^3$ for the south side, and 0.25-27.7 $\mu g/m^3$ for north of the field. The observed maximum ambient air concentrations from five different locations ranged from 0.0389 – 0.815 $\mu g/m^3$ (Mongar et al., 1998). Segawa et al. (2003) reported results of an ambient air monitoring study conducted at five locations in 2000 in Lompoc, Santa Barbara County, to determine concentration levels of 31 pesticides and their breakdown products. The highest air concentrations for 24 h, 14 days, and 10 weeks were 0.0151, 0.00405, and 0.00191 $\mu g/m^3$, respectively. A recent study conducted in Parlier, Fresno County, by Wofford et al. (2009) indicated that the insecticide chlorpyrifos was among the pesticides found most often. The results showed that the highest 1-day concentration was 0.150 $\mu g/m^3$ and the 14-day average concentration was 0.0961 $\mu g/m^3$ for chlorpyrifos.

3.2 Fate in water

Chlorpyrifos has a half-life of 14 days in an aqueous environment due to hydrolysis (McEwen and Stephenson, 1979). However, Howard (1991) reported half-lives ranges for chlorpyrifos in water at pH 7.0 and 25 ^oC from 35 to78 days due to hydrolysis.

Moreover, the degradation half-life of chlorpyrifos in water is 22 days due to photolysis (Howard, 1991).

3.3 Fate in soil

According to Tomlin (2000), the degradation half-life of chlorpyrifos in soil is 94 days. Other researchers also found that soil half-life ranged from 14 to 84 days in the field and under lab conditions (Chapman and Harris, 1980; Pike and Getzin, 1981). Furthermore, Graebing and Chib (2004) investigated soil photolysis of chlorpyrifos in a moisture and temperature controlled environment. They found that the irradiated half-life of chlorpyrifos on moist soil was 10 days, compared to 14 days on air-dry soil. When non-irradiated conditions were introduced, the half-life of chlorpyrifos was 18 and 30 days, respectively, for moist and air-dry conditions in sandy soil. Menon et al. (2004) studied the dissipation of chlorpyrifos in sandy loam and loamy sand soils. They found that chlorpyrifos showed moderately stable properties with half-lives of 13 and 17 days in loamy sand and sandy loam soils, respectively. Furthermore, they concluded that the rapid dissipation from soil post application might be caused by low sorption and its low organic matter content whereas fast dissipation from top soil might be the result of volatilization and photochemical degradation. In aerobic soils, the soil half-lives of chlorpyrifos ranged from 11 to 141 days in seven soils ranging in texture from loamy sand to clay and with soil pHs from 5.4 to 7.4. In anaerobic soils, the half-life was 15 days in loam and 58 days in clay soil (US EPA, 1989).

4. POTENTIAL HEALTH EFFECTS

Chlorpyrifos is an insecticide. Rat, rabbit, and mouse developmental toxicity studies on file at DPR did not indicate clear developmental toxicity. Signs of fetal toxicity (decreased ossification, retarded growth, decreased body weight) occurred only at or above dose levels causing clear maternal toxicity. A rat developmental neurotoxicity study had a No-Observed-Effect-Level (NOAEL) of 1 mg/kg for decreased pup survival and growth (Szabo et al., 1988). In addition to the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) toxicity studies, there is an extensive database of chlorpyrifos studies in the open literature. Several of these studies, including some human epidemiology studies, suggest adverse effects on neurologic and behavioral development (Nolan et al., 1984). In 2008, the Developmental and Reproductive Toxicant Identification Committee considered chlorpyrifos as a developmental toxin, but did not identify it as one. In a 2009 revised risk assessment scoping document, US EPA states, "Prenatal developmental toxicity in rats and rabbits and the rat reproduction studies provided no evidence of increased susceptibility of the fetuses or offspring. The developmental neurotoxicity study also did not provide clear indications of increased *quantitative* susceptibility in the offspring, although there were concerns for *qualitative* susceptibility in the offspring. However, the DNT study together with a growing body of studies in the open literature suggests that gestational and early postnatal exposure to pups may result in persistent alterations as indicated by various assessments of the animals when they reach adulthood". The US EPA maintained the same critical studies and points of departure used in the 2001 Interim Reregistration Eligibility Decision

(IRED) (US EPA, 2002). The IRED addressed short-term inhalation using a subchronic rat inhalation study. Rats were exposed 6 hours per day, 5 days per week. The highest dose level was 297 µg/m^3, and no effects were seen at any dose level, making 297 µg/m^3 a health-protective NOAEL. For an acute screening level, the 297 µg/m^3 is adjusted by 6/24 to give a 24-hour NOAEL of 74 µg/m^3 and a human (woman 13+ years) equivalent NOEL of 326 µg/m^3. In addition to the conventional uncertainty factor of 100X, US EPA applied an Food Quality Protection Act (FQPA)-safety factor of 10X to address the potential impacts of chlorpyrifos on neurological development. This would lead to an acute RfC or screening level of 326 ng/m^3 (including the FQPA factor).

5. CHLORPYRIFOS USE PROFILE IN CALIFORNIA

5.1 Chlorpyrifos use by county

The cumulative annual use of chlorpyrifos in California during 2009-2011 was obtained from the Pesticide Use Reporting Database (PUR). The results of annual use by counties are given in Table 2. Table 2 shows that the total use of chlorpyrifos increased from 1,240,475 lbs (2009) to 1,293,299 lbs (2011). Based on the sum of three years' (2009-

Table 2. Annual chlorpyrifos use by county and year in California during 2009-2011.

County	2009	2010	2011	Average†	Sum‡
			lbs ai		
Kern	281,686	227,656	218,387	281,686	727,730
Fresno	174,904	227,151	257,586	174,904	659,641
Tulare	143,961	191,678	244,843	143,961	580,483
Kings	52,262	110,738	124,261	52,262	287,261
Stanislaus	69,400	64,710	56,473	69,400	190,583
San Joaquin	71,823	58,685	39,984	71,823	170,492
Imperial	45,309	49,387	71,022	45,309	165,718
Monterey	50,011	49,728	38,286	50,011	138,024
Merced	57,736	41,392	34,033	57,736	133,162
Madera	36,824	29,334	23,527	36,824	89,686
Ventura	33,226	34,170	18,829	33,226	86,225
Glenn	22,582	34,385	20,376	22,582	77,343
Sutter	24,175	23,699	27,000	24,175	74,874
Butte	26,056	22,217	24,721	26,056	72,994
Santa Barbara	29,869	24,192	15,915	29,869	69,976
Solano	14,560	14,983	6,832	14,560	36,374
Tehama	14,142	11,457	8,176	14,142	33,775
Yuba	12,111	8,899	12,740	12,111	33,749

Table 2. continued.

County	2009	2010	2011	Average†	Sum‡
			lbs ai		
Colusa	10,560	8,935	8,751	10,560	28,245
Riverside	12,674	6,407	7,685	12,674	26,767
Yolo	9,470	9,057	6,465	9,470	24,992
San Luis Obispo	8,541	5,880	2,694	8,541	17,115
Sacramento	8,929	4,269	2,966	8,929	16,164
San Benito	3,338	1,738	2,828	3,338	7,903
Sonoma	1,939	4,197	1,323	1,939	7,459
San Bernardino	1,379	2,720	1,841	1,379	5,940
Napa	4,923	897	112	4,923	5,932
San Diego	1,642	1,499	2,260	1,642	5,402
Placer	2,185	1,846	1,363	2,185	5,394
Shasta	1,055	2,403	1,441	1,055	4,899
Modoc	3,060	0	1,644	3,060	4,704
Santa Cruz	1,262	1,193	1,714	1,262	4,170
Santa Clara	1,038	1,637	1,448	1,038	4,123
Lassen	728	224	2,602	728	3,554
Siskiyou	2,332	719	379	2,332	3,429
Contra Costa	1,496	430	971	1,496	2,897
San Mateo	964	1,200	637	964	2,802
Los Angeles	1,304	1,114	0	1,304	2,418
Orange	465	410	462	465	1,336
Calaveras	306	349	171	306	826
Lake	120	92	263	120	475
Mendocino	95	92	21	95	209
Mono	0	0	182	0	182
Amador	14	68	51	14	133
Alameda	0	29	34	0	63
Del Norte	14	3	0	14	16
Humboldt	4	4	4	4	12
Average§	26,393	27,274	27,517		
Sum¶	1,240,475	1,281,876	1,293,299		3,815,650

†Average yearly use by county.
‡Total use (2009-2011) by county.
§ Average use by year.
¶ Total use by year and grand total for California (2009-2011)

2011) use, Kern County recorded the overall highest use of chlorpyrifos (19 % of total statewide use). Kern County is followed by Fresno (17 %), Tulare (15 %), Kings (7.5 %), and Stanislaus counties (4.9 %). Table 3 lists the monthly use of chlorpyrifos within the years of 2009 through 2011 for the top ten counties. The general trend of significant use occurred between the months of January and August. However, the amount of use changed within given years but the peak use of chlorpyrifos was generally during the months of July and August in all counties (Table 3). The highest average use of chlorpyrifos was 20,451 lbs and 22,179 lbs in the months of July and August ,respectively, by all top ten counties,

5.2 Chlorpyrifos use by commodity and county

The total amount of chlorpyrifos used (and corresponding percentages) on treated acres in the top ten commodities/agricultural crops in California from 2009 through 2011 are given in Table 4. Although the highest chlorpyrifos use (823,990 lbs) in almond crop with 21.6 % of statewide use, the applied area (406,315 ac) for almond crop was the second highest in the state. After the almond crop, rank of commodities/agricultural crops' use of chlorpyrifos, in descending order, is as follows: Alfalfa (14 %), Walnut (13.6 %), Orange (13 %), Cotton (9.1 %), Grapes (8.9 %), Broccoli (3.5 %), Corn (2.8 %), Lemon (2.5 %), and Sugarbeet (2.2 %). A summary of chlorpyrifos use on the primary commodities/agricultural crops in the top five counties is presented in Table 5. Chlorpyrifos was used predominantly on almonds in three of the top five counties (Kern, Fresno, and Stanislaus). Meanwhile, oranges and cotton received the highest chlorpyrifos application in Tulare and Kings counties, respectively. Interestingly, almonds took fourth place in chlorpyrifos use in both counties (Table 5).

5.3 Chlorpyrifos use by method of application

Chlorpyrifos was mostly applied by ground application (67.1 %) in California between 2009 and 2011 (Table 6). Aerial application (32.3 %) ranks second in methods of application of chlorpyrifos in statewide use. The average applied amount of chlorpyrifos for both ground and other methods of application (41 and 42 lbs ai, respectively) were close. The average applied chlorpyrifos amount was 50 lbs ai in the aerial application. However, the average field size was smaller in ground (22 acre) than in aerial (57 acre) and other types (52 acres) of application methods. Therefore, ground application produced the highest average application rate (1.8 lbs ai/ac); the application rate for aerial and other types of application methods were quite similar to one another (Table 6).

5.3.1 Distribution of Chlorpyrifos use

Figure 2 depict the distribution of the total amount of active ingredient used (lbs), area treated with chlorpyrifos, and application rates (lbs ai/acre) for individual applications in the top ten counties in California between 2009 and 2011. There was almost no difference with respect to chlorpyrifos use within given years except at the 95th percentile level (Figure 2A).

Table 3. Monthly chlorpyrifos use by county and year (2009-2011) for the top ten counties in California.

County	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		lbs ai											
Kern	2009	24391	12980	43043	7093	36898	13007	22361	4679	1479	5943	518	109294
	2010	18856	10473	25502	4897	41395	9484	42644	22610	22981	13456	8984	6376
	2011	37800	8601	26366	13144	25566	10795	21444	38306	19245	7224	1749	8147
Fresno	2009	13641	5384	11884	2001	5604	5352	75883	35737	16370	2370	392	286
	2010	11345	5749	8965	1805	20683	11717	58042	65281	35003	5282	1757	1522
	2011	15214	6301	9200	2075	8033	11015	30725	117643	46145	8466	2268	501
Tulare	2009	5873	3137	17104	8934	21960	21903	39370	12385	8057	4900	158	180
	2010	5436	3551	19461	3610	13397	29483	50267	42838	14276	7712	1463	185
	2011	4308	3294	17157	4409	22162	35137	60259	62193	22122	12850	734	217
Kings	2009	0	192	2484	1050	7397	4198	14153	17350	4823	616	0	0
	2010	816	76	2153	312	5798	6673	31182	49339	13997	330	0	62
	2011	556	155	3123	980	1118	5774	21135	66704	22139	2156	150	271
Stanislaus	2009	5962	2539	2525	2981	16611	6013	21144	6504	1252	2401	543	926
	2010	4769	1530	1518	878	9251	10178	21033	7405	1897	2203	2859	1188
	2011	656	4541	1152	583	9626	6949	11504	15177	3625	1563	855	242
San Joaquin	2009	177	8	13693	1616	6191	4398	19728	11042	4686	7877	2394	12
	2010	4590	1277	7008	3727	1603	5472	9578	16153	2195	5151	1933	0
	2011	38	679	3611	614	5465	1973	8335	10669	6858	1599	113	30

Table 3. continued.

County	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		lbs ai											
Imperial	2009	5338	7398	4256	141	1538	1464	400	279	4212	14659	2407	3218
	2010	2727	1632	3758	2025	1536	85	43	608	12335	20560	3139	940
	2011	4996	6130	5163	985	222	648	1074	3138	9202	25545	5734	8185
Monterey	2009	2305	6514	7315	2691	3985	5628	6653	5316	1212	1234	4343	2815
	2010	2650	6177	5450	2915	4648	6239	6907	4768	1173	1251	5233	2318
	2011	1886	3283	4095	2556	3721	4586	5761	5254	2106	817	1973	2247
Merced	2009	37	2699	28685	1733	4495	4055	4592	5380	3714	2155	191	0
	2010	875	395	2820	1104	2826	2811	8604	11099	3048	6668	1142	0
	2011	178	176	4316	3754	3256	1527	6303	6417	2332	594	3064	2115
Madera	2009	0	81	4403	284	3737	3597	8605	8857	1996	2525	2741	0
	2010	306	607	1506	36	3788	3500	4313	7541	2465	2955	2319	0
	2011	75	517	1297	971	2432	1744	4199	4702	1715	3821	2054	0
Average		5860	3536	9634	2663	9831	7847	20541	22179	9755	5829	2040	5043

Table 4. Top ten commodities/agricultural crops based on total use (mass of active ingredient), corresponding percentage, and acres treated in California (2009-2011).

Commodity	Total use	Percentage	Area applied
	lbs ai	%	Acre
Almond	823,990	21.6	406,315
Alfalfa	535,920	14.0	1,121,517
Walnut	519,824	13.6	281,843
Orange	496,081	13.0	147,715
Cotton	345,663	9.1	372,735
Grapes	340,639	8.9	181,971
Broccoli	132,885	3.5	97,717
Corn	106,006	2.8	131,798
Lemon	95,730	2.5	29,913
Sugarbeet	82,161	2.2	123,557

Table 5. Chlorpyrifos use by year and average annual value for the top ten 0 commodities/agricultural crops in the top five counties.

County	Crop	Year			Average
		2009	2010	2011	
		lbs ai			lbs ai
Kern	Almond	173,083	70,210	186,265	143,186
	Alfalfa	18,977	41,109	151,484	70,523
	Grapes	51,414	51,819	66,073	56,435
	Orange	23,722	33,438	78,333	45,164
	Tangerine	6,821	8,343	51,269	22,144
	Cotton	125	8,217	26,130	11,491
	Lemon	3,083	6,524	8,649	6,086
	Sorghum	732	268	8,081	3,027
	Onion	348	1,515	6,703	2,855
	Wheat	235	1,847	5,968	2,683
Fresno	Almond	73,669	84,179	180,183	112,677
	Cotton	13,864	33,684	194,741	80,763
	Orange	21,529	42,313	82,804	48,882
	Alfalfa	24,202	21,522	57,747	34,490

Table 5. continued.

County	Crop	Year			Average
		2009	2010	2011	
			lbs ai		lbs ai
Fresno	Grapes	15,128	14,950	34,715	21,598
	Tangerine	2,989	5,204	17,554	8,583
	Peach	7,344	6,392	8,900	7,545
	Walnut	2,364	2,773	12,137	5,758
	Corn	3,827	3,399	8,142	5,123
	Nectarine	3,233	3,101	7,637	4,657
Tulare	Orange	66,374	87,329	314,092	155,931
	Alfalfa	13,317	36,629	92,272	47,406
	Walnut	17,225	11,422	41,235	23,294
	Almond	8,309	12,638	41,157	20,702
	Corn	4,402	8,848	42,322	18,524
	Grapes	12,594	12,977	19,095	14,889
	Tangerine	5,193	5,503	14,334	8,343
	Lemon	1,863	4,279	10,749	5,630
	Nectarine	3,104	2,381	5,018	3,501
	Wheat	4,447	1,280	4,484	3,404
Kings	Cotton	22,020	70,216	217,037	103,091
	Alfalfa	10,938	20,677	62,113	31,243
	Walnut	10,948	7,050	12,888	10,295
	Almond	3,031	8,094	5,884	5,669
	Corn	3,044	2,704	6,679	4,142
	Sorghum	718	1,068	3,716	1,834
	Grapes	1,014	446	825	762
	Wheat	440	75	1,394	636
	Onion	0	0	1,045	348
	Nectarine	0	36	262	99
Stanislaus	Almond	23,837	23,916	53,688	33,814
	Corn	65,737	4,056	21,332	30,375
	Walnut	23,949	25,212	41,581	30,247
	Grapes	5,663	5,035	5,815	5,505
	Alfalfa	3,311	2,382	6,139	3,944
	Sweet potato	889	729	6,129	2,583
	Citrus Fruits	0	952	3,338	1,430

Table 5. continued.

County	Crop	Year 2009	2010	2011	Average
			lbs ai		lbs ai
Stanislaus	Peach	1,199	866	0	688
	Apple	907	791	183	627
	Outdoor grown plants	20	187	603	270

Table 6. Statewide chlorpyrifos use by method of application in 2009-2011.

Application method	Total Number	Sum Applied Amount	Average Applied Amount	Sum Applied Area	Average Area	Average Rate
		lbs ai		ac		lbs ai/ac
Ground	55,407	2,257,671	41	1,231,927	22	1.8
Aerial	21,693	1,085,502	50	1,235,480	57	0.9
Other	454	19,283	42	23,511	52	0.8
Sum	77,554	3,362,455		2,490,918		

Similar patterns can be observed in the cumulative distribution of treated area whereas there are small discrepancies between years at the 90th percentile level (Figure 2B). The application rate of chlorpyrifos differentiates slightly at the 95th percentile level between years (4.0 lbs ai/ac in 2009, 5.1 lbs ai/ac in 2010, and 5.6 lbs ai/ac in 2011) (Figure 2C). For grapefruit, lemons, oranges and other citrus fruits, the recommended maximum label application rate for chlorpyrifos is 6 lbs ai/acre.

6. AIR MONITORING RECOMMENDATIONS

Using recent pesticide use report information for 2009-2011, CPDR suggests that the CARB monitors one ground application (67 %) on site for chlorpyrifos and its oxygen analog. Based on a preliminary assessment of the toxicology data, CDPR requests targeting to the concentration level of 0.03 µg/m^3 as the quantitation limits for chlorpyrifos and the chlorpyrifos oxygen analog (CDPR, 2013).

6.1 Application site monitoring

Table 4 indicates that almost 81 % of Chlorpyrifos use was on the orchards, cotton, and grapes. The selection of county and time of monitoring can be made based on the data

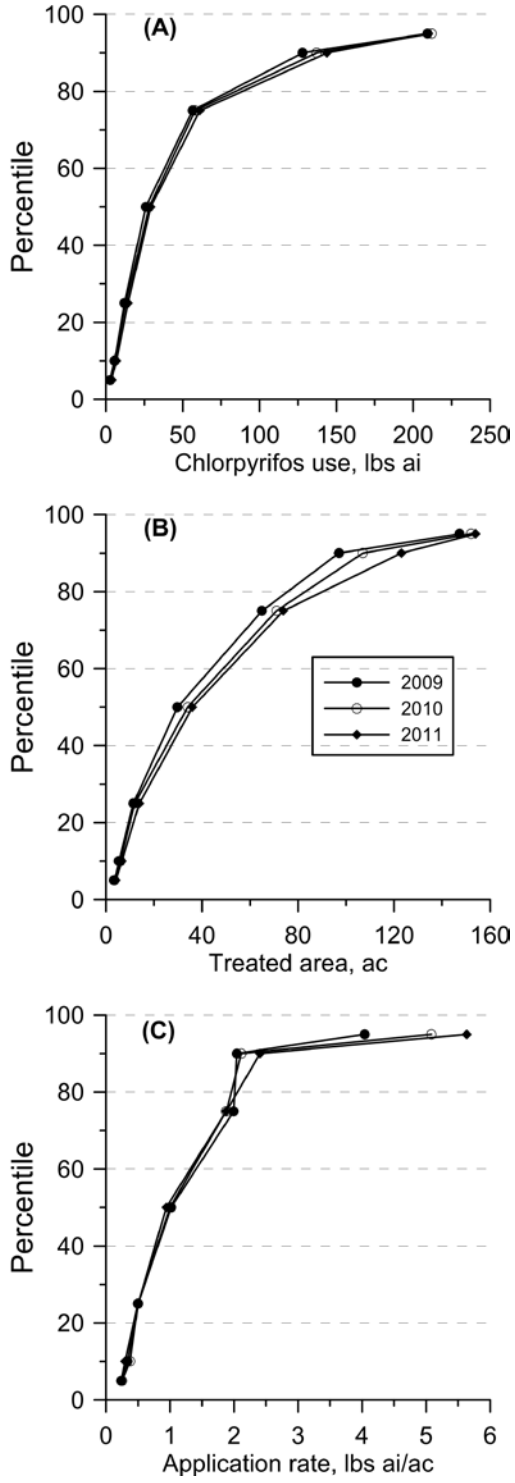

Figure 2. Cumulative frequency plot of chlorpyrifos for (A) amount applied (lbs ai), (B) treated area (ac) per application, and (C) rate of application, vs. percentile by year (2009–2011) in California's top ten counties.

provided in Tables 3 and 4. The CDPR suggests that ground application should be chosen as the method of application in the monitoring study with an application rate of 2-3 lbs ai/ac to a treated field of between 20-40 acres in size.

A minimum of eight samplers should be positioned around the application site, one on each side of the site and one at each corner. A ninth replicate sampler should be collocated at one position. Ideally, samplers should be placed a minimum of 20 m from the application area. CDPR recommends that CARB coordinate with the County Agricultural Commissioner for site selection. If a site is located on private property, permission from the property owner must be obtained before monitoring. Air samples should be taken before, during, and after application and for three daytime/overnight sampling periods. The start and end of the application should occur during daylight hours. Table 7 denotes the recommended sampling periods for collecting air monitoring samples before (pre-application), during (application), after application (post-application), and for three day time/overnight sampling periods.

Table 7. Sampling periods recommended for air monitoring an onsite.

Sampling periods	Start time	End time
1. Pre-application	12-24 h prior to application	Prior to application start
2. Application	Start of application	Until 1 h before sunset
3. Post-application	1 h before sunset	1 h after sunrise†
	1 h after sunrise	1 h before sunset
	1 h before sunset	1 h after sunrise†
	1 h after sunrise	1 h before sunset
	1 h before sunset	1 h after sunrise†

† All overnight samples must include the period from one hour before sunset to one hour after sunrise.

Moreover, the field spikes and trip blanks should be prepared in the laboratory and run in the field with the samples for quality assurance. When CARB prepares the monitoring reports, CDPR requests the following information to be included accurately (use GPS coordinates if applicable with World Geodetic System [WGS84] of 1984):

1) A record of the application site, including topographic features.
2) A record of the positions of the monitoring equipment with respect to the application site, including the exact direction and distance of the samplers from the edge of the application site.
3) A record of pesticide application, including application dosage or quantity of pesticide applied, application starting and ending time, method and application rate, etc.

4) A drawing of the monitoring site showing the precise location of the meteorological equipment, trees, buildings, and other obstacles with respect to North (identified as either true or magnetic North).
5) Meteorological data collected at 5-minute intervals including wind speed and direction, humidity, air temperature and comments regarding degree of cloud cover.

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California Environmental Protection Agency
AIR RESOURCES BOARD

Monitoring and Laboratory Division
Air Quality Surveillance Branch

Sampling Protocol for O, O-diethyl O-3,5,6-trichloro-2-pyridyl-phosphorothioate (Chlorpyrifos) Application Study

October 13, 2014

Prepared by:

James Pham
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Signatures:

_____

Kenneth R. Stroud, Chief Date
Air Quality Surveillance Branch
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Mac McDougall, Manager Date
Special Purpose Monitoring
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Appendix

APPENDIX A: Standard Operating Procedure Sampling and Analysis of O, O-diethyl O-3,5,6-trichloro-2-pyridyl-phosphorothioate (Chlorpyrifos)

1.0 Introduction

The California Department of Pesticide Regulation's (DPR) memorandum dated February 19, 2014, "Proposed Toxic Air Contaminant Monitoring For 2014", requests that the Air Resources Board (ARB) conduct a comprehensive air monitoring study for the insecticide O, O-diethyl O-3,5,6-trichloro-2-pyridyl-phosphorothioate (Chlorpyrifos) during a ground application.

This study will consist of eight sampling periods.

1) A background sample period duration time minimum 12-24 hours (begin Monday)
2) Application sampling period begins Tuesday morning until one (1) hour after end of application
3) The first post application **daytime** sampling period begins Tuesday afternoon one (1) hour after end of application until one (1) hour before sunset.
4) Post application #2 **overnight** sampling period begins Tuesday evening one (1) hour before sunset and is removed one (1) hour after sunrise on Wednesday morning.
5) Post application #3 **daytime** sampling period begins Wednesday morning one (1) hour after sunrise and is removed one (1) hour before sunset.
6) Post application #4 **overnight** sampling period begins Wednesday evening one (1) hour before sunset and is removed one (1) hour after sunrise Thursday morning.
7) Post application #5 **daytime** sampling period begins Thursday morning one (1) hour after sunrise and is removed one (1) hour before sunset.

The background sampling period will be performed 12 to 24 hours prior to the application of Chlorpyrifos. The application sampling period will begin 1 hour prior to the application of Chlorpyrifos and stop 1 hour after application completion. There will be a total of 85 resin sorbent tube samples: 63 background/application/post application, nine (9) field spikes, one (1) trip spike, one (1) trip blank, one (1) field blank, and ten (10) spares.

Background sampling will be started the day before the application and end approximately one (1) hour prior to the start of the application or when the elapsed time reaches a minimum of 12 hours. Eight (8) background samplers will be placed around the perimeter of the field along with one (1) collocated sampler and one (1) field spike sampler on the downwind side.

2.0 Project Goals and Objectives

The primary goal of this monitoring project is to measure the concentrations of Chlorpyrifos in the ambient air during and after application.

To achieve the project goal, the following objectives should be met:

1) Identification of monitoring sites that mutually satisfies criteria for ambient air sampling and DPR's requirements.
2) Appropriate application of sampling/monitoring equipment to determine Chlorpyrifos concentrations in the air adjacent to the application.
3) Application of relevant field quality assurance/quality control practices to ensure the integrity of field samples.

4) A final report containing all relevant information, data and results gathered in the course of MLD's activities during the planning and execution of this project

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4.0 Study Location

A Chlorpyrifos application is planned for October in the town of Brawley, CA in Imperial County. The field is located at coordinates 33.001026, -115.671623. The field is located at the intersection of Monte and Pellet Roads

5.0 Study Design

The Chlorpyrifos sampling schedule is listed in Table 1 (Sampling Periods). For October 2014, sunrise occurs at 0545 PST (6:45AM PDT) and sunset occurs at 0510 PST (06:10PM PDT).

TABLE 1: SAMPLING PERIODS

All overnight samples must include the period from one hour before sunset to one hour after sunrise.

a) Background sampling will start the day before the application for a minimum of 12 hours, but no more than 24 hours. The background samples will be removed at least one (1) hour prior to the start of the application. The background samplers will be installed at all four corners and at each of the four sides of the field at quarterly lengths with one (1) field spike sampler and one (1) collocated sampler next to the downwind site for a total of ten (10) samplers. The field spike samples will be pre-spiked with a concentration of 0.05 µg of Chlorpyrifos per sample.

b) The application sampling period will start approximately 30 minutes prior to the ground application of Chlorpyrifos and will continue until six (6) hours into the application (note percentage of field covered if application is still in progress) or until 1 hour after the completion of the application, whichever is sooner. The first post application sample will start one (1) hour after end of application until one (1) hour after sunrise. Second post application **daytime** sampling period will start one (1) hour after sunrise and continue until one (1) hour before sunset. Third post application **overnight** sampling period will start one (1) hour before sunset and will continue until one (1) hour after sunrise. Fourth post application **daytime** sampling period will start one (1) hour after sunrise and will continue until one (1) hour before sunset. Fifth post application **overnight** sampling period will start one (1) hour before sunset and will continue until one (1) hour after sunrise.

c) There will be eight (8) sampling sites around the field. For a square field, four (4) sites will be located at each corner and four (4) sites will be located at quarterly lengths on each side. The projected downwind site will have two additional samplers, one (1) collocated and one (1) field spike, located within 0.6 meters of the primary sampler. All sampler intakes will be 1.7 meters (67 $\pm$ 6 inches) above the ground. Samplers will be placed 20 $\pm$10 meters (33 to 98 feet) from the edge of the field.

d) Each sample will be collected by passing a measured volume of ambient air through one XAD-2 resin sorbent tube that is mounted on a sampling tree as shown in Figure 1. Sample flow is controlled by an inline rotameter (flow range of 0-5 LPM) and the resin sorbent tube will be protected from direct sunlight or rain. Prior to each sampling period, the sampler is checked for leaks. After the sample resin sorbent tube is installed, the flow rate will be set at 3.0 liters per minute

(lpm) using a digital mass flow meter. The flow rate will be checked at the end of each sampling period and the average of the start and stop flows shall be 3.0 lpm ±20%. At the end of each sampling period, the tubes will be placed in culture tubes with an identification label affixed and placed in a dry ice cooler. The field log sheet and resin sorbent tube label will contain the following information: log #, sample name, sampler ID number, start and end date/time, start/end elapsed time meter reading, start/end mass flow meter display reading, comments (if applicable), weather conditions and the start/end initials of the operator. The exposed XAD-2 resin sorbent tubes (SKC #226-30-06) with 400 and 200 mg of packing are stored in an ice chest (on dry ice) or in a freezer until extracted in the laboratory.

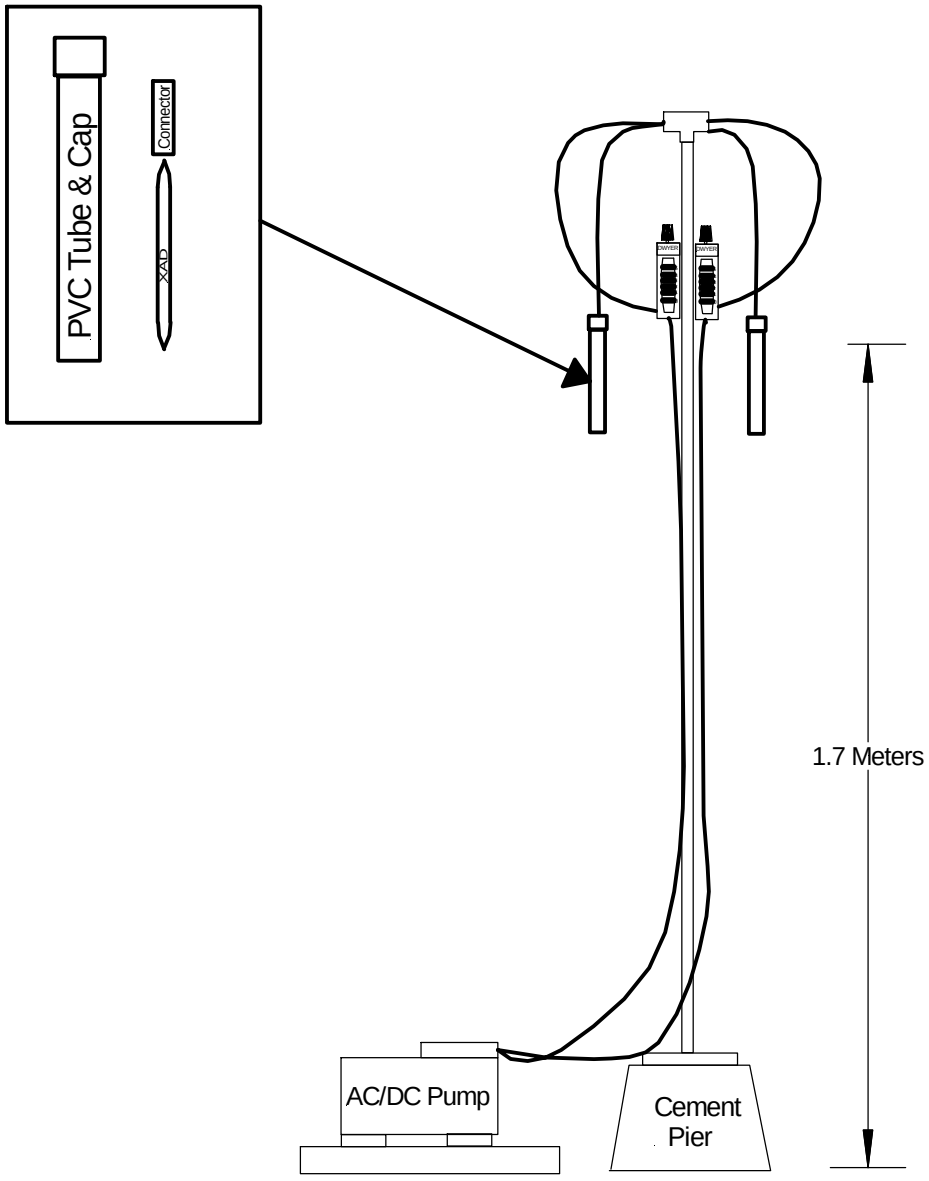

FIGURE 1: AIR SAMPLER TREE WITH PUMP

e) In order to reduce direct exposure to ARB staff during the pesticide application period all samplers will begin a minimum of thirty minutes prior to the start of the

application. At the end of each sampling period the following general procedure will occur at each site; flows will be verified, documentation completed, all resin sorbent tubes removed, the batteries replaced, a new resin sorbent tube installed and flows adjusted if necessary. Field notes and observations will be recorded (such as Chlorpyrifos application flow rate and total amount of Chlorpyrifos applied).

f) Meteorological data will be collected using a Met-One Automet portable meteorology system. The Automet will be located no closer than twenty meters from the edge of the field being monitored. The meteorological sensors will be installed between 7.5 meters above the ground. The AutoMet station will continuously measure and record 5 minute averages for wind speed, wind direction, ambient temperature and percent relative humidity throughout the background and application sampling periods.

g) The MLD will provide DPR with a final report containing all relevant information, collected data and analytical results gathered during the course of the study.

6.0 Sampling and Analysis Procedures

Special Purpose Monitoring Section (SPM) staff will hand-carry resin sorbent tubes to and from MLD's laboratory in Sacramento, and to and from the sampling location. The resin sorbent tubes will not be exposed to extreme conditions or subjected to rough handling that might cause loss or degradation of sample. At the end of the each sampling period, all resin sorbent tubes will be removed from the sampler, placed in a culture tube, labeled, and secured in a dry ice cooler.

After each sampling period, the operator will replace the batteries for each pesticide sampler with charged batteries, install a new resin sorbent tube, and install the rain/sun shield over the resin tube at each sampling site. The resin sorbent tube field log sheet (See Figure 2) shall be filled out along with the resin sorbent tube label. Prior to any sampling, flows will be set to 3.0 $\pm$ 0.3 lpm. At the start of each sampling period, the pesticide samplers will be manually turned on and the start date, time, elapsed time meter reading and indicated flow rate will be recorded. At the end of each sampling period, the flow rate will be measured, the pesticide sampler manually shut off and the following recorded on the resin sorbent tube field log sheet; end date, time, elapsed time meter reading and flow.

Sampling will occur as scheduled unless ambient conditions at the start include rain or instantaneous gusts of wind over ten (10) miles per hour. All reported sampling times, including meteorological data, will be reported in Pacific Standard Time (PST).

The Northern Laboratory Branch (NLB) will supply Special Purpose Monitoring with 85 resin sorbent tube samples: 63 background/application/post application include nine (9) collocated, nine (9) field spikes, one (1) trip spike, one (1) trip blank, one (1) field blank, and ten (10) spares. A label will be affixed around the top section of the resin sorbent tube identifying the sample. Spikes and other QC resin sorbent tubes will be identified. The NLB will perform analyses for Chlorpyrifos on all collected samples and report results to SPM in electronic format (Excel) and hardcopy. Laboratory analysis will be

performed in accordance with the draft standard operating procedures, “Method Development for the Sampling and Analysis of O, O-diethyl O-3,5,6-trichloro-2-pyridyl-phosphorothioate ...” The current analytical Method Detection Limit (MDL) is 0.002 ug/mL for Chlorpyrifos. The laboratory’s operating procedure is included in this Protocol as Appendix A.

The following resin sorbent tube validation and analytical quality control criteria will be followed during pesticide analysis.

1. **Sample Hold Time**: Sample hold time criteria will be consistent with the laboratory’s operation procedure stated 28 days.

2. **Duplicate Analysis**: Laboratory to provide duplicate analytical results and the corresponding relative percent difference (RPD)

3. **Method Detection Limit (MDL)**: Sample analysis results less than the MDL shall be reported as a less than numerical value. This less than numerical value shall incorporate any dilutions (dilution factor will be included in the report)

4. **Analytical Linear Range**: Analytical results greater than 10% of the highest calibration standard shall be diluted and reanalyzed within the calibrated linear range.

7.0 List of Field Equipment

Quantity	Item Description
(1)	Met-One Automet portable meteorology system consisting of a data logger and calibrated sensors measuring 5 minute averages for wind speed, direction, ambient temperature, and relative humidity.
(1)	Measuring Wheel
(1)	200 foot measuring tape
(1)	Tripod and compass
(1)	Global Positioning System (GPS) with backup batteries and carrying case
(1)	Digital Camera with backup batteries and carrying case
(2)	Aalborg certified mass flow meter 0-5 lpm
(92)	Resin sorbent tubes (10 field spikes, 1 trip spike, 1 trip blank, 56 background/application/post application and 10 spares)
(10)	Pesticide sampler each equipped with one (1) each sampling train and voloflows setup to sample one (1) resin tube.
(12)	Pump, 12 VDC.
(80)	Battery, 12 VDC 40 amps.
(6)	Chargers

8.0 Quality Control

Quality control procedures will be observed to ensure the integrity of samples collected in the field. National Institute of Standards and Technology (NIST) traceable transfer

standards will be used to calibrate meteorological sensors and measure sample flow rates.

The sample flow rate of the pesticide samplers will be measured using certified mass flow meters with a range of 0-5 liters per minute.

The metrological sensors will be calibrated and aligned following the procedures outlined in the standard operating procedures on the Air Monitoring Web Manual at the following link.

http://arb.ca.gov/airwebmanual/amwmn.php?c=5&t=sop

A label will be affixed around the top section of the resin sorbent tube identifying the sample with the following information: log #, sample name, sampler ID number, start and end date and time, start and end elapsed time meter (ETM) reading, start and end mass flow meter display reading and operators initials. Collocated (side-by-side) air samplers will operate at one site during the study period. This collocated site will be located at the projected downwind site.

Field Spike (FS): Ten (10) field spikes will be prepared by the laboratory by injecting resin sorbent tubes with a known concentration of Chlorpyrifos. The field spike resin sorbent tubes will be coupled with a pesticide sampler and collocated next to the projected downwind sampler. One (1) each field spike will be collected during each sampling period.

Trip Spike (TS): A trip spike will be prepared by the laboratory by injecting a resin sorbent tube with a known concentration of Chlorpyrifos with the same level as the field spikes. The trip spike resin sorbent tube accompanies the sample resin sorbent tubes from the lab to the field but is not sampled.

Trip Blank (TB): A trip blank will be prepared by the field staff. The trip blank resin sorbent tube accompanies the sample resin sorbent tubes from the lab to the field and back to the lab but is not sampled.

Collocated (C): Collocated samples will be collected at the designated down wind sampling site during all sampling periods.

Valid samples are those that have a final corrected average flow within ± 20% of 3.0 LPM.

Site/Sample Identification

The Chlorpyrifos application sampling sites will be named accordingly for the background, ambient, application, and post application. The naming convention will follow the formula “Site Location – Sample Number.” The background samples will have a name leading with “BKG.” Collocated and field spikes will have an additional C or FS in the name.

Background Site Naming:
BKG - *Site Location*

Application Site Naming:
Site Location - *Sample Number* (C/FS, if applicable)

Letter Abbreviations:
N = North Side
NE = North-east Corner
E = East Side
SE = South-east Corner
S = South Side
SW = South-west Corner
W = West Side
NW = North-west Corner

C = Collocated
FS = Field Spike

TS = Trip Spike
TB = Trip Blank
FB = Field Blank

Following the quality control procedures listed above will ensure the quality and integrity of the samples collected in the field and will insure accurate field and laboratory results.

9.0 Deliverables

9.1 Northern Laboratory Branch (NLB) Deliverables

Within 90 days after the last collected sample is received at the laboratory, the NLB will provide SPM with a report that will include the following topics:

1) Table(s) of sample to include:
   a. Sample identification (name).
   b. Date sample received from field.
   c. Date sample analyzed.
   d. Dilution ratio.
   e. Analytical results.
2) All equations used in calculating analytical results.
3) Table of duplicate results including calculated relative percent difference (RPD) when applicable.
4) Table of collocated results.
5) Table of analytical results from all field, trip and laboratory spikes including percent recoveries when applicable.
6) Table of analytical results from all trip blanks.
7) Table of analytical results from all laboratory blanks, standards and control checks performed, including dates performed and relative percent recoveries when applicable.

8) Copy or location of analytical method or Standard Operating Procedures (SOP) used for analysis.
9) Section or provision listing or reporting any and all deviations from analytical SOP and this protocol.

9.2 Air Quality Surveillance Branch Deliverables

Within 90 days from receipt of the final results report from the NLB, AQSB will provide DPR with a report containing the following topics:

1) Sampling Protocol.
2) Personnel Contact List.
3) Site Maps.
4) Site Photographs.
5) Site Descriptions and Measurements (site, sampler, GPS coordinates, inlet height, distance to roads, site-specific comments, Chlorpyrifos application rate, and total pounds or gallons of Chlorpyrifos applied).
6) Sample Summary Table.
7) Field Log Sheets.
8) Laboratory Analysis Reports with calculations in electronic format.
9) Met Station and Sampler Calibration Reports.
10) Transfer Standards' Certification Reports.
11) Disk containing electronic files of 5-minute averaged Meteorological Data.
12) Disk containing electronic files of Report.

XAD-2 RESIN SORBENT TUBE FIELD LOG SHEET

Project: Chlorpyrifos Pesticide Application Air Monitoring

Start Flow Set: 3.0 ±0.3 lpm End Flow Criteria: 3.0 lpm ±20%

Log #	Sample Name	Sampler ID Number	Date & Time Entry Example (6/14/08 13:42)		Elapsed Time Meter (ETM)		Mass Flow Meter Display		Corrected Average Flow	Comment Number	Weather K,P,C,F&R		Initials	
			Start	End	Start	End	Start	End			Start	End	Start	End

MFM Used #: _____ **Slope:** _____ **Intercept:** _____

1 of 6

Weather Codes: K = Clear, P = Partly Cloudy, C = ≥67% Cloudy, F = Fog and R = Rain (any)

Figure 2: Resin Sorbent Tube Field Log Sheet

APPENDIX A: Standard Operating Procedure Sampling and Analysis of O, O-diethyl O-3,5,6-trichloro-2-pyridyl-phosphorothioate (Chlorpyrifos)

The Special Analysis Section of MLD's Northern Laboratory Branch will perform the analyses for Chlorpyrifos collected by the resin sorbent tube method. This analytical procedure is entitled, "Standard Operating Procedure Sampling and Analysis of O, O-diethylO-3,5,6-trichloro-2-pyridyl-phosphorothioate (Chlorpyrifos)…" and can be located starting on the next page.

California Environmental Protection Agency

Air Resources Board

Method Development for the Sampling and Analysis of *O*, *O*-diethyl *O*-3,5,6-trichloro-2-pyridyl-phosphorothioate (Chlorpyrifos) and its Oxygen Analog (Chlorpyrifos-Oxon) in Application Air using Gas Chromatography/Flame Photometric Detector

Special Analysis Section
Northern Laboratory Branch
Monitoring and Laboratory Division

Revision 1
7/3/13

Approved by:

Russell Grace, Manager
Special Analysis Section

1. SCOPE

The current method is for the analysis of O, O-diethyl O-3,5,6-trichloro-2-pyridyl-phosphorothioate (Chlorpyrifos) and its Oxygen Analog (Chlorpyrifos-Oxon) using a gas chromatograph with a flame photometric detector. The procedure is for the analysis of application air monitoring of Chlorpyrifos and Chlorpyrifos-Oxon using XAD-2 resin tubes. The Department of Pesticide Regulation (DPR) asked the Air Resources Board (ARB) to analyze for Chlorpyrifos and Chlorpyrifos-Oxon during agricultural application monitoring with an estimated quantitation limit of 0.03 $\mu g/m^3$.

2. SUMMARY OF METHOD

Resin tubes, XAD-2, are placed on the sampler for 24 hours at a flow rate of 3.0 liters per minute (LPM). The samples are stored in an ice chest or refrigerator until extracted with dichloromethane (DCM). A gas chromatograph with a flame photometric detector (FPD) is used for analysis.

3. INTERFERENCES/LIMITATIONS

Interferences may be caused by contaminants in solvents, reagents, glassware and other processing apparatus that can lead to discrete artifacts or elevated baselines. A method blank, including both solvent and resin, must be analyzed with each batch of samples to detect any possible interference.

4. EQUIPMENT AND CONDITIONS

A. Instrumentation

Agilent 7890A Series gas chromatograph with flame photometric detector

Injector: Splitless, Liner: sp/less single taper liner with glass wool
Heater 220°C, Pressure 10 psi

Column: Agilent 19091J-413 HP-5 5% Phenyl Methyl Siloxane, 30 meter, 320 µm i.d., 0.25 µm thickness, or equivalent

GC Temperature Program: Oven initial 150°C, hold 2 min. Ramp to 230°C @ 10°C/min., hold 7.0 min.

Flows: Column: He: 1.34 ml/min, 10.0 psi. (average velocity: 28.968 cm/sec)
Detector: H2: 95 ml/min, Air: 75 ml/min, Makeup (N2): 30 ml/min

Retention times: Chlorpyrifos-Oxon 10.883 min; Chlorpyrifos 11.037 min

B. Auxiliary Apparatus

1. Precleaned vials, 8 ml capacity with Teflon caps
2. Whatman Disposable Glass Microfiber Syringe Filter 25mm GD/X
3. Disposable syringes, 3 ml
4. Sonicator
5. GC vials with septum caps

C. Reagents and Sampling Media

1. Dichloromethane, Pesticide grade or better
2. Chlorpyrifos, Chem Service lot# 1361200 Chlorpyrifos, Chem Service lot# 1408200, Chlorpyrifos-Oxon, Chem Service lot# 1284900
3. XAD-2 resin sorbent tubes, Cat. No. 226-30-06, SKC, Inc. Eighty Four, PA

5. ANALYSIS OF SAMPLES

1. It is necessary to analyze a solvent blank with each batch of samples. The blank must be free of interferences. A solvent blank must be analyzed after any sample that may result in possible carry-over contamination.

2. A five-point calibration curve shall be analyzed with each batch of samples. Due to instrument sensitivity, Chlorpyrifos-Oxon will be calibrated at a concentration two and a half times the concentration of Chlorpyrifos. The calibration will be 0.02-0.20 µg/ml for Chlorpyrifos and 0.05-0.50 for Chlorpyrifos-Oxon.

3. A calibration check sample is run after the calibration, after every ten samples and at the end of the sample batch. The value of the calibration check must be within $\pm 3\sigma$ (the standard deviation) or $\pm$10% of the expected value whichever is greater. If the calibration check is outside this limit, then those samples in the batch after this calibration check need to be reanalyzed.

4. With each batch of XAD-2 samples analyzed, a laboratory blank and a laboratory control spike will be run concurrently. A laboratory blank is XAD-2 extracted and analyzed the same way as the samples. A laboratory control spike is XAD-2 spiked with a known amount of standard. The laboratory control sample is extracted and analyzed the same way as the samples. Laboratory control samples should have recoveries that are greater than or equal to 70% of the theoretical spiked value.

5. For XAD-2 analysis, score and snap the sample resin tube, transfer the front bed of the resin tube into an 8-ml vial. (Save the back-up bed for future analysis if necessary.) Rinse the tube with 3.0 ml of DCM into the extraction

vial. Cap and place the vial in the sonicator for one hour. Filter the samples using a 3-ml syringe capped with a glass microfiber syringe filter directly into a GC vial and cap securely.

6. The atmospheric concentration of the XAD-2 samples is calculated according to:

   Concentration ($\mu g/m^3$) = Extract Concentration (µg/ml) X 3 ml / Air Volume Sampled (m^3)

6. QUALITY ASSURANCE

A. Instrument Reproducibility

The reproducibility of the instrument and analytical method was established by analyzing five (5) 1.0 µl injections of Chlorpyrifos/Chlorpyrifos-Oxon standard at three concentrations (low, mid, and high). The low, mid and high concentrations were 0.02/0.05, 0.05/0.125 and 0.20/0.50 µg/ml, respectively. Table 1 and Table 2 show the results of the instrument reproducibility for Chlorpyrifos and Chlorpyrifos-Oxon.

TABLE 1

REPRODUCIBILITY STUDY
CHLORPYRIFOS

Sample Number	Target Concentration (µg/ml)		
	Low Level 0.02	**Mid Level 0.05**	**High Level 0.20**
1	0.02	0.05	0.19
2	0.02	0.05	0.19
3	0.02	0.05	0.19
4	0.02	0.05	0.19
5	0.02	0.05	0.19
Average	**0.02**	**0.05**	**0.19**
SD	**0.00**	**0.00**	**0.00**
RSD	**2.04**	**1.44**	**0.85**

TABLE 2

REPRODUCIBILITY STUDY
CHLORPYRIFOS-OXON

Sample Number	Target Concentration (µg/ml)		
	Low Level 0.05	**Mid Level 0.125**	**High Level 0.50**
1	0.057	0.114	0.474
2	0.055	0.119	0.475
3	0.056	0.113	0.491
4	0.056	0.112	0.501
5	0.057	0.113	0.502
Average	**0.056**	**0.114**	**0.489**
SD	**0.001**	**0.003**	**0.013**
RSD	**1.679**	**2.334**	**2.745**

B. Calibration

A five-point calibration curve is made ranging from 0.02/0.05 µg/ml to 0.20/0.50 µg/ml for Chlorpyrifos and Chlorpyrifos-Oxon.

C. Calibration Check

A calibration check sample is run after the calibration, after every ten samples and at the end of the sample batch to verify the system is in calibration. The value of the check must be within $\pm 3\sigma$ (the standard deviation) or $\pm 25\%$ of the expected value whichever is greater. If the calibration check is outside the limit, then those samples in the batch after this calibration check need to be reanalyzed.

D. Method Detection Limit

The method detection limit (MDL) is based on US EPA MDL calculation. Using the analysis of seven (7) replicates of a low-level matrix spike, the method detection limits (MDL) and the estimated quantitation limits (EQL) for Chlorpyrifos and Chlorpyrifos-Oxon are calculated by: MDL = 3.14*(std dev values), where std dev = the standard deviation of the concentration calculated for the seven replicate spikes. Table 3 shows the results of the EQL determination.

TABLE 3

METHOD DETECTION LIMIT AND ESTIMATED QUANTITATION LIMIT DETERMINATION

low standard replicate#	Chlorpyrifos (µg/ml)	Chlorpyrifos-oxon (µg/ml)
1	0.017	0.058
2	0.016	0.061
3	0.016	0.061
4	0.015	0.063
5	0.017	0.064
6	0.015	0.067
7	0.017	0.069
average	0.016	0.063
std deviation	0.001	0.004
MDL	0.002	0.012
MDL (µg/ml)*	0.007	0.036
EQL (µg/m3)**	0.01	0.04

MDL = 3.143*STD * per sample, assuming a 3 ml extract volume
EQL = 5*MDL ** assuming a sampler flow rate of 3 liters per minute

Results below the EQL but greater than or equal to the MDL are reported to one significant figure. Results less than MDL are reported as the calculated MDL to one significant figure.

E. Collection and Extraction Efficiency (Recovery)

Chlorpyrifos and Chlorpyrifos-Oxon at low and high-end concentrations was spiked on XAD-2 tubes (four at each concentration). The spiked tubes are placed on a field sampler with airflows of 3 LPM for 24 hours. The samples were extracted with DCM and prepared as described in section 5. The average percent recovery of Chlorpyrifos should be $\pm$ 20% of the expected value. The average percent recovery of the low spikes and high spikes was greater than 80%. Tables 4 and 5 show the results of the recovery study.

TABLE 4

COLLECTION AND EXTRACTION EFFICIENCY OF CHLOPYRIFOS

Spike Level (µg/ml)	Sample 1 (µg/ml)	Sample 2 (µg/ml)	Sample 3 (µg/ml)	Sample 4 (µg/ml)	Average (µg/ml)	Standard Deviation	Average % Recovery
low level (0.02 µg/ml)	0.016	0.018	0.021	0.017	0.018	0.002	89.01
high level (0.20 µg/ml)	0.189	0.190	0.186	0.195	0.190	0.003	95.14

TABLE 5

COLLECTION AND EXTRACTION EFFICIENCY OF CHLORPYRIFOS-OXON

Spike Level (µg/ml)	Sample 1 (µg/ml)	Sample 2 (µg/ml)	Sample 3 (µg/ml)	Sample 4 (µg/ml)	Average (µg/ml)	Standard Deviation	Average % Recovery
low level (0.05 µg/ml)	0.080	0.084	0.076	0.079	0.080	0.003	159.54
high level (0.50 µg/ml)	0.633	0.661	0.634	0.671	0.650	0.016	129.93

F. Breakthrough

A breakthrough study was conducted using XAD-2 tubes spiked with low and high concentrations of Chlorpyrifos and Chlorpyrifos-Oxon. The spiked tubes were placed on field samplers with airflows of 3 LPM for 24 hours. Chlorpyrifos and Chlorpyrifos-Oxon were not detected in the secondary section of the XAD-2 cartridges.

G. Storage Stability

A 28-day storage stability study for Chlorpyrifos and Chlorpyrifos-Oxon was conducted with spiked XAD cartridges. Fifteen XAD cartridges were spiked with 0.02/0.05 µg/ml Chlorpyrifos/Chlorpyrifos-Oxon and fifteen XAD cartridges were spiked with 0.20/0.50 µg/ml Chlorpyrifos/Chlorpyrifos-Oxon. Three XAD cartridges were analyzed at each concentration the same day they were spiked to give day 0 results. The remaining spiked cartridges were stored in a freezer until analyzed at days 7, 14, 21, and 28 of the study. Chlorpyrifos and Chlorpyrifos-Oxon were stable up to 28 days at both concentrations. The results of the storage stability study are shown in Tables 6 and 7.

TABLE 6

STORAGE STABILITY STUDY
CHLOPYRIFOS

Spike Level (µg/ml)	Day 0 Avg (µg/ml)	Day 7 Avg (µg/ml)	Day 14 Avg (µg/ml)	Day 21 Avg (µg/ml)	Day 28 Avg (µg/ml)	Average Day 0-28 (µg/ml)	Standard Deviation	Average % Recovery
low level (0.02 µg/ml)	0.018	0.017	0.019	0.018	0.018	0.018	0.001	88.38
high level (0.20 µg/ml)	0.178	0.195	0.196	0.194	0.195	0.192	0.007	95.83

TABLE 7

STORAGE STABILITY STUDY
CHLOPYRIFOS-OXON

Spike Level (µg/ml)	Day 0 Avg (µg/ml)	Day 7 Avg (µg/ml)	Day 14 Avg (µg/ml)	Day 21 Avg (µg/ml)	Day 28 Avg (µg/ml)	Average Day 0-28 (µg/ml)	Standard Deviation	Average % Recovery
low level (0.05 µg/ml)	0.087	0.078	0.090	0.068	0.061	0.077	0.011	153.23
high level (0.50 µg/ml)	0.629	0.616	0.638	0.719	0.733	0.667	0.049	133.37

H. Safety

This procedure does not address all of the safety concerns associated with chemical analysis. It is the responsibility of the analyst to establish appropriate safety and health practices. For hazard information and guidance refer to the material safety data sheets (MSDS) of any chemicals used in this procedure.

California Environmental Protection Agency

Air Resources Board

_O_, _O_-diethyl _O_-3,5,6-trichloro-2-pyridyl-phosphorothioate (Chlorpyrifos) and its Oxygen Analog (Chlorpyrifos-Oxon) Analytical Results for Application Air Monitoring Samples in Imperial County

DATE: November 2014

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1.0 INTRODUCTION

The Department of Pesticide Regulation (DPR) requested that the Air Resources Board (ARB) conduct application air monitoring for o, o-diethyl o-3,5,6-trichloro-2-pyridyl-phosphorothioate (Chlorpyrifos) and its oxygen analog (Chlorpyrifos-Oxon) . This report covers the method development, analytical results, and quality assurance results for Chlorpyrifos and Chlorpyrifos-Oxon during an application study in Imperial County in 2014. DPR requested a method estimated quantitation limit (EQL) of 0.03 microgram per cubic meter (µg/m^3). The EQLs achieved during this project were 0.01 µg/m^3 for Chlorpyrifos and 0.04 µg/m^3 for Chlorpyrifos-Oxon.

2.0 METHOD DEVELOPMENT

2.1 Overview

XAD-2 resin tubes are used to collect the application air samples. After sampling, the resin tubes are stored at or below 4 degrees centigrade (°C) before extraction. The resin tubes are extracted with three milliliters (ml) of dichloromethane (DCM) desorbed in an ultrasonic bath for 60 minutes. Sample extracts are analyzed using a gas chromatograph with a flame photometric detector. Sample analysis and quantitation use an external calibration method. EQL for this method using XAD-2 resin tubes, based on 3.0 m^3 of air collected, and a final extract volume of 3 mls, is 0.01 µg/m^3 for Chlorpyrifos and 0.04 µg/m^3 for Chlorpyrifos-Oxon. Appendix A contains the method development report for Chlorpyrifos and Chlorpyrifos-Oxon.

2.2 Method Detection Limit (MDL)

The MDL calculation follows the United States Environmental Protection Agency (USEPA) procedures for calculating MDLs. Using the analysis of seven low level matrix spikes (0.020 µg/ml for Chlorpyrifos and 0.050 µg/ml for Chlorpyrifos-Oxon), the MDL and EQL for a 3 ml extract is calculated as follows:

s = the standard deviation of the concentration calculated for the seven replicate spikes.
For Chlorpyrifos: s = 0.0007795 µg/ml
MDL = (3.143) x (s) = (3.143) x (0.0007795) = 0.002 µg/ml.
*MDL for total µg/sample = 0.01 µg/sample**
EQL = (5) x (MDL) = (5) x (0.002) = 0.01 µg/ml
*EQL for total µg/sample = 0.04 µg/sample**

For Chlorpyrifos-Oxon: s = 0.003826 µg/ml
MDL = (3.143) x (s) = (3.143) x (0.003826) = 0.01 µg/ml.
*MDL for total µg/sample = 0.04 µg/sample**
EQL = (5) x (MDL) = (5) x (0.01) = 0.06 µg/ml
*EQL for total µg/sample = 0.18 µg/sample**

** assuming a three ml final extract volume*

Based on a total collection volume of 3.0 m^3 the EQL would be 0.01 µg/m^3 for Chlorpyrifos and 0.04 µg/m^3 for Chlorpyrifos-Oxon. Staff report results above the EQL to decimal places (hundredths of a microgram). Results less than MDL are reported as less than the actual MDL value ("< 0.01 µg/ml" for Chlorpyrifos and "< 0.04 µg/ml" for Chlorpyrifos-Oxon).

3.0 CHLORPYRIFOS AND CHLORPYRIFOS-OXON APPLICATION AIR MONITORING SAMPLE RESULTS

The laboratory received a total of 63 application samples plus seven field spikes, one field blank, one trip blank, and one trip spike on October 17, 2014. Table 1 presents the results of the analysis of the Chlorpyrifos application air samples by site.

4.0 ANALYTICAL QUALITY CONTROL SAMPLES

4.1 System Blanks

Laboratory staff analyzes a system blank with each analytical batch, after each continuing calibration verification (CCV), after every tenth sample, and after samples containing high levels of Chlorpyrifos or co-extracted contaminants. Staff defines the analytical batch as all the samples extracted together, but not to exceed 20 samples. The system blank is run to insure the solvent and instrument do not contribute interferences to the analysis, and to minimize carryover from high level samples. All system blanks were less than the MDL.

4.2 Method Blanks

Laboratory staff analyzed a method blank with each analytical batch. This is an XAD-2 resin tube prepared and analyzed as described for the application samples. Laboratory staff analyzed eight method blanks during this project. All method blanks were less than the MDL.

4.3 Laboratory Control Samples (LCS)

Laboratory staff analyzed a LCS with each analytical batch. A LCS is an XAD-2 cartridge spiked with 0.05 µg of Chlorpyrifos per ml. The LCS is extracted and analyzed as described for the samples. The LCS recoveries averaged 94.10 percent with a standard deviation of 4.79 percent. The acceptable LCS range was 75 percent to 125 percent (0.0375 to 0.0625 µg/ml).

4.4 Continuing Calibration Verification Standards (CCV)

Following standard lab procedures, laboratory staff analyzed a CCV after every calibration curve, after every tenth sample, and at the end of an analytical batch. The CCV must be within plus or minus (+) 25 percent of the expected value. If any of the

CCVs are outside this limit, the affected samples are re-analyzed. The CCV standard for each analytical batch is 0.05 µg/ml.

4.5 Laboratory Duplicates

No laboratory duplicates were run with this project.

5.0 FIELD, TRIP, AND LABORATORY SPIKES AND TRIP BLANKS

During the Imperial County 2014 project, seven laboratory, one trip, and seven field XAD spikes along with one field blank and one trip blank were analyzed. Laboratory staff prepared the spikes at 0.05 µg of Chlorpyrifos per ml. The spike recovery for Chlorpyrifos should be 75 to 125 percent.

5.1 Laboratory Spikes

Table 2 presents the results of the laboratory spikes. The average Chlorpyrifos recovery from the XAD resin tubes was 92.46 percent with a standard deviation of 1.74 percent.

5.2 Trip Spikes

Table 2 presents the results of the trip spike. The trip spike recovery for Chlorpyrifos was 96.12 percent.

5.3 Field Spikes

Table 2 presents the results of the field spikes. Seven field spikes were analyzed during this study. The spikes were collected during each sampling period. The spike level was 0.05 µg/ml. Recovery results varied from 0.40 to 3.03 µg/sample. Results for the unspiked collocated samples varied from 0.26 to 2.52 µg/sample.

5.4 Field and Trip Blanks

Table 2 presents the results of the field and trip blanks. One each of a field and trip blank were received during this project and both results were less than the MDL.

6.0 DISCUSSION

The Laboratory received 63 field samples and ten field quality control samples. Seven field spikes and along with one trip spike, one field blank, and one trip blank were received. Seven additional XAD spikes were prepared and held at the laboratory. Results for Chlorpyrifos ranged from 0.03 to 9.28 µg/sample. The breakdown product Chlorpyrifos-Oxon was not detected in any sample during analysis.

During the method development for this study, breakthrough was evaluated at

0.020/0.050 and 0.200/0.500 µg/ml Chlorpyrifos/Chlorpyrifos-Oxon. Chlorpyrifos and Chlorpyrifos-Oxon were not detected in the secondary section.

During this study one field and one trip blank were analyzed. Chlorpyrifos and Chlorpyrifos-Oxon were not detected in either blank.

One trip and seven laboratory XAD spikes were analyzed during this study. The percent recovery for the trip spike was 92 percent. The XAD laboratory spikes had an average recovery of 92.46 $\pm$ 1.74 percent. No anomalous events occurred with these samples.

Seven field spikes were analyzed during this study. The field spikes were sampled at the southeast corner of the field during each sampling period of the application study. The spiked and unspiked resin tubes were set up as collocated samples. The collocated background sample analyzed had a Chlorpyrifos level of 0.26 µg/sample. The collocated spiked resin tubes had Chlorpyrifos amounts ranging from 0.40 to 3.03 µg/sample. Table 2 presents the field spike recoveries.

All collocated unspiked samples run during this study had Chlorpyrifos levels ranging from 0.28 to 2.52 µg/sample.

No other anomalous events occurred.

Table 1: Chlorpyrifos and Chlorpyrifos-Oxon Application Air Monitoring Results Imperial County 2014

Site	Log Number	Sample ID	Date sampled	Date Analyzed	Chlorpyrifos amount (µg/sample)	Chlorpyrifos-Oxon amount (µg/sample)
South	1	BKG-S	10/14/14	10/30/14	0.03	<0.04
	11	S-1	10/14/14	11/03/14	0.41	<0.04
	21	S-2	10/14/14	11/04/14	0.30	<0.04
	31	S-3	10/15/14	11/06/14	0.59	<0.04
	41	S-4	10/15/14	11/08/14	2.64	<0.04
	51	S-5	10/16/14	11/07/14	0.43	<0.04
	61	S-6	10/16/14	11/10/14	1.19	<0.04
Southwest	2	BKG-SWC	10/14/14	10/30/14	0.14	<0.04
	12	SWC-1	10/14/14	11/03/14	0.16	<0.04
	22	SWC-2	10/14/14	11/05/14	0.87	<0.04
	32	SWC-3	10/15/14	11/05/14	0.34	<0.04
	42	SWC-4	10/15/14	11/08/14	0.70	<0.04
	52	SWC-5	10/16/14	11/07/14	0.07	<0.04
	62	SWC-6	10/16/14	11/07/14	0.17	<0.04
West	3	BKG-W	10/14/14	10/30/14	0.19	<0.04
	13	W-1	10/14/14	11/03/14	0.16	<0.04
	23	W-2	10/14/14	11/05/14	2.35	<0.04
	33	W-3	10/15/14	11/06/14	1.45	<0.04
	43	W-4	10/15/14	11/08/14	0.93	<0.04
	53	W-5	10/16/14	11/07/14	0.52	<0.04
	63	W-6	10/16/14	11/07/14	0.29	<0.04
Northwest	4	BKG-NWC	10/14/14	10/30/14	0.24	<0.04
	14	NWC-1	10/14/14	11/03/14	0.33	<0.04
	24	NWC-2	10/14/14	11/05/14	2.50	<0.04
	34	NWC-3	10/15/14	11/06/14	2.31	<0.04
	44	NWC-4	10/15/14	11/08/14	1.28	<0.04
	54	NWC-5	10/16/14	11/10/14	1.05	<0.04
	64	NWC-6	10/16/14	11/07/14	0.22	<0.04

Table 1: Chlorpyrifos and Chlorpyrifos-Oxon Application Air Monitoring Results Imperial County 2014

Site	Log Number	Sample ID	Date sampled	Date Analyzed	Chlorpyrifos amount (µg/sample)	Chlorpyrifos-Oxon amount (µg/sample)
North	5	BKG-N	10/14/14	10/30/14	0.42	<0.04
	15	N-1	10/14/14	11/03/14	0.43	<0.04
	25	N-2	10/14/14	11/05/14	2.31	<0.04
	35	N-3	10/15/14	11/06/14	5.81	<0.04
	45	N-4	10/15/14	11/08/14	1.45	<0.04
	55	N-5	10/16/14	11/10/14	2.92	<0.04
	65	N-6	10/16/14	11/07/14	0.34	<0.04
Northeast	6	BKG-NEC	10/14/14	10/30/14	0.40	<0.04
	16	NEC-1	10/14/14	11/03/14	0.39	<0.04
	26	NEC-2	10/14/14	11/05/14	0.58	<0.04
	36	NEC-3	10/15/14	11/06/14	9.28	<0.04
	46	NEC-4	10/15/14	11/06/14	0.14	<0.04
	56	NEC-5	10/16/14	11/10/14	3.83	<0.04
	66	NEC-6	10/16/14	11/07/14	0.25	<0.04
East	7	BKG-E	10/14/14	10/30/14	0.39	<0.04
	17	E-1	10/14/14	11/04/14	0.88	<0.04
	27	E-2	10/14/14	11/05/14	0.77	<0.04
	37	E-3	10/15/14	11/06/14	5.71	<0.04
	47	E-4	10/15/14	11/08/14	1.93	<0.04
	57	E-5	10/16/14	11/10/14	3.46	<0.04
	67	E-6	10/16/14	11/10/14	0.85	<0.04
Southeast	8	BKG-SEC	10/14/14	10/30/14	0.21	<0.04
	9	BKG-SEC-C	10/14/14	10/30/14	0.26	<0.04
	18	SEC-1	10/14/14	11/03/14	0.59	<0.04
	19	SEC-1C	10/14/14	11/04/14	0.67	<0.04
	28	SEC-2	10/14/14	11/04/14	0.20	<0.04
	29	SEC-2C	10/14/14	11/04/14	0.28	<0.04
	38	SEC-3	10/15/14	11/06/14	0.95	<0.04
	39	SEC-3C	10/15/14	11/06/14	1.32	<0.04
	48	SEC-4	10/15/14	11/08/14	2.55	<0.04
	49	SEC-4C	10/15/14	11/08/14	2.52	<0.04
	58	SEC-5	10/16/14	11/10/14	0.94	<0.04
	59	SEC-5C	10/16/14	11/10/14	0.97	<0.04
	68	SEC-6	10/16/14	11/10/14	1.38	<0.04
	69	SEC-6C	10/16/14	11/10/14	1.43	<0.04

Table 1 Notes: Application Monitoring Results, Imperial County 2014

If the analytical result is <MDL it is reported as less than the established method detection limit. Levels at or above the EQL are reported as the actual measured value and are reported to decimal places (hundredths of a µg).

µg = microgram
BKG = background

Sample ID (Sample identification) numbers followed by the letter C are collocated samples for the samples with the corresponding number.

Site location identification:

E:	East Side
N:	North Side
NEC:	Northeast Corner
NWC:	Northwest Corner
S:	South Side
SEC:	Southeast Corner
SWC:	Southwest Corner
W:	West Side

Table 2: Chlorpyrifos XAD-2 Spikes, Field and Trip Blank
Imperial County 2014

Quality Control Type	Log Number	Laboratory ID/Sample ID	Date Analyzed	Chlorpyrifos amount (µg/ml)	Percent Recovery
Lab Spike 0.05 µg/ml	--	LS001	11/12/14	0.045	90.67
	--	LS002	11/12/14	0.047	93.21
	--	LS003	11/12/14	0.045	89.83
	--	LS004	11/12/14	0.047	94.76
	--	LS005	11/12/14	0.046	91.90
	--	LS006	11/12/14	0.047	93.25
	--	LS007	11/12/14	0.047	93.63
Trip Spike 0.05 µg/ml	71	TS	11/12/14	0.048	96.12
Field Spike 0.05 µg/ml	10	BKG-SEC-FS	10/30/14	0.13	265.96
	20	SEC-1FS	11/04/14	0.25	496.13
	30	SEC-2FS	11/04/14	0.14	271.96
	40	SEC-3FS	11/06/14	0.41	823.70
	50	SEC-4FS	11/08/14	1.01	2018.62
	60	SEC-5FS	11/10/14	0.29	580.69
	70	SEC-6FS	11/10/14	0.56	1117.69
Trip Blank	72	TB	11/12/14	ND	--
Field Blank	73	FB	11/12/14	ND	--

Notes:

Field Spike levels not background subtracted.

ID Identification
µg Micrograms

Appendix A:

Method Development Report for Chlorpyrifos and Chlorpyrifos-Oxon

California Environmental Protection Agency

Air Resources Board

Method Development for the
Sampling and Analysis of *O*, *O*-diethyl *O*-3,5,6-trichloro-2-pyridyl-phosphorothioate (Chlorpyrifos) and its Oxygen Analog (Chlorpyrifos-Oxon) in Application Air using Gas Chromatography/Flame Photometric Detector

Special Analysis Section
Northern Laboratory Branch
Monitoring and Laboratory Division

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Version 1

Approved by:

Russell Grace, Manager
Special Analysis Section

1. SCOPE

The current method is for the analysis of O, O-diethyl O-3,5,6-trichloro-2-pyridyl-phosphorothioate (Chlorpyrifos) and its oxygen analog (Chlorpyrifos-Oxon) using a gas chromatograph with a flame photometric detector. The Department of Pesticide Regulation (DPR) requested that the Air Resources Board (ARB) analyze for Chlorpyrifos and Chlorpyrifos-Oxon during agricultural application monitoring with an estimated quantitation limit (EQL) of 0.03 micrograms per cubic meter ($\mu g/m^3$). This procedure is for the analysis of application air monitoring of Chlorpyrifos and Chlorpyrifos-Oxon using XAD-2 resin tubes.

2. SUMMARY OF METHOD

Resin tubes, XAD-2, are placed on the sampler for 24 hours at a flow rate of 3.0 liters per minute (LPM). The samples are stored in an ice chest or refrigerator until extracted with dichloromethane (DCM). A gas chromatograph with a flame photometric detector (GC/FPD) is used for analysis.

3. INTERFERENCES/LIMITATIONS

Interferences may be caused by contaminants in solvents, reagents, glassware and other processing apparatus that can lead to discrete artifacts or elevated baselines. A method blank, including both solvent and resin, must be analyzed with each batch of samples to detect any possible interference.

4. EQUIPMENT AND CONDITIONS

A. Instrumentation

i. Agilent 7890A Series gas chromatograph with flame photometric detector;
ii. Injector: Splitless, Liner: splitless single taper liner with glass wool,
iii. Heater: 220 degrees Celsius (°C), Pressure: 10 pounds per square inch (psi);
iv. Column: Agilent 19091J-413 HP-5 5 percent Phenyl Methyl Siloxane, 30 meter, 0.32 millimeter (mm) inner diameter (i.d.), 0.25 micron (µm) thickness, or equivalent;
v. GC Temperature Program: Oven initial 150 °C, hold 2 minutes (min), Ramp to 230°C at 10°C/min, hold 7.0 min;
vi. Flows: Column: Helium (He), 1.34 milliliters per minute (ml/min), 10.0 psi (average velocity: 28.968 centimeters per second (cm/sec)), Detector: Hydrogen (H_2), 95 ml/min, Air: 75 ml/min, Makeup (nitrogen (N_2)): 30 ml/min;
vii. Retention times: Chlorpyrifos-Oxon 10.883 min; Chlorpyrifos 11.037 min.

B. Auxiliary Apparatus

i. Precleaned vials, 8-ml capacity with Teflon caps;
ii. Whatman Disposable Glass Microfiber Syringe Filter 25 mm GD/X;
iii. Disposable syringes, 3 ml;
iv. Sonicator;
v. GC vials with septum caps.

C. Reagents and Sampling Media

i. Dichloromethane, Pesticide grade or better;
ii. Chlorpyrifos, Chem Service lot# 1361200 Chlorpyrifos, Chem Service lot# 1408200, Chlorpyrifos-Oxon, Chem Service lot# 1284900;
iii. XAD-2 resin sorbent tubes, Cat. No. 226-30-06, SKC, Inc. Eighty Four, Pennsylvania.

5. METHOD DEVELOPMENT

A. Instrument Reproducibility

The reproducibility of the instrument and analytical method was established by analyzing five (5) 1.0 microliter (μl) injections of Chlorpyrifos/Chlorpyrifos-Oxon standard at three concentrations (low, mid, and high). The low, mid and high concentrations were 0.020/0.050, 0.050/0.125 and 0.200/0.500 μg/ml, respectively. Table 1 and Table 2 show the results of the instrument reproducibility for Chlorpyrifos and Chlorpyrifos-Oxon, respectively.

TABLE 1

REPRODUCIBILITY STUDY
CHLORPYRIFOS

Sample Number	Target Concentration (μg/ml)		
	Low Level 0.020	Mid Level 0.050	High Level 0.200
1	0.020	0.050	0.190
2	0.020	0.050	0.190
3	0.020	0.050	0.190
4	0.020	0.050	0.190
5	0.020	0.050	0.190
Average	**0.020**	**0.050**	**0.190**
SD	**0.000**	**0.000**	**0.000**
RSD	**2.04**	**1.44**	**0.85**

TABLE 2

REPRODUCIBILITY STUDY
CHLORPYRIFOS-OXON

Sample Number	Target Concentration (µg/ml)		
	Low Level 0.050	**Mid Level 0.125**	**High Level 0.500**
1	0.057	0.114	0.474
2	0.055	0.119	0.475
3	0.056	0.113	0.491
4	0.056	0.112	0.501
5	0.057	0.113	0.502
Average	**0.056**	**0.114**	**0.489**
SD	**0.001**	**0.003**	**0.013**
RSD	**1.68**	**2.33**	**2.74**

B. Calibration

A five point calibration curve is made ranging from 0.020/0.050 µg/ml to 0.200/0.500 µg/ml for Chlorpyrifos and Chlorpyrifos-Oxon, respectively. A linear regression of 0.995 or higher is required for a calibration to be acceptable.

C. Calibration Check

A calibration check sample is run after the calibration, after every ten samples, and at the end of the sample batch to verify the system is in calibration. The value of the check must be within $\pm$ 3 standard deviations (σ) or $\pm$25 percent of the expected value, whichever is greater. If the calibration check is outside the limit, then the samples in the batch after this calibration check need to be reanalyzed.

D. Method Detection Limit

The method detection limit (MDL) is based on United States Environmental Protection Agency (US EPA) MDL calculation. Using the analysis of seven (7) replicates of a low-level matrix spike, the MDL and the EQL for Chlorpyrifos and Chlorpyrifos-Oxon are calculated by: MDL equals 3.143 times σ, where σ equals the standard deviation of the concentration calculated for the seven replicate spikes. Table 3 shows the results of the EQL determination.

TABLE 3

METHOD DETECTION LIMIT AND ESTIMATED QUANTITATION LIMIT DETERMINATION

low standard replicate#	Chlorpyrifos (μg/ml)	Chlorpyrifos-oxon (μg/ml)
1	0.017	0.058
2	0.016	0.061
3	0.016	0.061
4	0.015	0.063
5	0.017	0.064
6	0.015	0.067
7	0.017	0.069
average	0.016	0.063
std deviation	0.001	0.004
MDL	0.002	0.012
MDL (μg/ml)*	0.007	0.036
EQL (μg/m3)**	0.01	0.04

MDL = 3.143*STD * per sample, assuming a 3 ml extract volume
EQL = 5*MDL ** assuming a sampler flow rate of 3 liters per minute

E. Collection and Extraction Efficiency (Recovery)

Chlorpyrifos and Chlorpyrifos-Oxon at low and high-end concentrations were spiked on XAD-2 tubes (four at each concentration). The spiked tubes are placed on a field sampler with airflows of 3 LPM for 24 hours. The samples were extracted with DCM and prepared as described in section 5. The average percent recovery of the low spikes and high spikes for Chlorpyrifos was $\pm$ 20 percent of the expected value. The average percent recovery of the low spikes for Chlorpyrifos-Oxon was 129.9 percent, for the high spikes 159.5 percent. Tables 4 and 5 show the results of the recovery study.

TABLE 4

COLLECTION AND EXTRACTION EFFICIENCY OF CHLOPYRIFOS

Spike Level (μg/ml)	Sample 1 (μg/ml)	Sample 2 (μg/ml)	Sample 3 (μg/ml)	Sample 4 (μg/ml)	Average (μg/ml)	Standard Deviation	Average % Recovery
low level (0.02 μg/ml)	0.016	0.018	0.021	0.017	0.018	0.002	89.01
high level (0.20 μg/ml)	0.189	0.190	0.186	0.195	0.190	0.003	95.14

TABLE 5

COLLECTION AND EXTRACTION EFFICIENCY OF CHLORPYRIFOS-OXON

Spike Level (µg/ml)	Sample 1 (µg/ml)	Sample 2 (µg/ml)	Sample 3 (µg/ml)	Sample 4 (µg/ml)	Average (µg/ml)	Standard Deviation	Average % Recovery
low level (0.05 µg/ml)	0.080	0.084	0.076	0.079	0.080	0.003	159.54
high level (0.50 µg/ml)	0.633	0.661	0.634	0.671	0.650	0.016	129.93

F. Breakthrough

A breakthrough study was conducted using XAD-2 tubes spiked with low and high concentrations of Chlorpyrifos and Chlorpyrifos-Oxon. The spiked tubes were placed on field samplers with airflows of 3 LPM for 24 hours. Chlorpyrifos and Chlorpyrifos-Oxon were not detected in the secondary section of the XAD-2 tubes.

G. Storage Stability

A 28-day storage stability study for Chlorpyrifos and Chlorpyrifos-Oxon was conducted with spiked XAD resin tubes. Fifteen XAD resin tubes were spiked with 0.020/0.050 µg/ml Chlorpyrifos/Chlorpyrifos-Oxon and fifteen XAD resin tubes were spiked with 0.200/0.500 µg/ml Chlorpyrifos/Chlorpyrifos-Oxon. Three XAD resin tubes were analyzed at each concentration the same day they were spiked to give day 0 results. The remaining spiked resin tubes were stored in a freezer until analyzed at days 7, 14, 21, and 28 of the study. Chlorpyrifos and Chlorpyrifos-Oxon were stable up to 28 days at both concentrations. The results of the storage stability study are shown in Tables 6 and 7.

TABLE 6

STORAGE STABILITY STUDY CHLOPYRIFOS

Spike Level (µg/ml)	Day 0 Avg (µg/ml)	Day 7 Avg (µg/ml)	Day 14 Avg (µg/ml)	Day 21 Avg (µg/ml)	Day 28 Avg (µg/ml)	Average Day 0-28 (µg/ml)	Standard Deviation	Average % Recovery
low level (0.02 µg/ml)	0.018	0.017	0.019	0.018	0.018	0.018	0.001	88.38
high level (0.20 µg/ml)	0.178	0.195	0.196	0.194	0.195	0.192	0.007	95.83

TABLE 7

STORAGE STABILITY STUDY
CHLOPYRIFOS-OXON

Spike Level (µg/ml)	Day 0 Avg (µg/ml)	Day 7 Avg (µg/ml)	Day 14 Avg (µg/ml)	Day 21 Avg (µg/ml)	Day 28 Avg (µg/ml)	Average Day 0-28 (µg/ml)	Standard Deviation	Average % Recovery
low level (0.05 µg/ml)	0.087	0.078	0.090	0.068	0.061	0.077	0.011	153.23
high level (0.50 µg/ml)	0.629	0.616	0.638	0.719	0.733	0.667	0.049	133.37

H. Safety

This procedure does not address all of the safety concerns associated with chemical analysis. It is the responsibility of the analyst to establish appropriate safety and health practices. For hazard information and guidance refer to the safety data sheets (SDS) of any chemicals used in this procedure.

Appendix B:

Standard Operating Procedure for Chlorpyrifos and Chlorpyrifos-Oxon

California Environmental Protection Agency

Air Resources Board

Standard Operating Procedure

Title: Sampling and Analysis of *O*, *O*-diethyl *O*-3,5,6-trichloro-2-pyridyl-phosphorothioate (Chlorpyrifos) and its Oxygen Analog (Chlorpyrifos-Oxon)

SOP: NLB SOP SAS14-01, Version 1

Section: Special Analysis Section

Branch: Northern Laboratory Branch

Division: Monitoring and Laboratory Division

Approval: This SOP has been reviewed and approved by:

Russell Grace, Manager
Special Analysis Section
Northern Laboratory Branch

7-03-15
Date

Michael Werst, Chief
Northern Laboratory Branch

7.6.15
Date

DISCLAIMER: Mention of any trade name or commercial product in this Standard Operating Procedure does not constitute endorsement or recommendation of this product by the Air Resources Board. Specific brand names and instrument descriptions listed in the Standard Operating Procedures are equipment used by the ARB laboratory. Any functionally equivalent instrumentation can be used. This method is restricted to use by or under direct supervision of analysts experienced in the use of air sampling methods and analysis by gas chromatography with flame photometric detector (GC/FPD).

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1. SCOPE

This standard operating procedure (SOP) describes the determination of O, O-diethyl O-3,5,6-trichloro-2-pyridyl-phosphorothioate (Chlorpyrifos) and its oxygen analog (Chlorpyrifos-Oxon) in application air monitoring samples using a gas chromatograph with a flame photometric detector (GC/FPD).

2. SUMMARY OF METHOD

Application air samples are collected on XAD-2 resin tubes that are placed on a sampler for 24 hours at a flow rate of 3.0 liters per minute (lpm). The samples are stored in an ice chest or refrigerator until extracted with dichloromethane (DCM). A GC/FPD is used for analysis. Sample analysis and quantitation uses external standard method for instrument calibration. Estimated quantitation limit (EQL) for this method is approximately 0.01 micrograms per cubic meter ($\mu g/m^3$) for Chlorpyrifos and 0.04 $\mu g/m^3$ for Chlorpyrifos-Oxon.

3. DEFINITIONS OF TERMS/ACRONYMS

BATCH – an analytical batch is a set of prepared samples (i.e. extracts) analyzed together as a group in an uninterrupted sequence. A preparation (extraction) batch is a set of samples which is processed all in one group using the same equipment, reagents and staff within a single work shift.

BLANK – a sample that has not been exposed to the sample stream in order to monitor contamination during sampling, transport, storage, extraction, or analysis. The blank is subjected to the usual analytical and measurement process to establish a zero baseline or background value.

> METHOD BLANK (Extraction Blank) – a new, unused XAD-2 resin tube free of analyte and matrix to which all reagents are added in the same volumes or proportions as used in sample processing, and which is taken through the entire sample preparation process. It is used to monitor the laboratory preparation and analysis systems for interferences and contamination from glassware, reagents, sample manipulations, and the general laboratory environment.
>
> RESIN TUBE BLANK – a new, unused XAD-2 resin tube from the same lot as those used for samples that is not exposed to the target analyte or sample matrix but is carried through all extraction and analytical steps to determine any possible background contribution from the resin tube. The resin tube blank is used to represent the cleanliness of all samples in a single manufacturing lot.

SOLVENT BLANK – a sample consisting of reagent(s), without the target analyte or sample matrix, introduced into the analytical procedure at the appropriate point and carried through all subsequent steps to determine the contribution of the reagents and of the involved analytical steps.

CALIBRATION – Calibration refers to the act of evaluating and adjusting the precision and accuracy of measurement equipment using known values (standards).

COLLOCATED SAMPLE – a sample used to assess total precision (sampling and analysis) which is located within a specified radius of the primary sampler. The collocated sampler must be identical in configuration and operation to the primary sampler. The collocated sample is processed identically to the primary sample.

CONTINUING CALIBRATION VERIFICATION SAMPLE (CCV) – a sample containing analyte at a known concentration obtained from a source other than that of the calibration standards.

DUPLICATE – two aliquots taken from and representative of the same sample or product and carried through all steps of the sampling and analytical procedures in an identical manner. Duplicate samples are used to assess variance of the total method including sampling and analysis.

ESTIMATED QUANTITATION LIMIT (EQL) – defined as five times the method detection limit (MDL) and used as the lower limit for reporting data.

INTERFERENCE – discrete artifacts or elevated baselines from solvents, reagents, glassware, and other sample processing hardware that may cause misinterpretation of the chromatographic data.

METHOD DETECTION LIMIT (MDL) – the minimum concentration of a substance that can be measured and reported with 99 percent confidence that the analyte concentration is greater than zero and statistically different from a blank. It is determined from replicate analyses of a sample in a given matrix containing the analyte.

REPLICATE – a separate analysis of the same sample. The sample extract used for replicate analyses must be chosen at random. Relative percent difference between the sample and its replicate is calculated and must meet specified quality control criteria or be reanalyzed. Replicate analytical results are used to evaluate analytical precision but not the precision of sampling, preservation, or storage internal to the laboratory.

4. INTERFERENCES/LIMITATIONS

Interferences may be caused by contaminants in solvents, reagents, glassware and other processing apparatus that can lead to discrete artifacts or elevated baselines. A system and a method blank, including both solvent and resin, must be analyzed with each batch of samples to detect any possible interference.

5. PERSONNEL QUALIFICATIONS

All analysts performing analyses pursuant to this SOP will be experienced and adequately trained in the use of air sampling methods and analysis by GC/FPD, handling all pertinent solvents and sampling media, and have an understanding of the chemistry involved in the chemical analyses of the target analytes. All analysts will also be trained in proper safety procedures adopted by the laboratory.

6. HEALTH, SAFETY, AND CAUTIONS

This procedure does not address all of the safety concerns associated with chemical analysis. It is the responsibility of the analyst to establish appropriate safety and health practices. For hazard information and guidance, refer to the safety data sheets (SDS) of any chemicals used in this procedure.

7. EQUIPMENT AND CONDITIONS

A. Instrumentation

i. Agilent 7890A Series gas chromatograph with flame photometric detector;
ii. Injector: Splitless, Liner: sp/less single taper liner with glass wool;
iii. Heater: 220 degrees Celsius (°C), Pressure: 10 pounds per square inch (psi);
iv. Column: Agilent 19091J-413 HP-5 5percent Phenyl Methyl Siloxane, 30 meter, 0.32 millimeter (mm) inner diameter (i.d.), 0.25 micron (µm) thickness, or equivalent;
v. GC Temperature Program: Oven initial 150°C, hold 2 minutes (min), Ramp to 230°C @ 10°C/min, hold 7.0 min;
vi. Flows: Column: Helium (He): 1.34 millilters per min. (ml/min), 10.0 psi (average velocity: 28.968 centimeters per second (cm/sec));

vii. Detector: Hydrogen (H_2): 95 ml/min, Air: 75 ml/min, Makeup (Nitrogen (N_2)): 30 ml/min;
viii. Retention times: Chlorpyrifos-Oxon 10.883 min; Chlorpyrifos 11.037 min.

B. Auxiliary Apparatus

i. Precleaned vials, 8 ml capacity with Teflon caps;
ii. Whatman Disposable Glass Microfiber Syringe Filter 25mm GD/X;
iii. Disposable syringes, 3 ml;
iv. Sonicator;
v. GC vials with septum caps.

C. Reagents and Sampling Media

i. Dichloromethane, Pesticide grade or better;
ii. Chlorpyrifos, Chem Service lot number (#) 1361200 Chlorpyrifos, Chem Service lot # 1408200, Chlorpyrifos-Oxon, Chem Service lot # 1284900;
iii. XAD-2 resin sorbent tubes, Catalogue # 226-30-06, SKC, Incorporated, Eighty Four, Pennsylvania.

8. SAMPLE COLLECTION

A. Samples are collected in the field with a maximum flow rate of three (3) lpm.

B. After collection, the samples are placed in a glass tube and stored in a cooler at four degrees Celsius or less until returned to the laboratory.

C. Samples are stored in the laboratory at four degrees Celsius or less until ready for analysis. Chlorpyrifos and Chlorpyrifos-Oxon have been found to be stable on the XAD resin tubes for at least 28 days.

9. SAMPLE EXTRACTION

A. Prepare a method blank and laboratory control sample (LCS) tube with every batch of field samples not to exceed 20 samples in an analytical batch. The LCS is spiked with 10 µg of Chlorpyrifos before extraction.

B. Carefully score and break the sample XAD-2 tube just in front of the glass wool plug on the primary section.

C. Remove the glass wool plug using forceps. Pour the XAD-2 resin from the primary section into an eight ml glass vial.

D. Score the tube just in front of the secondary section glass wool. Retain the secondary section for later analysis to check for breakthrough.

E. Using three milliliters of DCM carefully rinse the inside of the primary section into the glass vial. Cap securely.

F. The extracts are placed in a sonicator for one hour. The extracts are ready for immediate analysis. Samples are only extracted when analysis follows immediately thereafter.

10. ANALYSIS OF SAMPLES

1. Transfer approximately 0.25 ml of the sample extract into a 1.5 ml autosampler vial equipped with a 0.25 ml insert. Sample extract is now ready for analysis.

2. A two-microliter injection volume will be used for all analyses. Prepare a sample sequence using the GC/FPD system software.

3. It is necessary to analyze a solvent blank with each batch of samples. The blank must be free of interferences. A solvent blank must be analyzed after any sample that may result in possible carry-over contamination.

4. A five point calibration curve shall be analyzed with each batch of samples. Due to instrument sensitivity, Chlorpyrifos-Oxon will be calibrated at a concentration two and a half times the concentration of Chlorpyrifos. The calibrations will be 0.020 to 0.200 µg/ml for Chlorpyrifos and 0.050 to 0.500 µg/ml for Chlorpyrifos-Oxon.

5. A calibration check sample is run after the calibration, after every ten samples, and at the end of the sample batch. The value of the calibration check must be within $\pm 3\sigma$ (the standard deviation) or $\pm$10percent of the expected value, whichever is greater. If the calibration check is outside this limit, then those samples in the batch after this calibration check need to be reanalyzed.

6. With each batch of XAD-2 samples analyzed, a method blank and a laboratory control sample (LCS) will be run concurrently. A method blank is XAD-2 extracted and analyzed the same way as the samples. The LCS is XAD-2 spiked with a known amount of standard. The LCS is extracted and analyzed the same way as the samples. The method blank analyte concentration must be below the method detection limit (MDL). If the method blank is not below the MDL, then a new method blank must be prepared and reanalyzed. Laboratory control samples should have recoveries that are 75 to 125 percent of the theoretical spiked value.

7. Review and edit the quantitation reports as needed.

8. The samples must be diluted if the analytical results are not within the calibration curve. Every attempt should be made to have the diluted results within the upper half of the calibration curve.

9. The final results will be adjusted by an appropriate dilution factor and reported in µg/ml.

10. The atmospheric concentration of the XAD-2 samples is calculated according to:

$$\text{Concentration } (\mu g/m^3) = \frac{\text{Extract Concentration } (\mu g/ml) \times 3 \text{ ml}}{\text{Air Volume Sampled } (m^3)}$$

11. DATA MANAGEMENT AND REPORTING

Data generated from the analysis of samples, solvents, standards, and blanks will be entered into a spreadsheet, where calculations are performed. All data will be reviewed by the analyst prior to the generation of a summary report. The summary report will be reviewed and approved by the laboratory supervisor.

12. QUALITY ASSURANCE

A. A system blank is analyzed with each batch of samples. The system blank is an aliquot of the solvent used to extract the samples. The analyte concentration must be below the method detection limit established for the method. A system blank is run at the beginning of the analytical batch, after the calibration curve prior to sample analysis, and before the calibration check.

B. A five point calibration curve is made ranging from 0.020 to 0.500 µg/ml for Chlorpyrifos and 0.200 to 0.500 µg/ml for Chlorpyrifos-Oxon.

C. A calibration check sample is run after the calibration, after every ten samples, and at the end of the sample batch to verify the system is in calibration. The value of the check must be within $\pm 3\sigma$ (the standard deviation) or ± 25 percent of the expected value whichever is greater. If the calibration check is outside the limit, then those samples in the batch after this calibration check need to be reanalyzed.

D. A method blank is run with each sample batch. The method blank is made by extracting the method solvent through an XAD-2 tube. The analyte concentration of this extract must be below the MDL established for the method.

E. A laboratory control sample (LCS) will be run with every sample batch. The LCS concentration should fall within the lower half of the calibration curve. The LCS stock standard should come from a different source or lot than the daily calibration standard. If not available, then the LCS should be prepared separately from the calibration curve standard. The analytical value of the LCS must be within three standard deviations of its historical mean. If the LCS is outside these limits, then the samples in the analytical batch must be reanalyzed.

XAD-2 RESIN SORBENT TUBE FIELD LOG SHEET

Project: Chlorpyrifos Pesticide Application - Imperial County 2014

Start Flow Set: 3.0 ± 0.3 LPM End Flow Criteria:3.0 + 0.6 LPM

Log #	Sample Name	Sampler ID Number	Date & Time		Elapsed Time Meter (ETM) (Hours)		Mass Flow Meter Display (LPM)		Corrected Average Flow	Comment Number	Weather K,P,C,F&R		Initials	
			Start	End	Start	End	Start	End			Start	End	Start	End
001	BKG - S	2974	10/13/14 1356	10/14/14 0601	1435.2	1451.3	3.08	0.19	1.68	1	K	K	JP	JP
002	BKG - SWC	4667	10/13/14 1415	10/14/14 0611	758.1	774.0	3.07	3.20	3.16	2	K	K	JP	JP
003	BKG - W	2981	10/13/14 1419	10/14/14 0615	811.3	827.2	3.08	3.23	3.18		K	K	JP	JP
004	BKG - NWC	4652	10/13/14 1425	10/14/14 0620	268.0	283.9	3.06	3.17	3.14		K	K	JP	JP
005	BKG - N	4685	10/13/14 1432	10/14/14 0625	336.3	352.1	3.00	3.03	3.04		K	K	JP	JP
006	BKG - NEC	4653	10/13/14 1442	10/14/14 0630	129.8	145.5	3.06	3.18	3.15		K	K	JP	JP
007	BKG - E	4677	10/13/14 1456	10/14/14 0635	963.7	979.4	3.08	3.19	3.16		K	K	JP	JP
008	BKG - SEC	4662	10/13/14 1512	10/14/14 0645	229.2	244.8	3.07	3.21	3.17		K	K	JP	JP
009	BKG - SEC - C	4672	10/13/14 1511	10/14/14 0647	927.1	942.7	3.06	3.16	3.14		K	K	JP	JP
010	BKG - SEC - FS	3007	10/13/14 1510	10/14/14 0640	714.2	729.2	3.07	3.26	3.19		K	K	JP	JP
011	S - 1	4660	10/14/14 0702	10/14/14 1019	665.5	668.8	3.07	3.05	3.09		K	K	JP	JP
012	SWC - 1	4667	10/14/14 0703	10/14/14 1022	774.0	773.7	3.07	2.96	3.04		K	K	JP	JP
013	W - 1	2981	10/14/14 0703	10/14/14 1027	827.2	830.5	3.07	2.98	3.05		K	K	JP	JP
014	NWC - 1	4652	10/14/14 0706	10/14/14 1030	283.9	287.3	3.07	3.00	3.06		K	K	JP	JP
015	N - 1	4685	10/14/14 0707	10/14/14 1033	352.1	355.6	3.07	2.97	3.05		K	K	JP	JP
016	NEC - 1	4653	10/14/14 0709	10/14/14 1037	145.5	149.0	3.07	2.98	3.05		K	K	JP	JP
017	E - 1	4677	10/14/14 0710	10/14/14 1041	979.4	982.9	3.07	3.00	3.06		K	K	JP	JP
018	SEC - 1	4662	10/14/14 0712	10/14/14 1045	244.8	248.4	3.07	3.00	3.06		K	K	JP	JP
019	SEC - 1C	4672	10/14/14 0712	10/14/14 1047	942.7	946.3	3.07	2.90	3.01		K	K	JP	JP
020	SEC - 1FS	3007	10/14/14 0712	10/14/14 1043	729.2	733.3	3.07	2.96	3.04		K	K	JP	JP

MFM Used #: **2013289** **Slope:** **0.991** **Intercept:** **0.056**

*1. Pump failure during background sample at the South sampling location

*2. Transcription error on original field log sheet and on sample label

Weather Codes: K = Clear, P = Partly Cloudy, C = ≥67% Cloudy, F = Fog, and R = Rain (any)

XAD-2 RESIN SORBENT TUBE FIELD LOG SHEET

Project: Chlorpyrifos Pesticide Application - Imperial County 2014

Start Flow Set: 3.0 ± 0.3 LPM End Flow Criteria:3.0 + 0.6 LPM

Log #	Sample Name	Sampler ID Number	Date & Time		Elapsed Time Meter (ETM) (Hours)		Mass Flow Meter Display (LPM)		Corrected Average Flow	Comment Number	Weather K,P,C,F&R		Initials	
			Start	End	Start	End	Start	End			Start	End	Start	End
021	S - 2	4660	10/14/14 1019	10/14/14 1600	668.8	674.5	3.07	3.05	3.09		K	K	JP	JP
022	SWC - 2	4667	10/14/14 1022	10/14/14 1604	773.7	779.4	3.07	3.09	3.11		K	K	JP	JP
023	W - 2	2981	10/14/14 1027	10/14/14 1608	830.5	836.2	3.07	3.04	3.08		K	K	JP	JP
024	NWC - 2	4652	10/14/14 1030	10/14/14 1611	287.3	293.0	3.07	3.07	3.10		K	K	JP	JP
025	N - 2	4685	10/14/14 1033	10/14/14 1615	355.6	361.3	3.07	3.07	3.10		K	K	JP	JP
026	NEC - 2	4653	10/14/14 1037	10/14/14 1619	149.0	154.7	3.07	3.06	3.09		K	K	JP	JP
027	E - 2	4677	10/14/14 1041	10/14/14 1623	982.9	988.6	3.07	3.07	3.10		K	K	JP	JP
028	SEC - 2	4662	10/14/14 1045	10/14/14 1631	248.4	254.1	3.07	3.07	3.10		K	K	JP	JP
029	SEC - 2C	4672	10/14/14 1047	10/14/14 1633	946.3	952.0	3.07	3.11	3.12		K	K	JP	JP
030	SEC - 2FS	3007	10/14/14 1043	10/14/14 1628	733.3	739.0	3.07	3.10	3.11		K	K	JP	JP
031	S - 3	4660	10/14/14 1600	10/15/14 0638	674.5	689.1	3.07	3.20	3.16		K	K	JP	JP
032	SWC - 3	4667	10/14/14 1604	10/15/14 0642	779.4	794.0	3.07	3.20	3.16		K	K	JP	JP
033	W - 3	2981	10/14/14 1608	10/15/14 0646	836.2	850.8	3.07	3.20	3.16		K	K	JP	JP
034	NWC - 3	4652	10/14/14 1611	10/15/14 0648	293.0	307.6	3.07	3.20	3.16		K	K	JP	JP
035	N - 3	4685	10/14/14 1615	10/15/14 0654	361.3	375.9	3.07	3.20	3.16		K	K	JP	JP
036	NEC - 3	4653	10/14/14 1619	10/15/14 0658	154.7	169.4	3.07	3.22	3.17		K	K	JP	JP
037	E - 3	4677	10/14/14 1623	10/15/14 0703	988.6	1003.2	3.07	3.15	3.14		K	K	JP	JP
038	SEC - 3	4662	10/14/14 1631	10/15/14 0711	254.1	268.7	3.07	2.92	3.02		K	K	JP	JP
039	SEC - 3C	4672	10/14/14 1633	10/15/14 0713	952.0	966.6	3.07	3.22	3.17		K	K	JP	JP
040	SEC - 3FS	3007	10/14/14 1628	10/15/14 0707	739.0	753.7	3.07	3.21	3.17		K	K	JP	JP

MFM Used #: **2013289** **Slope:** **0.991** **Intercept:** **0.056**

Weather Codes: K = Clear, P = Partly Cloudy, C = ≥67% Cloudy, F = Fog, and R = Rain (any)

XAD-2 RESIN SORBENT TUBE FIELD LOG SHEET

Project: Chlorpyrifos Pesticide Application - Imperial County 2014

± 0.31 LPM - End Flow Criteria 3.0 ± 0.6 LPM

Log #	Sample Name	Sampler ID Number	Date & Time		Elapsed Time Meter (ETM) (Hours)		Mass Flow Meter Display (LPM)		Corrected Average Flow	Comment Number	Weather K,P,C,F&R		Initials	
			Start	End	Start	End	Start	End			Start	End	Start	End
041	S - 4	4660	10/15/14 0638	10/15/14 1556	689.1	698.3	3.07	2.98	3.05		K	K	JP	JP
042	SWC - 4	4667	10/15/14 0642	10/15/14 1558	794.0	803.2	3.07	3.04	3.08		K	K	JP	JP
043	W - 4	2981	10/15/14 0646	10/15/14 1602	850.8	860.1	3.07	3.08	3.10		K	K	JP	JP
044	NWC - 4	4652	10/15/14 0648	10/15/14 1605	307.6	316.8	3.07	3.00	3.06		K	K	JP	JP
045	N - 4	4685	10/15/14 0654	10/15/14 1609	375.9	385.1	3.07	3.00	3.06		K	K	JP	JP
046	NEC - 4	4653	10/15/14 0658	10/15/14 1614	169.4	178.6	3.07	3.00	3.06		K	K	JP	JP
047	E - 4	4677	10/15/14 0703	10/15/14 1618	1003.2	1012.4	3.07	3.00	3.06		K	K	JP	JP
048	SEC - 4	4662	10/15/14 0720	10/15/14 1625	268.7	277.8	3.07	3.05	3.09		K	K	JP	JP
049	SEC - 4C	4672	10/15/14 0723	10/15/14 1628	966.6	975.7	3.07	3.00	3.06		K	K	JP	JP
050	SEC - 4FS	3007	10/15/14 0707	10/15/14 1622	753.7	762.9	3.07	2.86	2.99		K	K	JP	JP
051	S - 5	4660	10/15/14 1556	10/16/14 0633	698.3	713.0	3.08	3.23	3.18		K	K	JP	JP
052	SWC - 5	4667	10/15/14 1558	10/16/14 0636	803.2	817.9	3.07	3.15	3.14		K	K	JP	JP
053	W - 5	2981	10/15/14 1602	10/16/14 0639	860.1	874.7	3.07	3.15	3.14		K	K	JP	JP
054	NWC - 5	4652	10/15/14 1605	10/16/14 0643	316.8	331.4	3.07	3.15	3.14		K	K	JP	JP
055	N - 5	4685	10/15/14 1609	10/16/14 0646	385.1	399.7	3.07	3.10	3.11		K	K	JP	JP
056	NEC - 5	4653	10/15/14 1614	10/16/14 0650	178.6	193.2	3.07	3.16	3.14		K	K	JP	JP
057	E - 5	4677	10/15/14 1618	10/16/14 0655	1012.4	1027.0	3.07	3.11	3.12		K	K	JP	JP
058	SEC - 5	4662	10/15/14 1625	10/16/14 0701	277.8	292.3	3.07	3.10	3.11		K	K	JP	JP
059	SEC - 5C	4672	10/15/14 1628	10/16/14 0704	975.7	990.3	3.07	3.15	3.14		K	K	JP	JP
060	SEC - 5FS	3007	10/15/14 1622	10/16/14 0658	762.9	777.5	3.07	3.10	3.11		K	K	JP	JP

MFM Used #: **2013289** **Slope:** **0.991** **Intercept:** **0.056**

Weather Codes: K = Clear, P = Partly Cloudy, C = ≥67% Cloudy, F = Fog, and R = Rain (any)

XAD-2 RESIN SORBENT TUBE FIELD LOG SHEET

Project: Chlorpyrifos Pesticide Application - Imperial County 2014

Start Flow Set: 3.0 ± 0.3 LPM End Flow Criteria:3.0 + 0.6 LPM

Log #	Sample Name	Sampler ID Number	Date & Time		Elapsed Time Meter (ETM) (Hours)		Mass Flow Meter Display (LPM)		Corrected Average Flow	Comment Number	Weather K,P,C,F&R		Initials	
			Start	End	Start	End	Start	End			Start	End	Start	End
061	S - 6	4660	10/16/14 0633	10/16/14 1527	713.0	721.8	3.07	3.18	3.15		K	K	JP	JP
062	SWC - 6	4667	10/16/14 0636	10/16/14 1530	817.9	826.7	3.07	3.00	3.06		K	K	JP	JP
063	W - 6	2981	10/16/14 0639	10/16/14 1533	874.7	883.6	3.07	3.00	3.06		K	K	JP	JP
064	NWC - 6	4652	10/16/14 0643	10/16/14 1535	331.4	340.3	3.07	3.06	3.09		K	K	JP	JP
065	N - 6	4685	10/16/14 0646	10/16/14 1538	399.7	408.5	3.07	3.05	3.09		K	K	JP	JP
066	NEC - 6	4653	10/16/14 0650	10/16/14 1540	193.2	202.0	3.07	3.00	3.06		K	K	JP	JP
067	E - 6	4677	10/16/14 0655	10/16/14 1543	1027.0	1035.8	3.07	3.00	3.06		K	K	JP	JP
068	SEC - 6	4662	10/16/14 0701	10/16/14 1548	292.3	301.2	3.07	3.00	3.06		K	K	JP	JP
069	SEC - 6C	4672	10/16/14 0704	10/16/14 1549	990.3	999.1	3.07	3.00	3.06		K	K	JP	JP
070	SEC - 6FS	3007	10/16/14 0658	10/16/14 1546	777.5	786.3	3.07	3.00	3.06		K	K	JP	JP
071	Trip Spike										K	K	JP	JP
072	Trip Blank										K	K	JP	JP
073	Field Blank										K	K	JP	JP

MFM Used #: **2013289** **Slope:** **0.991** **Intercept:** **0.056**

Weather Codes: K = Clear, P = Partly Cloudy, C = ≥67% Cloudy, F = Fog, and R = Rain (any)

ARB Calibration Report - Outside Temperature

Calibration Summary:

ID Information:

Station Name:	AutoMet 20005304	Manufacturer:	Met One	AS-IS:	X
Site #:	Dacthal post	Model #:	060A-2	FINAL:	
Station Address:	Sacto. 5th St. Warehouse	Serial #:	A6801	Calibration Date:	04/19/11
Agency:	ARB	Translator #:	466A	Report Date:	
		Serial #:	X1042	Previous Cal. Date:	

Calibration Info.:

Calibration Results:

	Component:	Outside Temp.
	Instrument Range (degrees centigrade):	-50 to +50
	AS-IS Average Ice Bath Difference (°C):	0.26
	AS-IS Average Ambient Bath Difference (°C):	0.17
	AS-IS Average Hot Bath Difference (°C):	0.25
	Slope:	1.000
Outside Temperature Best Fit Line	Intercept:	-0.232
	Correlation:	1.00000
AS-IS Meets PSD °C Difference Requirement:		YES

Meteorology:

Temperature (°C):	23.0
Elevation (Feet.):	25
Pressure (mmHg):	760.0

Sensor Height:

Feet Above Ground:	20.5
Feet Above Roof:	N.A.

Calibration Standards:

Standard:	I.D. #:	Cert. Date:	Slope:	Intercept:
Digi-Sense 93410-50 Digital Thermometer	196743	05/22/09	0.9972	-0.0540
Cole Parmer Thermister Probe		N.A.	N.A.	N.A.

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Calibration Data:

If Average Difference of any bath is >0.50°C, correct.

Reference Bath	DAS Degree C (x)	Digital Degree C	True Degree C (y)	Difference DAS - True
ICE	0.41	0.19	0.14	0.27
	0.36	0.19	0.14	0.22
	0.41	0.19	0.14	0.27
Average	0.39		0.14	0.26
AMBIENT	26.74	26.70	26.57	0.17
	26.52	26.47	26.34	0.18
	25.87	25.84	25.71	0.16
Average	26.38		26.21	0.17
HOT	49.16	49.14	48.95	0.21
	49.32	49.24	49.05	0.27
	49.83	49.77	49.58	0.25
Average	49.44		49.19	0.25

Transalator:

Zero Scale:	
N.A.	N.A.
DMM Volts	Degrees C
N.A.	N.A.
Full Scale:	
Regression & Graph Data:	
x	y
0.39	0.14
26.38	26.21
49.44	49.19
PSD Data:	0.26
	0.17
	0.25

Outside Temperature Regression Data

Regression Results:

x Coefficient (Slope):	1.0003
y Constant (Intercept):	-0.2318
Number of Observations:	3
Correlation:	0.999998

Corrected OTEMP:

(DAS * x) + y
0.16
26.15
49.22

Comments:	Post-Dacthal study cal. AutoMet Configs: 179.34 - 72.89		
Calibrated by:	Steve Rider	Checked by:	

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ARB Calibration Report - Outside Temperature

Calibration Summary:

ID Information:

Station Name:	Automet #1	Manufacturer:	Met One	AS-IS:	X
Site #:	Chlorpyrifos Application	Model #:	060A-2	FINAL:	
Station Address:	Brawley CA	Serial #:	U1516	Calibration Date:	10/09/14
Agency:	ARB	Translator #:	466A	Report Date:	10/09/14
		Serial #:	F4830	Previous Cal. Date:	

Calibration Info.:

Calibration Results:

	Component:	Outside Temp.
	Instrument Range (degrees centigrade):	-50 to 50
	AS-LEFT Average Ice Bath Difference (°C):	0.41
	AS-LEFT Average Ambient Bath Difference (°C):	0.54
	AS-LEFT Average Hot Bath Difference (°C):	0.45
	Slope:	0.998
Outside Temperature Best Fit Line	Intercept:	-0.418
	Correlation:	1.00000
AS-LEFT Meets PSD °C Difference Requirement:		NO

Meteorology:

Temperature (°C):	26.3
Elevation (Feet.):	25
Pressure (mmHg):	760.0

Sensor Height:

Feet Above Ground:	12.0
Feet Above Roof:	N.A.

Calibration Standards:

Standard:	I.D. #:	Cert. Date:	Slope:	Intercept:
Digi-Sense 93410-50 Digital Thermometer	196743	01/22/13	0.9990	-0.3300
Cole Parmer Thermister Probe	N.A.	N.A.	N.A.	N.A.

==========

Calibration Data:

If Average Difference of any bath is >0.50°C, correct.

Reference Bath	DAS Degree C (x)	Digital Degree C	True Degree C (y)	Difference DAS - True
ICE	0.74	0.66	0.33	0.41
	0.74	0.66	0.33	0.41
	0.74	0.66	0.33	0.41
Average	0.74		0.33	0.41
AMBIENT	30.51	30.33	29.97	0.54
	30.51	30.33	29.97	0.54
	30.51	30.33	29.97	0.54
Average	30.51		29.97	0.54
HOT	35.74	35.66	35.29	0.45
	35.74	35.66	35.29	0.45
	35.74	35.66	35.29	0.45
Average	35.74		35.29	0.45

Transalator:

Zero Scale:	
N.A.	N.A.
DMM Volts	Degrees C
N.A.	N.A.
Full Scale:	
Regression & Graph Data:	
x	y
0.74	0.33
30.51	29.97
35.74	35.29
PSD Data:	0.41
	0.54
	0.45

Outside Temperature Regression Data

Regression Results:

x Coefficient (Slope):	0.9979
y Constant (Intercept):	-0.4176
Number of Observations:	3
Correlation:	0.999996

Corrected OTEMP:

(DAS * x) + y
0.32
30.03
35.25

Comments:			
Calibrated by:	Steve Aston	Checked by:	

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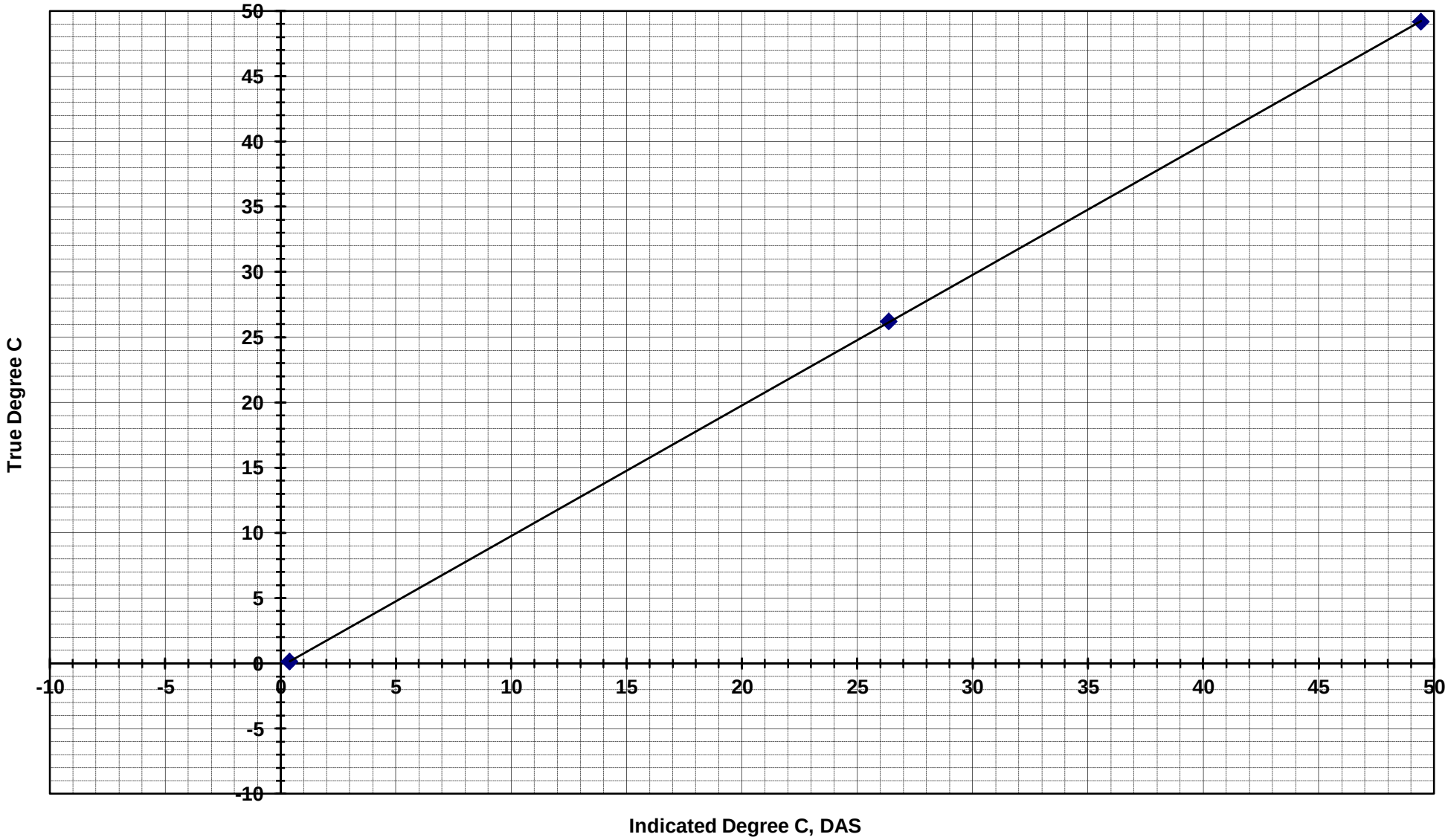
CALIBRATION GRAPH (AS-FOUND)

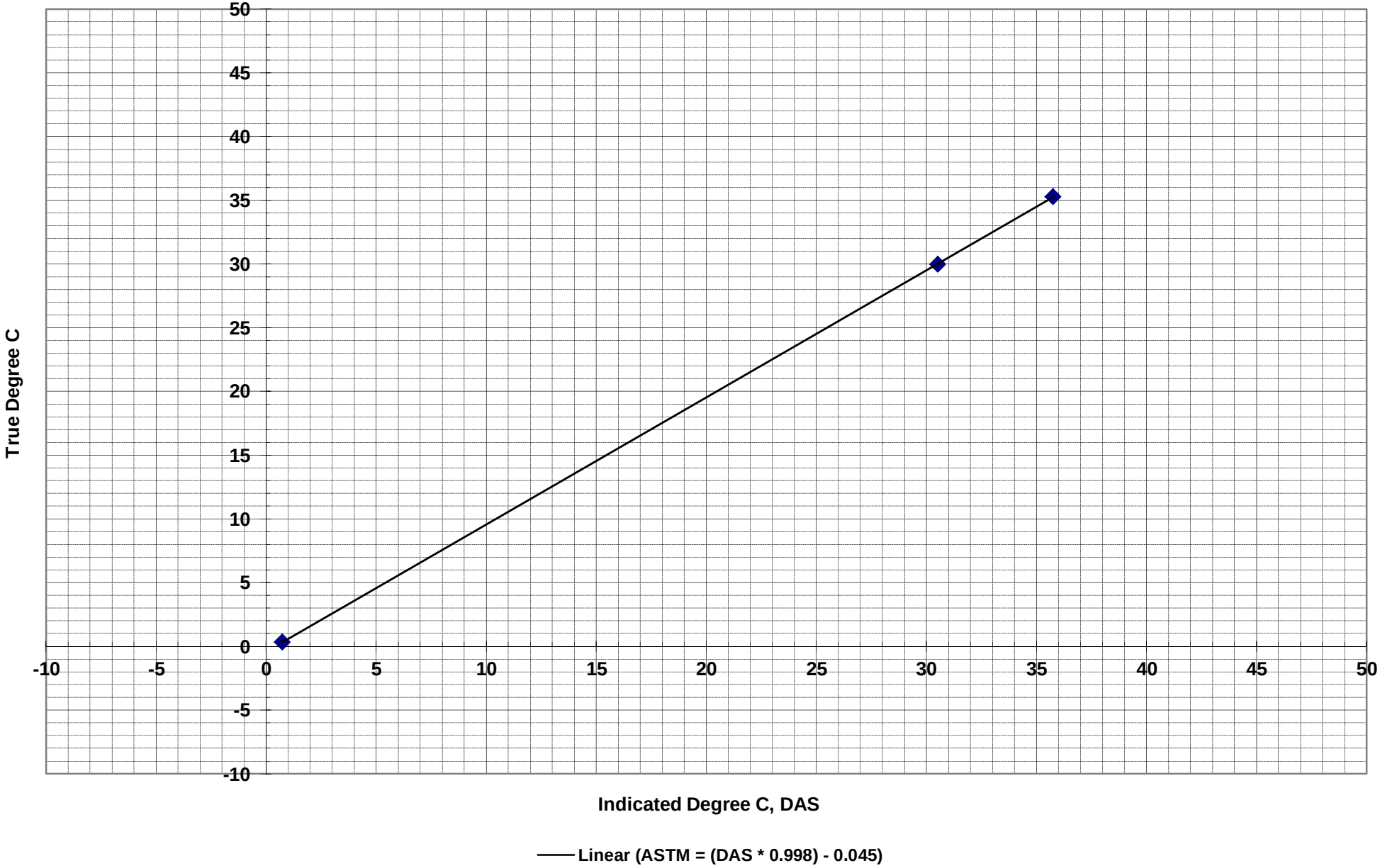
Pesticide Automet Outside Temperature
Station Number: Chloropicrin Automet Sensor Number: M6303 Cal. Date: 11/19/01



Created by: Steve Rider

CALIBRATION GRAPH (AS-LEFT)

Hinkley AutoMet Outside Temperature
Station Number: ??-??? Sensor Number: W1067 Cal. Date: 04/12/00



Created by: Steve Rider

ARB Calibration Report - % Relative Humidity

Calibration Summary:

ID Information:

Station Name:	Automet 5304	Manufacturer:	Vaisala	AS-IS:	X
Site #:	Dacthal Post	Model #:	HMP45D	FINAL:	
Station Address:	5th St. Warehouse in Sacto.	Serial #:	W4410024	Calibration Date:	04/19/11
Agency:	ARB	Translator #:	466A	Report Date:	
		Serial #:	X1042	Previous Cal. Date:	

Calibration Info.:

Calibration Results:

	Component:	Relative Humidity
	Instrument Range (Percent Relative Humidity):	0 to 100
	Slope:	1.012
Relative Humidity Best Fit Line	Intercept:	-0.523
	Correlation:	0.99984
	Absolute Average Percent Difference (%RH):	0.5
	AS-IS Meets PSD Requirements:	YES

Meteorology:

Temperature (°C):	23.0
Elevation (Ft.):	25
Pressure (mmHg):	760.0

Sensor Height:

Feet Above Ground:	20.5
Feet Above Roof:	N.A.

Calibration Standards:

Standard:	I.D. #:	Cert. Date:	Cert. Factor:
Rotronic ER25 Calibration Device:	None	Factory	N.A.
Rotronic EA10 Salt Standard:	100702	09/27/07	(10 x 1)+0
Rotronic EA35 Salt Standard:	350704	01/09/08	(35 x 1)+0
Rotronic EA50 Salt Standard:	500701	08/20/07	(50 x 1)+0
Rotronic EA80 Salt Standard:	800705	08/08/07	(80 x 1)+0

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Calibration Data:

Translator:

Zero Scale:		Full Scale:	
DMM Voltage:	%RH:	DMM Voltage:	%RH:
N.A.	N.A.	N.A.	N.A.

% Relative Humidity Accuracy (If Any Difference > 5.0%RH, adjust so Avg. Diff. Is <2.0%RH Difference)

	TRUE %RH (y)	DAS %RH (x)	DAS Voltage	Difference DAS - True	Meets PSD Criteria
	0	0.5	N.A.	N.A.	YES
	9.6	10.4	N.A.	0.8	1
1115	34.5	33.9	N.A.	-0.6	1
	49.7	49.9	N.A.	0.2	1
	79.9	79.6	N.A.	-0.3	1
			ABS Avg. Diff.:	0.5	

Relative Humidity Regression Data

Regression Results:

x Coefficient (Slope):	1.0117
y Constant (Intercept):	-0.5228
Number of Observations:	4
Correlation:	0.999838

Corrected %RH:

(DAS * x) + y
0.0
10.0
33.7
50.0
80.0
100.0

Comments:	Post-Dacthal study cal.		
Calibrated by:	Steve Rider	Checked by:	

ARB Calibration Report - Relative Humidity

Calibration Summary:

ID Information:

Station Name:	Automet 5304	Manufacturer:	Vaisala	AS-IS:	X
Site #:	Chlorpyrifos Application	Model #:	HMP45D	FINAL:	
Station Address:	Brawley CA	Serial #:	X3210031	Calibration Date:	10/09/14
Agency:	ARB	Translator #:	466A	Report Date:	10/09/14
		Serial #:	F4830	Previous Cal. Date:	

Calibration Results:

	Component:	Relative Humidity
	Instrument Range (Percent Relative Humidity):	0 to 100
	Slope:	1.073
Relative Humidity Best Fit Line	Intercept:	-1.541
	Correlation:	0.99995
	Absolute Average Percent Difference (%RH):	2.0
	AS-LEFT Meets PSD Requirements:	YES

Meteorology:

Temperature (^{0}C):	26.3
Elevation (Ft.):	25
Pressure (mmHg):	760.0

Sensor Height:

Feet Above Ground:	20.5
Feet Above Roof:	N.A.

Calibration Standards:

Standard:	I.D. #:	Cert. Date:	Cert. Factor:
Rotronic ER25 Calibration Device:	None	Factory	N.A.
Rotronic EA10 Salt Standard:	101201	01/25/12	(10 x 1)+0
Rotronic EA35 Salt Standard:	351103	11/21/11	(35 x 1)+0
Rotronic EA50 Salt Standard:	501103	11/16/11	(50 x 1)+0
Rotronic EA80 Salt Standard:	801201	02/24/12	(80 x 1)+0

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Calibration Data:

Translator:

Zero Scale:		Full Scale:	
DMM Voltage:	%RH:	DMM Voltage:	%RH:
N.A.	N.A.	N.A.	N.A.

% Relative Humidity Accuracy (If Any Difference > 5.0%RH, adjust so Avg. Diff. Is <2.0%RH Difference)

TRUE %RH (y)	DAS %RH (x)	DAS Voltage	Difference DAS - True	Meets PSD Criteria
0	1.4	N.A.	N.A.	YES
10.0	11.0	N/A	1.0	1
35.0	33.7	N/A	-1.3	1
50.0	48.1	N/A	-2.0	1
80.0	76.2	N/A	-3.8	1
		ABS Avg. Diff.:	2.0	

Relative Humidity Regression Data

Regression Results:

X Coefficient (Slope):	1.0726
Y Constant (Intercept):	-1.5411
Number of Observations:	4
Correlation:	0.999953

Corrected %RH:

(DAS * x) + y
0.0
10.3
34.6
50.0
80.1
100.0

Comments:	

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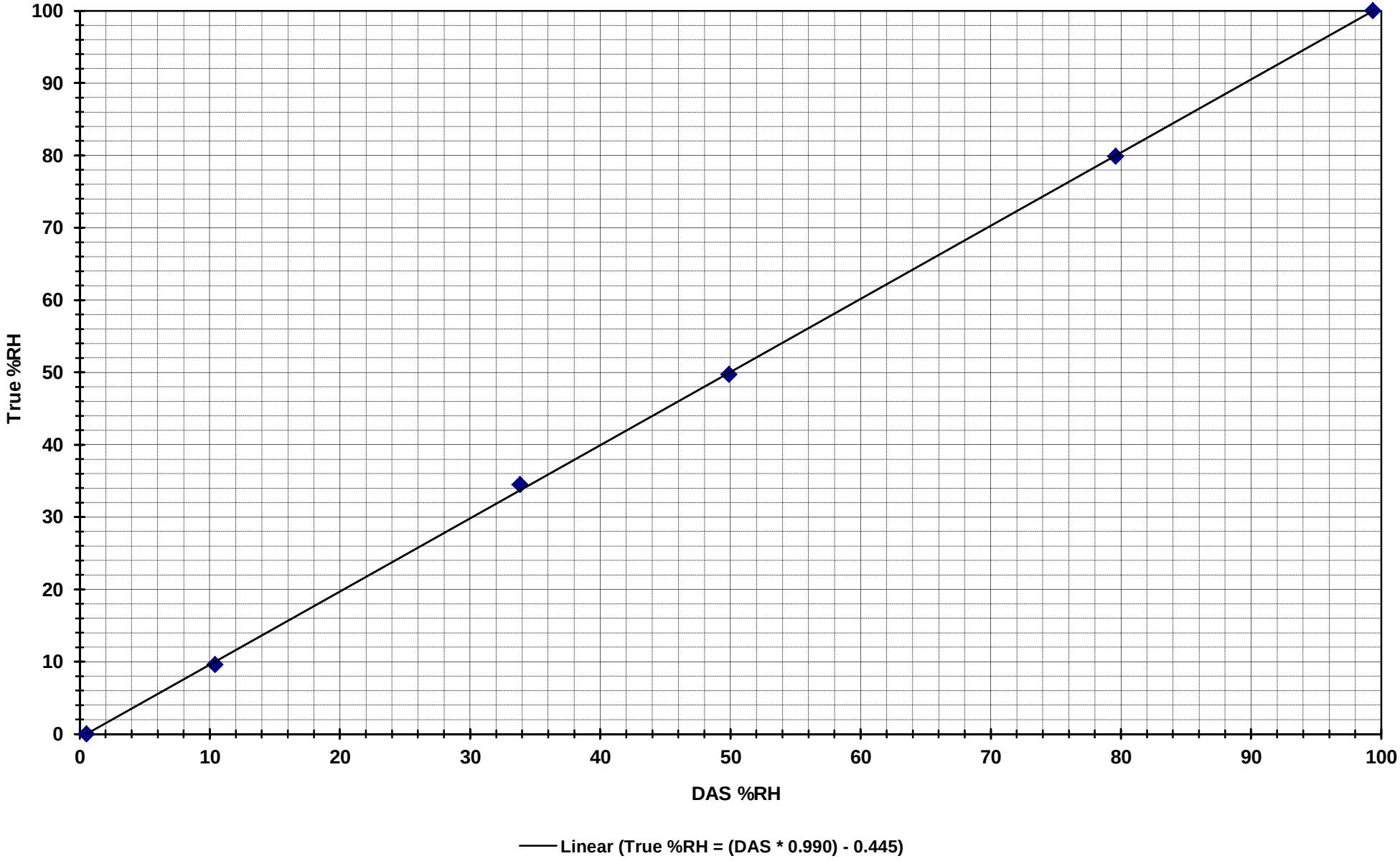
CALIBRATION GRAPH (AS-FOUND)

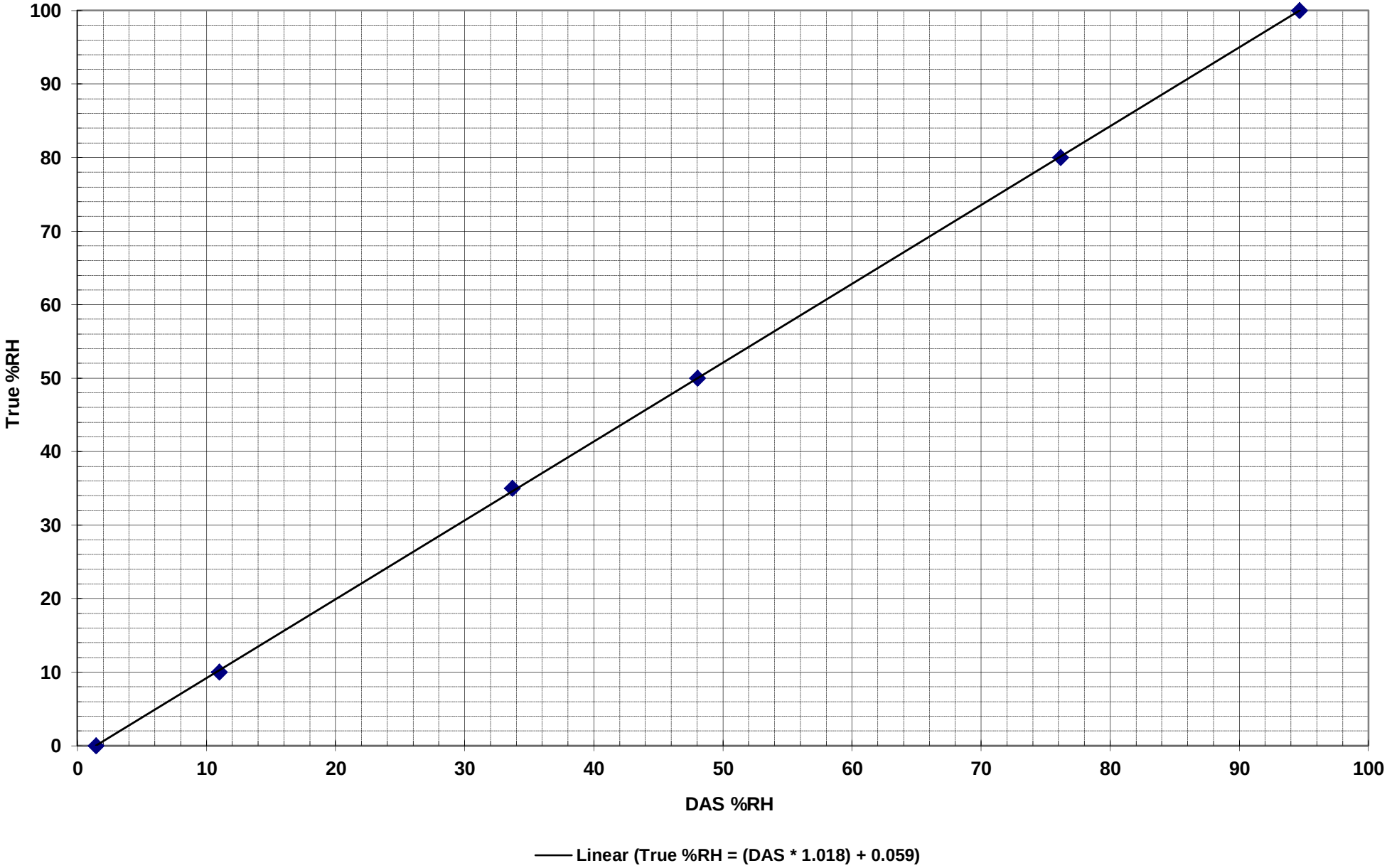
Pesticide Automet % Relative Humidity
Station Number: Chloropicrin Application Sensor Number: M6303 Cal. Date: 11/19/01



Created by: Steve Rider

CALIBRATION GRAPH (AS-LEFT)

Hinkley AutoMet % Relative Humidity
Station Number: ??-??? Sensor Number: Y5107 Cal. Date: 04/12/01



Created by: Steve Rider

ARB Calibration Report - Resultant Wind Direction

Calibration Summary:

ID Information:

Station Name:	Automet 5304	Manufacturer:	Met One	AS-IS:	X
Site #:	Carbaryl Pre	Model #:	020C-1	FINAL:	
Station Address:	Sacto. 5th St. Warehouse	Serial #:	A6978	Calibration Date:	09/06/11
Agency:	ARB	Translator #:	466A	Report Date:	
		Serial #:	X1042	Previous Cal. Date:	04/19/11

Calibration Info.:

Calibration Results:

Component:		Wind Direction
Instrument Range (degrees):		0 to 360
AS-IS Azimuth in relation to True North (deg):		1.1
AS-IS Starting Torque (gm-cms):		4.5
AS-IS Absolute Average Difference (degrees):		2.1
	Slope:	1.017
Wind Direction Best Fit Line	Intercept:	-1.224
	Correlation:	0.99999
AS-IS Meets Both PSD Requirements:		YES

For FINAL, see next page.

Meteorology:

Temperature (°C):	22.0
Elevation (Feet.):	25
Pressure (mmHg):	760.0

Sensor Height:

Feet Above Ground:	22.5
Roof height in feet.:	0.0
Calculated data to meet EPA height:	10.3
To meet EPA height:	-22.5
	10.3

Calibration Standards:

Standard:	I.D. #:	Cert. Date:	Cert. Factor:
Brunton 5008 Pocket Transit	5081192140	Factory	WYSIWYG
R.M. Young 18310 Torque Disk	N.A.	Factory	N.A.
Met One 040 Degree Fixture	N.A.	Factory	WYSIWYG

==========

Calibration Data:

AS-IS Condition (0 to 360° only):

Declination of Site (Degrees East):		Translator:	DMM Voltage:	Degrees:
Calculated True North Heading:	360.0	Zero Scale:	N.A.	N.A.
Crossarm Orientation Uncorrected Transit Reading:		Half Scale:	N.A.	N.A.
Crossarm Degrees in Relation to True North:	0.0		gram-centimeters:	4.5
DAS Output with Vane Parallel to Crossarm:	1.1	Starting	K Factor:	38
DAS Output Degrees off from True North:	-358.9	Torque:	Speed in m/sec.:	0.34
Azimuth computed from above measurements:	1.1		Meets torque std.:	YES

Direction Accuracy:

True Degrees (y):	DAS Degrees (x):	Difference DAS - True	Calculated Data to Meet PSD Direction
10	10.3	0.3	
90	90.2	0.2	1
180	178.9	-1.1	1
270	266.3	-3.7	1
350	344.9	-5.1	1

PSD Correction:
1.1
Absolute Avg. Diff.:
2.1
Meets PSD Difference Standard:
YES

Wind Direction Regression Data

Regression Results:

x Coefficient (Slope):	1.0174
y Constant (Intercept):	-1.2237
Number of Observations:	5
Correlation:	0.999989

Corrected RWD:

(DAS * x) + y
9.3
90.5
180.8
269.7
349.7

ARB Calibration Report - Resultant Wind Direction

FINAL Condition (0 to 360° only):

Declination of Site (Degrees East):	0.0	FINAL PSD Correction	Calculated Data to Meet PSD Direction
Calculated True North Heading:	360.0		
Crossarm Orientation Uncorrected Transit Reading:		0.0	
Crossarm Degrees in Relation to True North:	0.0	FINAL Meets Direction Standard	1
DAS Output with Vane Parallel to Crossarm:			1
DAS Output Degrees off from True North:	-360.0		0
Azimuth computed from above measurements:	0.0	NO	1

Comments:	Pre-Carbaryl application cal. Post cal input offset of 1.0. Now no readings near failing.			
Calibrated by:	Steve Rider		Checked by:	

ARB Calibration Report - Resultant Wind Direction

Calibration Summary:

ID Information:

Station Name:	Automet #1	Manufacturer:	Met One	AS-IS:	X
Site #:	Chlorpyrifos Application	Model #:	020C-1	FINAL:	
Station Address:	Brawley CA	Serial #:	A1177	Calibration Date:	10/09/14
Agency:	ARB	Translator #:	466A	Report Date:	10/09/14
		Serial #:	f4830	Installation Date:	

Calibration Info.:

Calibration Results:

Component:		Wind Direction
Instrument Range (degrees):		0 to 360
AS-LEFT Azimuth in relation to True North (deg):		13.4
AS-LEFT Starting Torque (gm-cms):		3.0
AS-LEFT Absolute Average Difference (degrees):		0.6
	Slope:	1.004
Wind Direction Best Fit Line	Intercept:	-0.426
	Correlation:	0.99999
AS-LEFT Meets Both PSD Requirements:		NO

Meteorology:

Temperature (°C):	26.3
Elevation (Feet.):	25
Pressure (mmHg):	760.0

Sensor Height:

Feet Above Ground:	12.0
Roof height in feet.:	0.0
Calculated data to	20.8
meet EPA height:	-12.0
To meet EPA height:	20.8

Calibration Standards:

Standard:	I.D. #:	Cert. Date:	Cert. Factor:
Brunton 5008 Pocket Transit	5081192140	Factory	WYSIWYG
R.M. Young 18310 Torque Disk	N.A.	Factory	N.A.
Met One 040 Degree Fixture	N.A.	Factory	WYSIWYG

==========

Calibration Data:

Direction Accuracy:

True Degrees (y):	DAS Degrees (x):	Difference DAS - True	Calculated Data to Meet PSD Direction
10	10.2	0.2	
90	90.5	0.5	1
180	179.8	-0.2	0
270	268.5	-1.5	1
350	349.5	-0.5	0
	Absolute Avg. Diff.:	0.6	

Translator:	DMM Voltage:	Degrees:
Zero Scale:	N.A.	N.A.
Half Scale:	N.A.	N.A.
Starting Torque:	gram-centimeters:	3
	K Factor:	38
	Speed in m/sec.:	0.28
	Meets torque std.:	YES
	PSD Correction:	13.4

Wind Direction Regression Data

Regression Results:

x Coefficient (Slope):	1.0040
y Constant (Intercept):	-0.4262
Number of Observations:	5
Correlation:	0.999992

Corrected RWD:

(DAS * x) + y
9.8
90.4
180.1
269.2
350.5

AS-LEFT Condition (0 to 360° only):

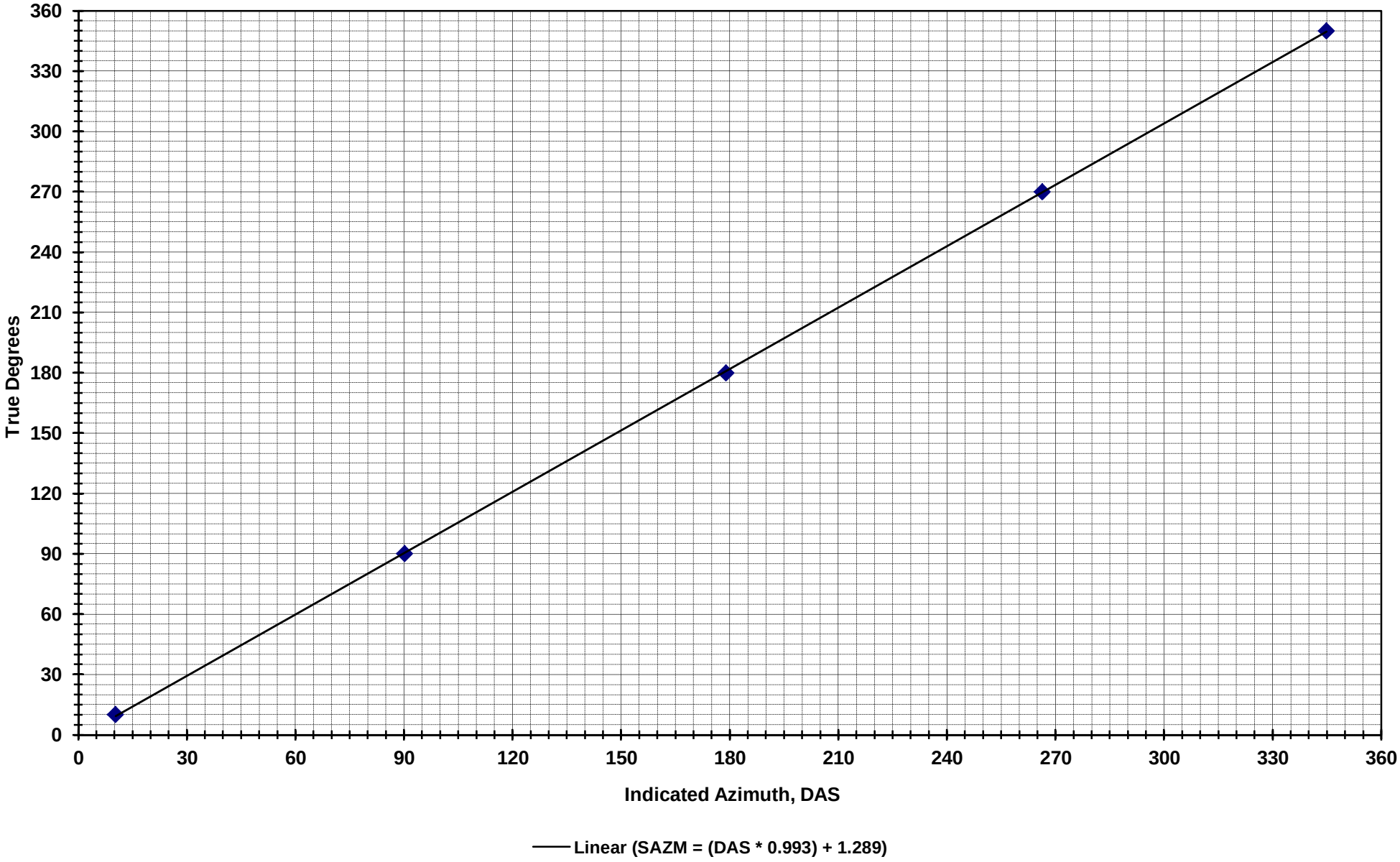
			Calculated Data to Meet PSD Direction
Declination of Site (Degrees East):	11.3		
Calculated True North Heading:	348.7		
Crossarm Orientation Uncorrected Transit Reading:			
Crossarm Degrees in Relation to True North:	11.3	Meets Direction Standard	1
DAS Output with Vane Parallel to Crossarm:	2.1		0
DAS Output Degrees off from True North:	-357.9		1
Azimuth computed from above measurements:	13.4	NO	0

Comments:			
Calibrated by:	Steve Aston		Checked by:

Rev. 07/00 (SUR)

CALIBRATION GRAPH (AS-FOUND)

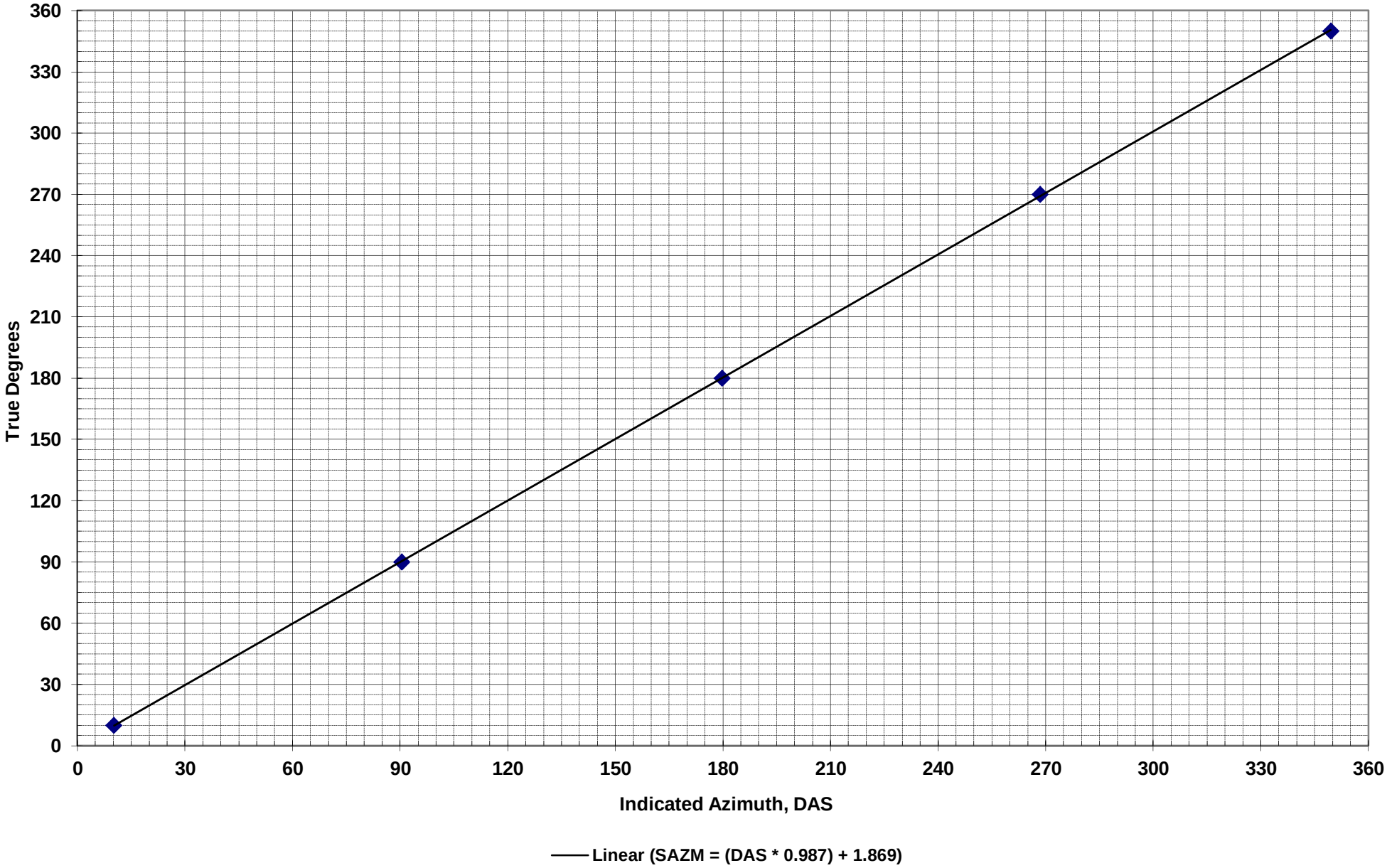
Pesticide Automet Resultant Wind Direction
Station Number: Chloropicrin Application Sensor Number: X1538 Cal. Date: 11/19/01



Created by: Steve Rider

CALIBRATION GRAPH (AS-LEFT)

Shafter-Walker Resultant Wind Direction
Station Number: 29-802 Sensor Number: P3061 Cal. Date: 04/17/00



Created by: Steve Rider

ARB Calibration Report - Resultant Wind Speed

Calibration Summary:

ID Information:

Station Name:	Automet 5304	Manufacturer:	Met One	AS-IS:	X
Site #:	Dacthal Post	Model #:	010C	FINAL:	
Station Address:	Sacto. 5th St. Warehouse	Serial #:	A6703	Calibration Date:	04/19/11
Agency:	ARB	Translator #:	466A	Report Date:	
		Serial #:	X1042	Previous Cal. Date:	

Calibration Info.:

Calibration Results:

Component:		Wind Speed
Instrument Range (knots per hour):		0 to 86.84
AS-IS Starting Torque (gm-cm):		0.53
AS-IS Absolute Avg Speed Difference (Knots):		0.02
Wind Speed Best Fit Line	Slope:	1.000
	Intercept:	0.017
	Correlation:	1.00000
AS-IS Meets Both PSD Requirements:		YES

Meteorology:

Temperature (°C):	23.0
Elevation (Feet.):	25
Pressure (mmHg):	760.0

Sensor Height:

Feet Above Ground:	22.5
Roof height in feet.:	0.0
Calculated data to meet EPA height:	10.3
	-22.5
To meet EPA height:	10.3

Calibration Standards:

Standard:	I.D. #:	Cert. Date:	Cert. Factor:
R.M. Young 18310 Torque Disc (0 to 15 gm-cm):	N.A.	N.A.	N.A.
R.M. Young 18810 Selectable Drive (10-1,000 rpm):	10329	02/19/09	RPM=(Meter*10)+0

==========

Calibration Data:

Translator:

Zero Scale:		Full Scale:	
DMM Voltage:	Knots:	DMM Voltage:	Knots:
N.A.	N.A.	N.A.	N.A.

Starting Torque:

In gm-cms:	0.4	Starting speed in meters/sec:	0.53
K Factor:	1.4	Meets PSD torque standard:	YES

Speed Accuracy (@ 0 <0.54 & Difference DAS - True <±5% of True)

RPM:	True (y): Knots per Hour	DAS (x): Knots	Difference DAS - True	PSD Difference Data	Meets PSD Difference Standard:
0	0.52	0.50	-0.02	1	YES
50	3.11	3.10	-0.01	0.3%	
110	6.22	6.21	-0.01	0.1%	Absolute Avg. Diff.:
220	11.92	11.88	-0.04	0.3%	0.02
450	23.83	23.80	-0.03	0.1%	
920	48.17	48.14	-0.03	0.1%	

Wind Speed Regression Data

Regression Results:

x Coefficient (Slope):	1.0003
y Constant (Intercept):	0.0169
Number of Observations:	6
Correlation:	1.000000

Corrected RWS:

(DAS * x) + y
0.52
3.12
6.23
11.90
23.82
48.17

Comments:	Post-Dacthal study cal.		
Calibrated by:	Steve Rider		Checked by:

Rev. 07/00 (SUR)

ARB Calibration Report - Resultant Wind Speed

Calibration Summary:

ID Information:

Station Name:	Automet #1	Manufacturer:	Met One	AS-IS:	X
Site #:	Chlorpyrifos Application	Model #:	010B	FINAL:	
Station Address:	Brawley CA	Serial #:	019-8	Calibration Date:	10/09/14
Agency:	ARB	Translator #:	466A	Report Date:	10/09/14
		Serial #:	F4830	Previous Cal. Date:	

Calibration Info.:

Calibration Results:

	Component:	Wind Speed
	Instrument Range (knots per hour):	0 to 86.84
	AS-LEFT Starting Torque (gm-cm):	0.27
	AS-LEFT Absolute Avg Speed Difference (knots):	0.03
Wind Speed Best Fit Line	Slope:	0.999
	Intercept:	0.016
	Correlation:	1.00000
	AS-LEFT Meets Both PSD Requirements:	YES

Meteorology:

Temperature (°C):	26.3
Elevation (Feet.):	25
Pressure (mmHg):	760.0

Sensor Height:

Feet Above Ground:	12.0
Roof height in feet.:	0.0
Calculated data to meet EPA height:	20.8
	-12.0
To meet EPA height:	20.8

Calibration Standards:

Standard:	I.D. #:	Cert. Date:	Cert. Factor:
R.M. Young 18310 Torque Disc (0 to 15 gm-cm):		Factory	N.A.
R.M. Young 18810 Selectable Drive (10-1,000 rpm):	10329	01/18/13	RPM=(Meter*10)+0

==========

Calibration Data:

Translator:

Zero Scale:		Full Scale:	
DMM Voltage:	Knots:	DMM Voltage:	Knots:
N.A.	N.A.	N.A.	N.A.

Starting Torque:

In gm-cms:	0.1	Starting speed in meters/sec:	0.27
K Factor:	1.4	Meets PSD torque standard:	YES

Speed Accuracy (@ 0 <0.54 & Difference DAS - True <±5% of True)

RPM:	True (y): Knots per Hour	DAS (x): Knots	Difference DAS - True	PSD Difference Data	Meets PSD Difference Standard:
0	0.52	0.50	-0.02	1	YES
50	3.11	3.10	-0.01	0.3%	
110	6.22	6.20	-0.02	0.3%	Absolute Avg. Diff.:
220	11.92	11.90	-0.02	0.1%	0.03
450	23.83	23.90	0.07	0.3%	
920	48.17	48.20	0.03	0.1%	

Wind Speed Regression Data

Regression Results:

x Coefficient (Slope):	0.9986
y Constant (Intercept):	0.0156
Number of Observations:	6
Correlation:	0.999999

Corrected RWS:

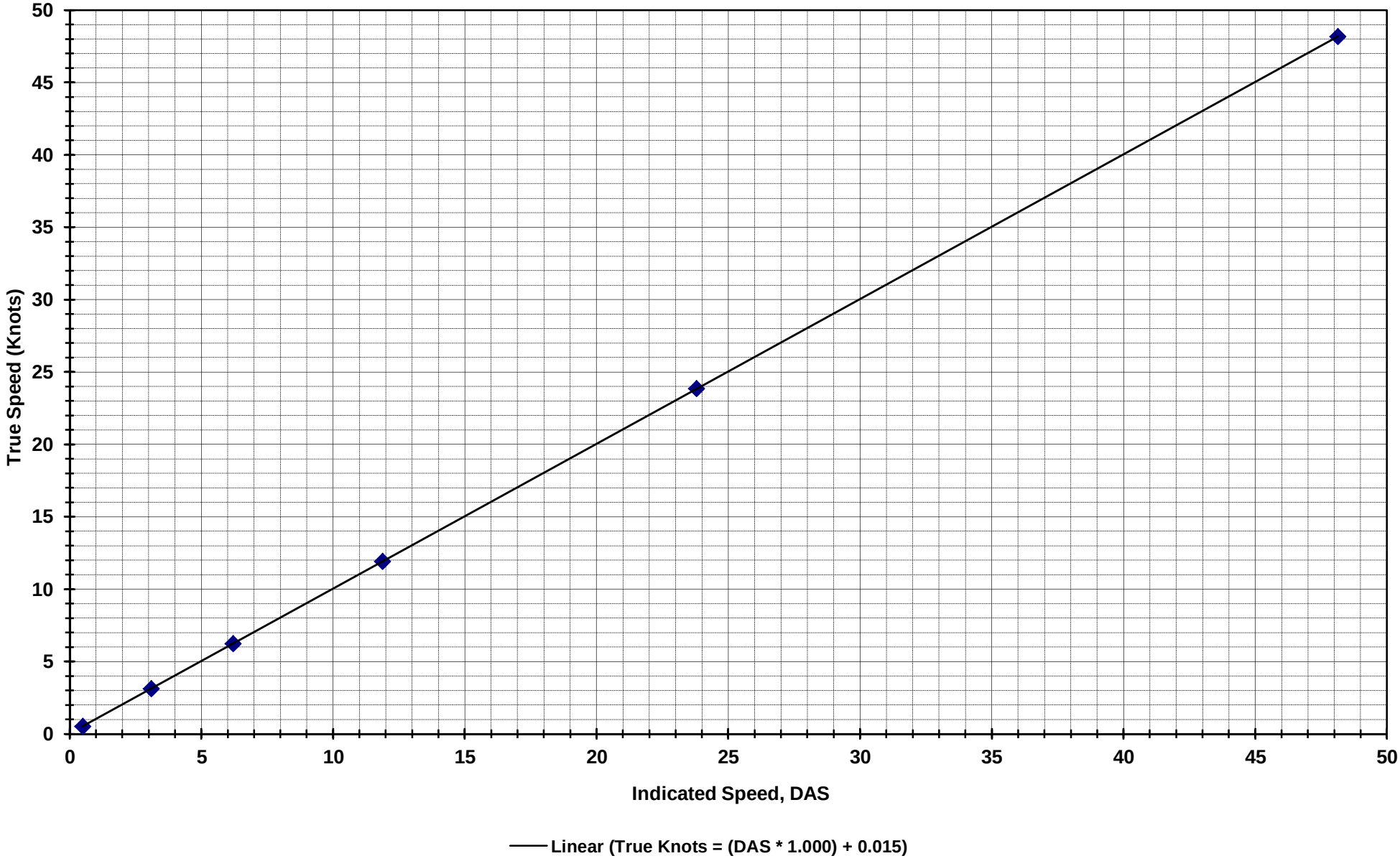
(DAS * x) + y
0.51
3.11
6.21
11.90
23.88
48.15

Comments:			
Calibrated by:	Steve Aston		Checked by:

Rev. 07/00 (SUR)

CALIBRATION GRAPH (AS-FOUND)

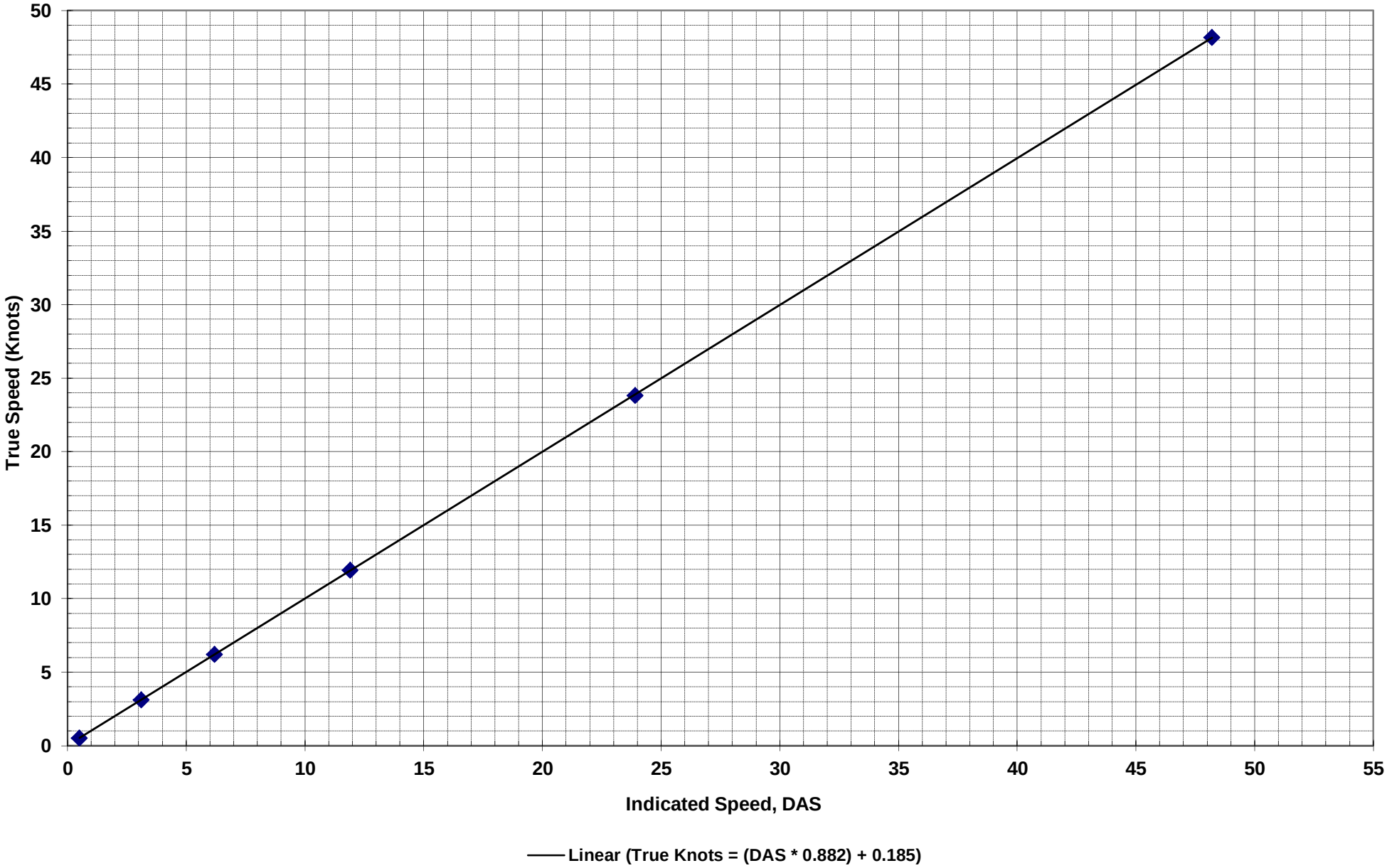
Pesticide Application Resultant Wind Speed
Station Number: Chloropicrin Application Sensor Number: 1462 Cal. Date: 11/19/01



Created by: Steve Rider

CALIBRATION GRAPH (AS-LEFT)

Hinkley AutoMet Resultant Wind Speed
Station Number: ??-??? Sensor Number: Y5107 Cal. Date: 04/12/01



Created by: Steve Rider

Monterey Nutrient Buffer 10-12-0 ZNP

CA Reg. No. 17545-50020

COMPOSITION AS SPRAY ADJUVANT

PRINCIPAL FUNCTIONING AGENTS**:**
Phosphoric acid, iron sulfate, manganese sulfate, zinc sulfate, and coconut imidazoline sodium carboxylate 28.9%
CONSTITUENTS INEFFECTIVE AS SPRAY ADJUVANT: 71.1%
TOTAL: 100.0%

COMPOSITION AS NUTRIENT SPRAY

GUARANTEED ANALYSIS
10-12-0

Total Nitrogen (N) 10.0%
10.0% Urea Nitrogen
Available Phosphoric Acid (P_2O_5) ... 12.0%
Manganese (Mn) 1.0%
Zinc (Zn) 2.0%

Derived from urea, phosphoric acid, manganese sulfate and zinc sulfate.

Information regarding the contents and levels of metals in this product is available on the Internet at http://www.regulatory-info-monterey.com

KEEP OUT OF REACH OF CHILDREN

CAUTION

FIRST AID

IF IN EYES: Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing. Call a Poison Control Center or doctor for treatment advice.

IF ON SKIN: Take off contaminated clothing. Rinse skin immediately with plenty of water for 15-20 minutes. 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.

ATTENTION: This product contains chemicals known to the State of California to cause cancer and birth defects or other reproductive harm.

PRECAUTIONARY STATEMENTS

HAZARDS TO HUMANS AND DOMESTIC ANIMALS

CAUTION: Causes skin irritation. Harmful if swallowed. Avoid contact with skin, eyes or clothing. Wear long sleeved shirt, long pants, and shoes plus socks when mixing or handling concentrate. Wash thoroughly with soap and water after handling and before eating, drinking, chewing gum, or using tobacco. Remove and wash contaminated clothing before reuse.

ENVIRONMENTAL HAZARDS

Do not contaminate water when cleaning equipment or disposing of equipment washwaters.

DIRECTIONS FOR USE

MONTEREY NUTRIENT BUFFER 10-12-0 ZNP is designed specifically as a clear, foliar nutrient-buffer system containing nitrogen, phosphorus, zinc and manganese. MONTEREY NUTRIENT BUFFER 10-12-0 ZNP, when used as directed, acidifies alkaline waters while providing a well balanced supply of foliar nutrients. Urea is utilized as the sole source of nitrogen to enhance uptake of all contained nutrients.

MONTEREY NUTRIENT BUFFER 10-12-0 ZNP is a superior acidifying-buffering agent. Normal rates of 1-2 pints per 100 gallons of spray mix will lower the pH of alkaline water to levels more optimal for maximum performance of most insecticides. Certain fungicides may also benefit from the addition of MONTEREY NUTRIENT BUFFER 10-12-0 ZNP.

Read and follow the precautions, restrictions and recommendations on the labels of pesticides used with MONTEREY NUTRIENT BUFFER 10-12-0 ZNP. Use according to the most restrictive label directions for each product in any tank mix.

COMPATIBILITY: MONTEREY NUTRIENT BUFFER 10-12-0 ZNP is compatible with most insecticides and minor elements with the exception of compounds containing sabadilla used on citrus. However, if the desired combination has not been previously used, a compatibility test is recommended. Caution should be used with copper fungicides as this material may increase their solubility.

MIXING: Shake well before using. Fill spray tank ½ full of water and begin agitation. Add the recommended amount of MONTEREY NUTRIENT BUFFER 10-12-0 ZNP. Add products as directed by label or in the following sequence and continue filling tank: (1) Dry flowables or water dispersing granules, (2) Wettable powders, (3) Flowables, (4) Solutions, (5) Emulsifiable concentrates. Continue agitation until spray solution is completely mixed. Continuous agitation of finished spray is recommended. If spray solution has been allowed to stand, thoroughly agitate and remix before application. Thoroughly rinse the spray system with clean water after use to reduce corrosion.

RECOMMENDATIONS: A wetting agent or spreader should be used when applying MONTEREY NUTRIENT BUFFER 10-12-0 ZNP to prevent beading of droplets. Avoid making applications to crops stressed from heat, drought, salinity, etc.

MONTEREY NUTRIENT BUFFER 10-12-0 ZNP may be used as a foliar nutrient spray or buffer adjuvant on all field, fiber, forage, fruit, nut and vegetable crops.

Alfalfa: For seed formation, apply 1-2 quarts per acre in 10-30 gallons water just prior to bloom, followed by 3-4 applications every 10 days.

Asparagus, spinach, carrots, celery, garlic, onions, peppers, potatoes, artichokes: Apply 1-2 quarts per acre as needed.

Barley, wheat, rice, milo, oats: Apply 1-2 quarts per acre during early tiller to early boot stages of growth.

Beans, peas, lentils: Apply 1-2 quarts per acre just prior to bloom stage.

Boysenberries, blackberries, strawberries: Apply 1-2 quarts per acre as needed.

Citrus: Apply 1-2 quarts per acre as needed.

Cole crops (broccoli, brussels sprouts, cabbage, cauliflower): Make 1-2 applications at a rate of 1-2 quarts per acre.

Corn: Apply 1-2 quarts in 20 gallons of water per acre. Best periods are when plants are 2"-4" tall and when tassels first appear.

Cotton: Make 1-3 applications starting just prior to main bloom at a rate of 1-2 quarts per acre.

Deciduous fruits and nuts including, but not limited to, almonds, apples, apricots, peaches, pears, plums and walnuts: Apply 1-2 quarts per acre per application in delayed dormant through spring period. Several applications per year are advised. Do not apply as a foliar nutrient spray during bloom.

Grapes: Make 3 applications per year, starting at bloom at a rate of 1-2 quarts per acre.

Lettuce: Make 1-4 applications at 10-day intervals starting at thinning period at a rate of 1-2 quarts per acre.

Melons, cucumbers, squash: Apply 1-2 quarts per acre with maximum concentration of 1-2 quarts to 15 gallons water.

Sugar beets: Apply 1-2 quarts per acre. Several applications at 10-15 day intervals may be justified.

Tomatoes: Apply 1-2 quarts per acre every 10-15 days in the period just prior to and during the fruiting period.

Ornamentals and flower crops: Apply 1-2 quarts per acre in sufficient water to cover.

STORAGE AND DISPOSAL

DO NOT CONTAMINATE WATER, FOOD OR FEED BY STORAGE OR DISPOSAL.

STORAGE: Store in original container away from children, animals, foods, feeds and seeds. Handle in accordance with Precautionary Statements. In the event of spillage or leakage, soak up the material with absorbent clay, sand, sawdust or other absorbent material. Scrape up and dispose in accordance with Product Disposal.

PRODUCT 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) during mixing and loading. Recycling decontaminated containers is the best option of container disposal. The Agricultural Container Recycling Council (ACRC) operates the national recycling program. To contact your state or local ACRC recycler, visit the ACRC web page at www.acrecycle.org. Decontaminated containers may also be disposed of in a sanitary landfill.

CONDITIONS OF SALE AND WARRANTY

Monterey AgResources (MAR) warrants that this product conforms to the chemical description on the label and is reasonably fit for the purposes stated when used in accordance with the use directions under normal conditions. MAR neither makes, nor authorizes any agent or representative to make, any other warranties, express or implied, including fitness or merchantability.

The directions for use of this product 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 timing and method of application, weather and crop conditions, presence of other materials, or other influencing factors, all of which are beyond the control of MAR and Seller. Buyer and user acknowledge and assume all risks and liability resulting from the handling, storage and use of this material not in strict accordance with directions given herewith. In no case shall MAR or the Seller be liable for consequential, special, indirect, or incidental damages or losses resulting from the handling or use of this product. The foregoing is a condition of sale by MAR and is accepted as such by the Buyer.

NET CONTENTS: ____ GALLONS / ____ LITERS

Manufactured for:

MONTEREY AgResources
P.O. Box 35000
Fresno, CA 93745
(559) 499-2100

DUPONT®

DuPont™ Asana® XL

insecticide

RESTRICTED USE PESTICIDE
DUE TO TOXICITY TO FISH AND AQUATIC ORGANISMS.
For retail sale to and use only by Certified Applicators or persons under their direct supervision and only for those uses covered by the Certified Applicator's certification.

GROUP	3	INSECTICIDE

DuPont™ Asana® XL
insecticide

This product contains 0.66 lbs. Active Ingredient per gallon.
0.66 Emulsible Concentrate

Active Ingredient	*By Weight*
Esfenvalerate (S)-cyano (3-phenoxyphenyl) methyl (S)-4-chloro-alpha-(1-methylethyl) benzeneacetate	8.4%
Inert Ingredients*	91.6%
TOTAL	100 %

* CONTAINS XYLENE RANGE AROMATIC SOLVENT

EPA Reg. No. 352-515 EPA Est. No. _____

Nonrefillable Container
Net: _____
OR
Refillable Container
Net: _____

KEEP OUT OF REACH OF CHILDREN

WARNING **AVISO**

Si usted no entiende la etiqueta, busque a alguien para que se la explique a usted en detalle. (If you do not understand this label, find someone to explain it to you in detail.)

FIRST AID

IF SWALLOWED
Call a poison control center or doctor immediately for treatment advice. Do not give any liquid to the person. Do not induce vomiting unless told to do so by a poison control center or a doctor. Do not give anything by mouth to an unconscious person.

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 further treatment advice.

IF IN EYES
Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eyes. Call a poison control center for treatment advice.

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 advice.

NOTE TO PHYSICIAN
If on skin, after drying apply vitamin E cream or oil if available. If not available, apply vegetable oil liberally over painful areas. The oil or cream may be used repeatedly until relief is achieved.
Contains xylene range aromatic solvent - vomiting may cause aspiration pneumonia.
Have the product container or label with you when calling a poison control center or doctor, or going for treatment. You may also contact 1-800-441-3637 for emergency medical treatment information.

PRECAUTIONARY STATEMENTS

HAZARDS TO HUMANS AND DOMESTIC ANIMALS

WARNING ! May be fatal if swallowed. Harmful if inhaled. Do not get in eyes, on skin, or on clothing. Avoid breathing vapor or spray mist. Wash thoroughly with soap and water after handling and before eating, drinking, chewing gum, using tobacco or using the toilet. Remove contaminated clothing and wash clothing before reuse.
For medical emergencies involving this product, call toll free 1-800-441-3637.

PERSONAL PROTECTIVE EQUIPMENT

Some materials that are chemical-resistant to this product are listed below. If you want more options, follow the instructions for category E on an EPA chemical-resistance category selection chart.

Applicators and other handlers must wear:
Long-sleeved shirt and long pants.
Chemical-resistant gloves, such as Barrier Laminate or Neoprene Rubber or Nitrile Rubber or Viton.
Shoes plus socks.
Protective eyewear.

Discard clothing or other absorbent materials that have been drenched or heavily contaminated with this product's concentrate. Do not reuse them. Follow manufacturer's instructions for cleaning/maintaining PPE. If no such instructions for washables, use detergent and hot water. Keep and wash PPE separately from other laundry.

USER SAFETY RECOMMENDATIONS

USERS SHOULD: Wash thoroughly with soap and water after handling and before eating, drinking, chewing gum, using tobacco or using the toilet. Remove clothing immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing.

ENGINEERING CONTROL STATEMENTS

When handlers use closed systems, enclosed cabs, or aircraft in a manner that meets the requirements listed in the Worker Protection Standard (WPS) for agricultural pesticides [40 CFR part 170.240 (d)(4-6)], the handler PPE requirements may be reduced or modified as specified in the WPS.

ENVIRONMENTAL HAZARDS

This pesticide is extremely toxic to fish and aquatic invertebrates. Do not apply directly to water, or 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 areas may be hazardous to aquatic organisms in neighboring areas. Do not contaminate water when cleaning equipment or when disposing of equipment washwaters.

This product is highly toxic to bees exposed to direct treatment or residues on blooming crops or weeds. Do not apply this product or allow it to drift to blooming crops if bees are visiting the treatment area.

WILDLIFE PROTECTION IS EVERYONE'S RESPONSIBILITY

DIRECTIONS FOR USE

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

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. For any requirements specific to your State or Tribe, consult the agency responsible for pesticide regulation.

AGRICULTURAL USE REQUIREMENTS

Use this product only in accordance with its labeling and with the Worker Protection Standard, 40 CFR part 170. This Standard contains requirements for the protection of agricultural workers on farms, forests, nurseries, and greenhouses, and handlers of agricultural pesticides. It contains requirements for training, decontamination, notification, and emergency assistance. It also contains specific instructions and exceptions pertaining to the statements on this label about personal protective equipment (PPE) and restricted-entry interval. The requirements in this box only apply to uses of this product that are covered by the Worker Protection Standard.

Do not enter or allow worker entry into treated areas during the restricted entry interval (REI) of 12 hours.

PPE required for early entry to treated areas that is permitted under the Worker Protection Standard and that involves contact with anything that has been treated, such as plants, soil, or water, is:

Coveralls.
Chemical-resistant gloves, such as Barrier Laminate or Neoprene Rubber or Nitrile Rubber or Viton.
Shoes plus socks.
Protective eyewear.

DuPont™ ASANA® XL insecticide should be used only in accordance with recommendations in this label or in separate DuPont recommendations available through local dealers. DuPont will not be responsible for losses or damages resulting from (i) the reformulation of ASANA® XL into any other product, and (ii) the use of ASANA® XL in any manner that is not specifically recommended by DuPont on the label. User assumes all risk from such non-recommended use.

GENERAL INFORMATION

ASANA® XL insecticide 0.66 emulsible concentrate contains 0.66 pounds of active ingredient per gallon. For the applications given below, mix the required amount of ASANA® XL in sufficient diluent to provide uniform coverage (Refer to Use Tables). ASANA® XL may be applied by ground or aerial application equipment. For aerial application use the following directions unless otherwise specified in this label: use a minimum of 2 gallons per acre (gpa) of water, except in tree and orchard crops use a minimum of 10 gpa.

Apply at the recommended rates when insect populations reach locally determined economic thresholds. Consult the cooperative extension service, professional consultants or other qualified authorities to determine appropriate threshold levels for treatment in your area.

RESISTANCE

For resistance management, ASANA® XL is a group 3 insecticide. Repeated exclusive use of ASANA® XL, or other group 3 insecticides may lead to the buildup of resistant strains of insects in some crops.

Some insects are known to develop resistance to products used repeatedly for control. Because the development of resistance cannot be predicted, the use of this product should conform to resistance management strategies established for the use area. Consult your local or state agricultural authorities for details.

If resistance to this product develops in your area, this product, or other products with a similar mode of action, may not provide adequate control. If poor performance cannot be attributed to improper application or extreme weather conditions, a resistant strain of insect may be present. If you experience difficulty with control and resistance is a reasonable cause, immediately consult your local company representative or agricultural advisor for the best alternative method of control for your area.

INTEGRATED PEST MANAGEMENT

DuPont recommends the use of Integrated Pest Management (IPM) programs to control pests. This product may be used as part of an Integrated Pest Management (IPM) program which can include biological, cultural, and genetic practices aimed at preventing economic pest damage. Application of this product should be based on IPM principles and practices including field scouting or other detection methods, correct target pest identification, population monitoring, and treating when target pest populations reach locally determined action thresholds. Consult your state cooperative extension service, professional consultants or other qualified authorities to determine appropriate action treatment threshold levels for treating specific pest/crop or site systems in your area.

SPRAY PREPARATION

Spray equipment must be clean and free of previous pesticide deposits before applying ASANA® XL.

TANK MIXING AND COMPATIBILITY

Unless directed otherwise in a specific crop section of this label, do not tank mix ASANA® XL with fungicides containing fentin hydroxide (triphenyltin hydroxide) such as "Super Tin" as crop injury may result.

This product can be mixed with pesticide products labeled for use on crops on this label in accordance with the most restrictive of label limitations and precautions. No label dosage rates should be exceeded. This product cannot be mixed with any product containing a label prohibition against such mixing. Since formulations may be changed and new ones introduced, it is recommended that users premix a small quantity of a desired tank mix and observe for possible adverse changes (settling out, flocculation, etc.). Avoid mixtures of several materials and very concentrated spray mixtures. For best results, use of spray equipment having continuous agitation is recommended.

ASANA® XL may be tank mixed with DuPont herbicide products when insect populations require control concurrent with the need for weed control. Follow all herbicide and ASANA® XL label directions regarding proper usage.

ASANA® XL may be used in combination with 2,4-D herbicides providing that the following mixing directions are followed: 1) Do not apply the combination in a volume of water

less than 2 gallons per acre total spray. 2) Always mix the DuPont™ ASANA® XL thoroughly in the total volume of spray water first, followed by the addition of the 2,4-D herbicide. Because of the availability of a great variety of 2,4-D herbicide products, a test for physical compatibility should be conducted before field mixtures of a particular combination are made.

CHEMIGATION

Apply this product only through sprinkler including center pivot, lateral move, end tow, side (wheel) row, traveler, big gun, solid set, or hand move irrigation systems. Do not apply this product through any other type of irrigation system. ASANA® XL may be premixed in a supply tank with water, oil, fertilizer, or other appropriate tank mixed agricultural chemicals. A pretest of physical compatibility for untried tank mixes is advised. Agitation may be necessary. Application should be in sufficient water and of sufficient duration to apply the recommended rate evenly to the entire treated area. No run-off can be permitted during chemigation. Crop injury, lack of effectiveness, or illegal pesticide residues in the crop can result from nonuniform distribution of treated water. Do not apply when wind speed favors drift beyond the area intended for treatment.

If you have questions about calibration, you should contact State Extension Service specialists, equipment manufacturers or other experts. A person knowledgeable of the 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.

Do not connect an irrigation system (including greenhouse systems) used for ASANA® XL application to a public water system.

The system must contain a functional check valve, vacuum relief valve, and low pressure drain appropriately located on the irrigation pipeline to prevent water source contamination from backflow. The pesticide injection pipeline must contain a functional, automatic, quick-closing check valve to prevent the flow of fluid back toward the injection pump. The pesticide injection pipeline must also contain a functional, normally closed, solenoid-operated valve located on the intake side of the injection pump and connected to the system interlock to prevent fluid from being withdrawn from the supply tank when the irrigation system is either automatically or manually shut down. The system must contain functional interlocking controls to automatically shut-off the pesticide injection pump when the water pump motor stops. The irrigation line or water pump must include a functional pressure switch which will stop the water pump motor when the water pressure decreases to the point where pesticide distribution is adversely affected. Systems must use a metering pump, such as a positive displacement injection pump (e.g., diaphragm pump) effectively designed and constructed of materials that are compatible with pesticides and capable of being fitted with a system interlock.

CROP ROTATION

ALL ROTATION CROPS MAY BE PLANTED IMMEDIATELY FOLLOWING LAST APPLICATION.

BUFFER ZONES

Vegetative Buffer Strip

Construct and maintain a minimum 10-foot-wide vegetative filter strip of grass or other permanent vegetation between the field edge and down gradient aquatic habitat (such as, but not limited to, lakes, reservoirs, rivers, permanent streams, marshes or natural ponds, estuaries, and commercial fish farm ponds).

Only apply products containing esfenvalerate onto fields where a maintained vegetative buffer strip of at least 10 feet exists between the field and down gradient aquatic habitat.

For guidance, refer to the following publication for information on constructing and maintaining effective buffers:

Conservation Buffers to Reduce Pesticide Losses, Natural Resources Conservation Services. USDA, NRCS. Fort Worth, Texas 21pp. http://www.in.nrcs.usda.gov/technical/agronomy/newconbuf.pdf

Buffer Zone for Ground Application (groundboom, overhead chemigation, or airblast)

Do not apply within 25 feet of aquatic habitats (such as, but not limited to, lakes, reservoirs, rivers, permanent streams, marshes, natural ponds, estuaries, and commercial fish ponds).

Buffer Zone for ULV Aerial Application

Do not apply within 450 feet of aquatic habitats (such as, but not limited to, lakes, reservoirs, rivers, permanent streams, marshes, natural ponds, estuaries, and commercial fish ponds).

Buffer Zone for Non- ULV Aerial Application

Do not apply within 150 feet of aquatic habitats (such as, but not limited to, lakes, reservoirs, rivers, permanent streams, marshes, natural ponds, estuaries, and commercial fish ponds).

SPRAY DRIFT REQUIREMENTS

Wind Direction and Speed

Only apply this product if the wind direction favors on-target deposition.

Do not apply when the wind velocity exceeds 15 mph.

Temperature Inversion

Do not make aerial or ground applications into temperature inversions.

Inversions are characterized by stable air and increasing temperatures with height above the ground. Mist or fog may indicate the presence of an inversion in humid areas. The applicator may detect the presence of an inversion by producing smoke and observing a smoke layer near the ground surface.

Droplet Size

Use only Medium or coarser spray nozzles (for ground and non-ULV aerial application) according to ASAE (S572) definition for standard nozzles. In conditions of low humidity and high temperatures, applicators should use a coarser droplet size.

Additional Requirements for Ground Applications

Wind speed must be measured adjacent to the application site on the upwind side, immediately prior to application.

For ground boom applications, apply using a nozzle height of no more than 4 feet above the ground or crop canopy.

For airblast applications, turn off outward pointing nozzles at row ends and when spraying the outer two rows. To minimize spray loss over the top in orchard applications, spray must be directed into the canopy.

Additional Requirements for Aerial Applications

The spray boom should be mounted on the aircraft as to minimize drift caused by wingtip or rotor vortices. The minimum practical boom length should be used and must not exceed 75% of the wing span or 80% rotor diameter.

Flight speed and nozzle orientation must be considered in determining droplet size.

Spray must be released at lowest height consistent with pest control and flight safety. Do not release spray at a height greater than 10 feet above the crop canopy unless a greater height is required for aircraft safety.

When applications are made with a cross-wind, the swath will be displaced downwind. The applicator must compensate for this displacement at the downwind edge of the applications area by adjusting the path of the aircraft upwind.

SPRAY TANK CLEANOUT

Immediately following application of ASANA® XL, thoroughly clean all mixing and spray equipment. Flush the tank, pump, hoses, and boom with several changes of water after removing nozzle tips and screens (clean these parts separately). Take all necessary precautions when cleaning equipment. Do not clean near wells, water sources or desirable vegetation. Dispose of waste rinse water in accordance with local regulations.

SPECIFIC USES—FIELD CROPS

Crop	Insect	Application Rate		Acres treated per gal of DuPont™ ASANA® XL	Last Application (days to harvest)
		lb ai/acre	fl oz/acre		
Corn (field)†	**Western Bean Cutworm**	0.015 - 0.03	2.9 - 5.8	44 - 22	21
	Armyworm (True Armyworm) **Black Cutworm (except CA)** **Chinch Bug** **Corn Earworm** **Corn Leaf Aphid** **Corn Rootworm** (adult control) **Cutworm** **Flea Beetle** **Grasshopper** **Japanese beetle (adult) (except CA)** **Oat Bird-Cherry Aphid** **Southwestern Corn Borer** **Stalk Borer**	0.03 - 0.05	5.8 - 9.6	22-13	
	European Corn Borer	0.04 - 0.05	7.8 - 9.6	16 - 13	
	Black Cutworm - ASANA® XL may be applied at 3.2 - 9.6 fl oz/acre (0.0165 - 0.05 lb ai/acre) for the control of black cutworm when applied at planting of corn (except CA). **Chinch Bug** - Over the top sprays, as used for control of ear and stalk infesting corn pests, are not adequate for chinch bug control. It is very important that the spray be directed at the base of the plant through the use of drop nozzles or some other mechanism. **Corn Earworm** - First application should be at or before silking. Repeat applications may be applied if economically damaging populations exist. Subsequent applications should be made at 3 - 5 day intervals until silking is completed. **Corn Leaf Aphid, Oat Bird-Cherry Aphid** - For optimum results, direct the spray at the aphid population so as to achieve maximum coverage of the exposed insects. Aphids not contacted by the spray, such as in whorls and leaf axils, may not be adequately controlled. **Corn Rootworm (Adult)** - Apply at the first sign of silk feeding. ASANA® XL may be tank-mixed with methyl parathion and applied on field corn where supplemental control of Adult Corn Rootworm is desired in conjunction with insects controlled by ASANA® XL when used alone. Refer to the ASANA® XL and methyl parathion labels for appropriate rates of the individual products for controlling the respective insects. **Cutworm** - Applications for cutworm control may be applied before, during, or after planting as required to protect emerging or emerged corn seedlings. **European Corn Borer** - **First brood:** Spray while eggs are in the blackhead stage or before the larvae enter the whorl. Application by ground equipment is suggested. Good coverage of both upper and lower leaf surfaces is essential. This can be accomplished with drop nozzles over the row and on each side of the corn plant. Multiple applications may be required when egg laying is prolonged or where moderate to heavy populations are present. A higher rate is recommended for moderate to heavy populations. Proper coverage by ground equipment usually requires 20-30 gallons of carrier. Once larvae enter the whorl, foliar sprays will not provide adequate control. **Second brood:** Make applications when sufficient egg masses are found. Spray when eggs are in the blackhead stage or starting to hatch. When egg laying is prolonged or a third generation is present, additional sprays may be required. A higher rate is recommended for moderate to heavy populations. Good coverage above, below, and in the ear zone is essential. This usually requires 2 - 3 gallons of carrier by air. If ground equipment is used, drop nozzles on each side of the plant will provide best coverage. ASANA® XL may be tank-mixed with methyl parathion and applied on field corn where supplemental control of European Corn Borer is desired in conjunction with insects controlled by ASANA® XL when used alone. Refer to the ASANA® XL and methyl parathion labels for appropriate rates of the individual products for controlling the respective insects. **Grasshopper** - For control of first and second instar grasshopper nymphal stages a rate range of 3.9 to 5.8 fluid ounces of product per acre (0.02 - 0.03 lb ai/A) can be used. Correct timing of spray applications to the first and second instar nymphal stages and thorough coverage is critical to achieve optimum control. For grasshopper nymph stages larger than second instar, use ASANA® XL at use rates of 5.8 to 9.6 fluid ounces of product per acre (0.03 - 0.05 lb ai/A). **Southwestern Corn Borer** - For moderate to heavy infestations, higher rates (0.036-0.05 lb ai per acre) are recommended. **Stalk Borer, Flea Beetle** - Application must be made early in migration from grassy areas to corn, before borers enter the plant. **Western Bean Cutworm** - Apply before larvae enter the ear.				
	†Do not apply more than 0.25 lb ai per acre per season.				

SPECIFIC USES—FIELD CROPS (cont'd)

Crop	Insect	Application Rate lb ai/acre	Application Rate fl oz/acre	Acres treated per gal of DuPont™ ASANA® XL	Last Application (days to harvest).
Corn (field) At Plant	**Cutworm**	0.0023 lbs a.i. per 1000 feet of row	0.45 fl oz per 1000 feet of row		21
	Apply as an in-furrow, T-band, or band treatment using a minimum 4" band. Use the table below to determine the pounds active ingredient and fluid ounces of ASANA® XL applied at 0.0023 lbs. a.i. per 1000 feet or row for various row spacings. In furrow Applications: Apply into the seed furrow through spray nozzles, behind the planter furrow openers and in front of the press wheel. Banded Applications: Apply at planting as a 4-7 inch T-band sprayed across the open seed furrow between the furrow openers and the press wheels or as a band application behind the press wheel. Apply a minimum spray volume of 3 gallons per acre. Do not exceed 0.05 lbs. a.i. per acre per season as an at-plant application. Do not apply more than 0.25 pounds active ingredient per acre per season including at-plant plus foliar applications of ASANA® XL.				
	Row Spacing (inches) / Linear Ft/A / ASANA® XL Lbs.ai/A / ASANA® XL Fl oz/A	40" / 13,068 / 0.03 / 5.8	38" / 13,756 / 0.032 / 6.2	36" / 14,520 / 0.033 / 6.4	30" / 17,424 / 0.04 / 7.8
Corn (pop)	For specific insect control recommendations refer to Field Corn (above). Follow directions carefully.				1
	Multiple applications and/or shortened intervals between sprays must be used to insure proper insect control. Do not apply more than 0.5 lb a.i. per acre per season.				
Corn (seed)	For specific insect control recommendations refer to Field Corn (above). Follow directions carefully.				1
	Multiple applications and/or shortened intervals between sprays must be used to insure proper insect control. Do not apply more than 0.25 lb a.i. per acre per season.				
Cotton	**Cotton Leaf Perforator**	0.03	5.8	22	21
	Beet Armyworm* **Black cutworm (except CA)** **Boll Weevil** **Cabbage Looper** **Cotton Aphid*** **Cotton Bollworm** **Cotton Leafworm** **Cutworms** **Fleahoppers** **Grasshoppers** **Green Stink Bug (except CA)** **Leafhoppers** **Lygus Bugs** **Pink Bollworm** **Plant Bugs** **Saltmarsh Caterpillar** **Southern Green Stink Bug (except CA)** **Thrips (on seedling cotton)** **Tobacco Budworm** **Whitefly***	0.03 - 0.05	5.8 - 9.6	22 - 13	
	NOTE: For light infestations of the above insects	0.02	3.9	33	
	*Aids in control. May be applied in water or nonvolatile vegetable oils. When applying ASANA® XL in an oil carrier, apply a total spray volume of at least 1 qt per acre. When applying ASANA® XL in a water carrier, apply at least 1 gal per acre by air (at least 3 gal per acre in Arizona and 5 gal per acre in California) or 4 gal per acre by ground. Do not apply more than 0.5 lb ai per acre per season. Do not graze livestock on treated fields or feed treated trash. **Black Cutworm** - ASANA® XL may be applied at 3.2 - 9.6 fl oz/acre (0.0165 - 0.05 lb ai/ acre) for the control of black cutworm when applied at planting of cotton (except CA). **Boll Weevil** - To control Boll Weevil infestations, a 3 to 5 day interval between applications may be necessary. **Heliothis spp.** - ASANA® XL can provide contact ovicidal effect on Heliothis spp. eggs when applied according to label directions for control of tobacco budworm; application should be timed to correspond with peak egg deposition to achieve maximum ovicidal effect. Use on this pest stage (egg) is not registered in California. Do not make more than a total of 10 synthetic pyrethroid applications (of one product or combination of products) to a cotton crop in one growing season.				

SPECIFIC USES—FIELD CROPS (cont'd)

Crop	Insect	Application Rate		Acres treated per gal of DuPont™ ASANA® XL	Last Application (days to harvest)
		lb ai/acre	fl oz/acre		
Peanuts	**Corn Earworm** **Potato Leafhopper** **Red-necked Peanut Worm** **Velvetbean Caterpillar**	0.015 - 0.03	2.9 - 5.8	44 - 22	21
	Beet Armyworm* **Cutworms** **Granulate Cutworm** **Grasshoppers**	0.03 - 0.05	5.8 - 9.6	22 - 13	
	Fall Armyworm* **Lesser Cornstalk Borer****	0.05	9.6	13	
	*Aids in control. For heavy infestations use of DuPont™ LANNATE® insecticide is recommended. Please refer to the LANNATE® label for use instructions. **Aids in control. Do not feed or graze livestock on treated vines. Do not apply more than 0.15 lb a.i. per acre per season.				
Sorghum (Grain) (except CA)	**Sorghum Midge**	0.015 - 0.03	2.9 - 5.8	44 - 22	21
	Black Cutworm **Chinch Bugs** **Corn Earworm (headworm)** **Cutworms**	0.03 - 0.05	5.8 - 9.6	22 - 13	
	Do not apply more than 0.15 lb a.i. per acre per season. When applying in nonvolatile vegetable oils use a total spray volume of 1 or more qts per acre. **Black Cutworm** - ASANA® XL may be applied at 3.2 - 9.6 fl oz/acre (0.0165 - 0.05 lb ai/acre) for the control of black cutworm when applied at planting of sorghum. **Chinch Bug Control** - For optimum results, spray should be directed at base of plants.				
Soybean	**Green Cloverworm** **Mexican Bean Beetle** **Potato Leafhopper** **Saltmarsh Caterpillar** **Velvetbean Caterpillar** **Woollybear Caterpillar**	0.015 - 0.03	2.9 - 5.8	44 - 22	21
	Bean Leaf Beetle **Beet Armyworm*** **Cabbage Looper** **Corn Earworm** **Cutworms** **Grasshoppers** **Green Stink Bug (except CA)** **Japanese Beetle (adult)** **Southern Green Stink Bug** **Soybean Aphid (except CA)** **Three-cornered Alfalfa Hopper**	0.03 - 0.05	5.8 - 9.6	22 - 13	
	Grasshopper - For control of first and second instar grasshopper nymphal stages a rate range of 3.9 to 5.8 fluid ounces of product per acre (0.02 - 0.03 lb ai/A) can be used. Correct timing of spray applications to the first and second instar nymphal stages and thorough coverage is critical to achieve optimum control. For grasshopper nymph stages larger than second instar, use ASANA® XL at use rates of 5.8 to 9.6 fluid ounces of product per acre (0.03 - 0.05 lb ai/A). **Soybean Aphid** - ASANA® XL provides control of soybean aphid, however under certain conditions such as rapid aphid population growth, or extremely high populations, a tank mixture may be considered.. ASANA® XL can be tank mixed with other insecticides such as chlorpyrifos (e.g. "Lorsban") or methomyl (e.g. DuPont™ LANNATE®) to achieve rapid knockdown of soybean aphid. Because LANNATE® is a fast acting contact insecticide, best results follow direct spraying of the target insect. When preparing a tank mixture, read and follow the label instructions for all products in the mixture regarding restrictions, requirements and proper usage. Use sufficient water to obtain thorough, uniform coverage. For aerial application use a minimum of 2 gallons per acre, and for ground application use a minimum of 10 gallons per acre. *Aids in control. When applying in nonvolatile vegetable oils, use a total spray volume of at least 1 qt. Do not feed or graze livestock on treated fields. Do not apply more than 0.2 lb ai per acre per season.				
Sugar Beets	**Beet Armyworm*** **Beet Webworm** **Cabbage Looper** **Cutworms** **Flea Beetle (except CA)** **Grasshoppers** **Leafhoppers** **Saltmarsh Caterpillar** **Sugar beet Root Maggot (adult) (except CA)**	0.03 - 0.05	5.8 - 9.6	22 - 13	21
	Grasshopper - For control of first and second instar grasshopper nymphal stages a rate range of 3.9 to 5.8 fluid ounces of product per acre (0.02 - 0.03 lb ai/A) can be used. Correct timing of spray applications to the first and second instar nymphal stages and thorough coverage is critical to achieve optimum control. For grasshopper nymph stages larger than second instar, use ASANA® XL at use rates of 5.8 to 9.6 fluid ounces of product per acre (0.03 - 0.05 lb ai/A). *Aids in control. Do not apply more than 0.15 lb ai/acre per season. Apply with ground or air equipment using sufficient water to provide uniform coverage(minimum of 2 gal of water per acre).				

SPECIFIC USES—FIELD CROPS (cont'd)

Crop	Insect	Application Rate		Acres treated per gal of DuPont™ ASANA® XL	Last Application (days to harvest)
		lb ai/acre	fl oz/acre		
Sugar Beets At Plant	Cutworm	0.0023 lbs. a.i. per 1000 feet of row	0.45 fl. oz. per 1000 feet of row		21
	Apply as an in-furrow, T-band, or band treatment using a minimum 4" band. Use the table below to determine the pounds active ingredient and fluid ounces of ASANA® XL applied at 0.0023 lbs. a.i. per 1000 feet of row for various row spacings. In-Furrow Applications: Apply into the seed furrow through spray nozzles, behind the planter furrow openers and in front of the press wheel. Banded Applications: Apply at planting as a 4-7 inch T-band sprayed across the open seed furrow between the furrow openers and the press wheels or as a band application behind the press wheel. Apply a minimum spray volume of 3 gallons per acre. Do not exceed 0.05 lbs. a.i. per acre per season as an at-plant application. Do not apply more than 0.25 pounds active ingredient per acre per season including at-plant plus foliar applications of ASANA® XL.				
	Row Spacing (inches)	40"	38"	36"	30"	22"
	Linear Ft/A	13,068	13,756	14,520	17,424	23,760
	ASANA® XL Lbs.ai/A	0.03	0.032	0.033	0.04	0.05
	ASANA® XL Fl oz/A	5.8	6.2	6.4	7.8	9.6
Sugarcane	**Sugarcane Borer**	0.03 - 0.05	5.8 - 9.6	22 - 13		21
	Do not apply more than 0.2 lb ai/acre per season.					
Sunflower	**Sunflower Beetle (except CA)**	0.0075 - 0.03	1.45 - 5.8	88 - 22		28
	Banded Sunflower Moth **Beet Armyworm*** **Cutworms** **Grasshoppers** **Heliothis (complex)** **Leafhoppers** **Sunflower Maggot** **Sunflower Moth** **Sunflower Seed Weevil** **Sunflower Stem Weevil**	0.03 - 0.05	5.8 - 9.6	22 - 13	
	Grasshopper - For control of first and second instar grasshopper nymphal stages a rate range of 3.9 to 5.8 fluid ounces of product per acre (0.02 - 0.03 lb ai/A) can be used. Correct timing of spray applications to the first and second instar nymphal stages and thorough coverage is critical to achieve optimum control. For grasshopper nymph stages larger than second instar, use ASANA® XL at use rates of 5.8 to 9.6 fluid ounces of product per acre (0.03 - 0.05 lb ai/A). *Aids in control. Do not apply more than 0.2 lb. ai/acre per season.				

SPECIFIC USES—FRUITS

DILUTE SPRAY: Apply specified dosage per 100 gallons of water in a uniform spray applied to the point of drip with conventional ground equipment. Do not exceed maximum number of gallons per acre indicated.

NOTE: In order to apply the correct amount of DuPont™ ASANA® XL insecticide to your orchard you must know the number of gallons of water needed to spray one acre of your trees to the point of drip. If you do not already know this gallonage, you should conduct a test to determine it. If you do not know how to conduct such a test with your equipment, you should ask for assistance from your equipment dealer or State Extension specialist.

CONCENTRATE SPRAY: APPLY SPECIFIED DOSAGE PER ACRE IN NO LESS THAN 30 GALS. OF WATER PER ACRE BY GROUND. FOR AERIAL APPLICATION IN TREE AND ORCHARD CROPS, USE A MINIMUM OF 10 GALLONS OF WATER PER ACRE. WHEN APPLYING ASANA® XL BY AIR, CONSULT YOUR COOPERATIVE EXTENSION SERVICE FOR FURTHER APPLICATION GUIDELINES.

Crop	Insect	Application Rate			Acres treated per gal of DuPont™ ASANA® XL	Last Application (days to harvest)
		Concentrate Spray		Dilute Spray		
		lb ai /acre	fl oz /acre	fl oz /100 gal		
Apples	**Apple Aphid** **Apple Maggot** **Codling Moth** **Green Fruitworm** **Lesser Appleworm** **Mullein Plant Bug (except CA)** **Oblique Banded Leafroller** **Oriental Fruit Moth** **Periodical Cicada** **Plant Bugs** **(Tarnished Plant Bug, Stink Bugs)** **Plum Curculio** **Red - Banded Leafroller** **Rosy Apple Aphid** **San Jose Scale** **(fruit infestations only)** **Tentiform Leaf Miner** **Tufted Apple Bud Moth** **Variegated Leafroller** **White Apple Leafhopper**	0.025 - 0.075	4.8 - 14.5	2.0 - 5.8	26 - 9	21
	Apple Ermine Moth **(ID, OR & WA only)**			3.0		
	Tufted Apple Bud Moth **(overwintering)** **(MD, NC, NJ, PA, VA, WV only)**	0.04 - 0.075	8.0 - 14.5		16 - 9	
	Do not feed or graze livestock on treated orchard floors. Do not apply more than 0.525 lbs. a.i. per acre per season. For dilute spray apply 200 - 600 gals per acre, but do not apply more than 14.5 fl. oz. of ASANA® XL per acre per treatment. **Apple Ermine Moth**--Apply with 2 to 4 gallons of superior spray oil in 100 gallons of water in a spray-to-wet application to insure thorough coverage of all stems and branches where Apple Ermine Moth hibernacula are found. When using on apple nursery stock, do not treat bundled plants since it is difficult to achieve a full coverage application which could result in less than complete control. Make first application in the fall after 90% of leaf fall has occurred—usually after October 15. Make a second application 7 to 14 days later. Note: Overwintering larvae do not die until approximately 30 days after application. **Plant Bug, Rosy Apple Aphid Control**--Time of application is critical in achieving control. Use prebloom and post bloom spray timings recommended by State Extension Services. **Tufted Apple Bud Moth (overwintering)**--For use on apple for the control of overwintering larvae of the tufted apple bud moth with directed ground application to the apple orchard floor. Make one application of ASANA® XL at either pink stage of apple or at petal fall stage of apple. Use the lower rate on small larvae (pink stage of apple) and/or on lower populations. Use the higher rate on larger larvae (petal fall stage of apple) and/or on moderate to high populations. Apply specified dosage per acre to the orchard floor in no less than 30 gals of water per acre by ground to obtain uniform coverage. Apply treatment in a band from trunk to drip line to allow coverage of areas where overwintering tufted apple bud moth are found. **Beneficial Insects**: Application of ASANA® XL to the groundcover at the pink stage of apple development may be toxic to overwintering *Stethorus punctum*. *S. punctum* is a coccinellid insect and the major predator of spider mites in the MD, NC, NJ, PA, VA and WV fruit growing areas. This predator overwinters in the same areas of the orchard groundcover as the tufted apple bud moth and moves into apple trees from mid-April through mid-May when maximum daily temperatures exceed 68°F. Emergence from the groundcover is 20-70% complete by the pink stage and 90-100% complete by petal fall on the apple cultivar Yorking.					

SPECIFIC USES—FRUITS (cont'd)

Crop	Insect	Application Rate: Concentrate Spray lb ai /acre	Application Rate: Concentrate Spray fl oz /acre	Application Rate: Dilute Spray fl oz /100 gal	Acres treated per gal of DuPont™ ASANA® XL	Last Application (days to harvest)
Blueberry (except CA)	**Aphids (NJ only)** **Blueberry Spanworm** **Cherry Fruitworm*** **Cranberry Fruitworm** **Cranberry Weevil*** **Grasshoppers** **Japanese Beetle** **Leafhoppers** **Red Striped Fireworm***	0.025 - 0.05	4.8 - 9.6		26 - 13	14
	Blueberry Maggot **Black Vine Weevil (adult control)** **Strawberry Root Weevil (adult control) (OR, WA only)**	0.05	9.6		13	
	*Aids in control. Do not apply more than 0.2 lb ai/acre per season (38.4 fluid ounces of product per acre per season). Use of ground application is recommended; for ground application use a minimum of 50 gals water per acre. Do not apply this product through any type of irrigation system. **Note:** ASANA® XL can act as a bee repellent, do not apply within 7 days of pollination. Apply as a pre-bloom or post-bloom spray only. **Black vine weevil & strawberry root weevil (adult control) (OR, WA only):** Look for leaf notching beginning in late May to early June as the first sign of weevil feeding. Also check for adults on or just below the soil surface around the base of plants. Apply ASANA® XL within two to three weeks of first sign of infestation. Do not apply by air; apply by ground using a minimum of 50 gallons of water per acre. Direct spray to provide full coverage of foliage and soil area around base of plants. Best results are from applications made after dark when temperatures are warm and weevils are actively feeding. Root weevils emerge over a several week period, make additional applications when signs of new feeding appear.					
Caneberries (blackberries, boysenberries, dewberries, loganberries, raspberries, youngberries, and varieties of these) (except CA)	**Aphids** **Oblique Banded Leafroller** **Orange Tortrix**	0.025 - 0.05	4.8 - 9.6		26 - 13	7
	Adult Root Weevils* (OR & WA only)	0.05	9.6		13	
	*Aids in control. Do not apply by air. Do not apply more than 0.15 lb ai per acre per season. Do not apply this product through any type of irrigation system. NOTE: ASANA® XL can act as a bee repellent, do not apply within 7 days of pollination. Apply as a pre-bloom or post-bloom spray only. Remove bees prior to application. For maximum safety to bees, apply ASANA® XL in the evening after sunset. **Adult Root Weevils (OR & WA only):** Look for leaf notching beginning in late May to early June as the first sign of weevil feeding. Also check for adults on or just below the soil surface around the base of plants. Apply ASANA® XL within two to three weeks of infestation. Apply by ground using a minimum of 50 gallons of water per acre. Direct spray to provide thorough coverage of all plant foliage and the soil area around the base of the plant. Best results are from applications made after dark when temperatures are warm and weevils are actively feeding. Root weevils emerge over a period of several weeks; make subsequent applications when signs of new feeding appear. **Oblique Banded Leafroller Orange Tortrix and Aphids:** Apply as a full coverage spray in a minimum of 50 gallons of water with ground equipment only. Apply no earlier than 12 days before harvest and no later than 7 days before harvest.					
Kiwifruit	**Boxelder Bug (suppression only)**	0.05	9.6	-	13	14
	Spray in sufficient water for thorough coverage. A maximum of 7 applications is allowed per season (total of 0.35 lb ai/acre/season) with a minimum of 7 days between treatments.					
Pear	**Codling Moth** **Green Fruitworm** **Leafrollers** **Pear Psylla** **Pear Slug** **Periodical Cicada** **Plum Curculio**	0.025 - 0.075	4.8 - 14.5	2.0 - 5.8	26 - 9	28
	Do not apply more than 0.375 lbs. a.i. per acre per season. Do not apply more than 0.225 lb. a.i. per acre between bloom and harvest. Do not feed or graze livestock on treated orchard floors. For dilute spray apply 200 - 600 gals per acre, but do not apply more than 14.5 fl. oz. of ASANA® XL per acre per treatment.					
Pear (Dormant)	**Pear Psylla**	0.05 - 0.1	9.6 - 19.2	7.3 - 12.8	13.2 - 6.6	
	Apply during dormant to prebloom (white bud) stage only. Do not apply more than 0.2 lb a.i. per acre per season. Do not graze orchard floor. For dilute spray apply 150 - 250 gals per acre, but do not apply more than 19.2 fl. oz. of ASANA® XL per acre per treatment.					

SPECIFIC USES—FRUITS (cont'd)

Crop	Insect	Application Rate			Acres treated per gal of DuPont™ ASANA® XL	Last Application (days to harvest)
		Concentrate Spray		Dilute Spray		
		lb ai /acre	fl oz /acre	fl oz /100 gal		
Stone Fruits (including apricots, cherries, nectarines, peaches, plums, prune plums)	**American Plum Borer** **Black Cherry Aphid** **Cherry Fruit Fly** **Green Fruitworm** **Leafhoppers** **Leafrollers** **Lesser Peach Tree Borer** **Oriental Fruit Moth** **Peach Tree Borer** **Peach Twig Borer** **Periodical Cicada** **Plant Bugs (Tarnished Plant Bug, Stink Bugs)** **Plum Curculio** **Western Cherry Fruit Fly**	0.025 - 0.075	4.8 - 14.5	2.0 - 5.8	26 - 9	14
	Peach Twig Borer (Dormant) (CA only)	0.04 - 0.075	8.0 - 14.5	3.1 - 5.8	16 - 9	
	Tufted Apple Bud Moth (overwintering) (Peach only) (MD, NC, NJ, PA, VA and WV only)	0.04 - 0.075	8.0 - 14.5		16 - 9	
	Do not apply more than 0.375 lbs a.i. per acre per season with no more than 0.3 lbs. a.i. per acre per season between bloom and harvest. For dilute spray apply 200 - 400 gals per acre, but do not apply more than 14.5 fl. oz of ASANA® XL per acre per treatment. Do not graze livestock on treated orchard floors. **Peach Tree Borer, American Plum Borer, Lesser Peach Tree Borer Control** - Apply as directed trunk and scaffold limb spray. Thorough coverage of trunk and scaffold limbs is required. **Peach Twig Borer (Dormant)**--Make application with an EPA registered dormant oil; for specific recommendations on use of oil consult manufacturer's label. For best performance, ground application equipment is recommended. **Peach Twig Borer, Plum Curculio, Oriental Fruit Moth, Cherry Fruit Fly, Western Cherry Fruit Fly, Leafrollers, Black Cherry Aphid, Periodical Cicada Control** - Apply by ground sprayer to achieve thorough coverage of all aerial portions of the tree. **Plant Bug Control** - Time of application is critical in achieving control. Use prebloom and postbloom spray timings recommended by State Extension Services. **Tufted Apple Bud Moth (overwintering)**--For use on peach for the control of overwintering larvae of the tufted apple bud moth with directed ground application to the peach orchard floor. Make one application of ASANA® XL at either popcorn stage of peach or at shucksplit stage of peach. Use the lower rate on small larvae (popcorn stage of peach) and/or on lower populations. Use the higher rate on larger larvae (shucksplit stage of peach) and/or on moderate to high populations. Apply specified dosage per acre to the orchard floor in no less than 30 gals of water per acre by ground to obtain uniform coverage. Apply treatment in a band from trunk to drip line to allow coverage of areas where overwintering tufted apple bud moth are found. **Beneficial Insects:** Application of ASANA® XL to the groundcover at the popcorn stage of peach development may be toxic to overwintering *Stethorus punctum*. *S. punctum* is a coccinellid insect and the major predator of spider mites in the MD, NC, NJ, PA, VA and WV fruit growing areas. This predator overwinters in the same areas of the orchard groundcover as the tufted apple bud moth and moves into peach trees from mid-April through mid-May when maximum daily temperatures exceed 68°F. Emergence from the groundcover is 90-100% complete by shucksplit. Shucksplit is the preferred timing to minimize predator toxicity.					

SPECIFIC USES—TREE NUT CROPS

DILUTE SPRAY: Apply specified dosage per 100 gallons of water in a uniform spray applied to the point of drip with conventional ground equipment. Do not exceed maximum number of gallons per acre indicated.

NOTE: In order to apply the correct amount of DuPont™ ASANA® XL insecticide to your orchard you must know the number of gallons of water needed to spray one acre of your trees to the point of drip. If you do not already know this gallonage, you should conduct a test to determine it. If you do not know how to conduct such a test with your equipment, you should ask for assistance from your equipment dealer or State Extension specialist.

CONCENTRATE SPRAY: APPLY SPECIFIED DOSAGE PER ACRE IN NO LESS THAN 30 GALS. OF WATER PER ACRE BY GROUND. FOR AERIAL APPLICATION IN TREE AND ORCHARD CROPS, USE A MINIMUM OF 10 GALLONS OF WATER PER ACRE. WHEN APPLYING ASANA® XL BY AIR, CONSULT YOUR COOPERATIVE EXTENSION SERVICE FOR FURTHER APPLICATION GUIDELINES.

Crop	Insect	Application Rate: Concentrate Spray lb ai /acre	Application Rate: Concentrate Spray fl oz /acre	Application Rate: Dilute Spray fl oz /100 gal	Acres treated per gal of DuPont™ ASANA® XL	Last Application (days to harvest)
Almonds	**Navel Orangeworm** **Peach Twig Borer** **Peach Twig Borer (Dormant) (CA only)**	0.05 - 0.1	9.6 - 19.2	7.3 - 12.8	13.2 - 6.6	21
	Do not apply more than 0.2 lb. a.i. per acre per season. Do not graze livestock on treated orchard floors. **Peach Twig Borer (Dormant)**--Make application with an EPA registered dormant oil; for specific recommendations on use of oil consult manufacturer's label. For best performance, ground application equipment is recommended.					
Filberts	**Filbertworm** **Oblique Banded Leafroller**	0.05 - 0.1	9.6 - 19.2	7.3 - 12.8	13.2 - 6.6	21
	Make first application after emergence of filbert worm moths in early summer. Do not apply a second treatment earlier than three weeks after the first. Do not apply more than 0.2 lb. a.i. per acre per season. For dilute spray, apply 200 - 400 gals. per acre, but do not apply more than 19.2 fl. oz of ASANA® XL per acre per treatment. Do not graze livestock on treated orchard floors.					
Pecans	**Hickory Shuckworm** **Pecan Aphids** **Pecan Nut Casebearer** **Pecan Leaf Phylloxera** **Pecan Spittlebug** **Pecan Stem Phylloxera** **Pecan Weevil**	0.025 - 0.075	4.8 - 14.5	2.0 - 5.8	26 - 9	21
	Do not feed or graze livestock on treated orchard floors. Do not apply more than 0.3 lbs. a.i. per acre per season. For dilute spray apply 200 - 600 gals per acre, but do not apply more than 14.5 fl. oz. of ASANA® XL per acre per treatment. ASANA® XL may be tank-mixed with fungicides containing fentin hydroxide (triphenyltin hydroxide) such as "Super Tin". Refer to the ASANA® XL and fentin hydroxide (triphenyltin hydroxide) labels for appropriate rates of the individual products for controlling the respective pests. **Phylloxera** - Correct timing of spray applications is critical in achieving optimum control of leaf and stem phylloxera. Consult local spray recommendations for correct times of application.					
Walnuts	**Codling Moth** **Navel Orangeworm** **Walnut Aphid** **Walnut Husk Fly**	0.05 - 0.1	9.6 - 19.2	4.0	13 - 6	21
	Do not apply more than 0.2 lb. a.i. per acre per season. For dilute sprays, apply 200 - 400 gals per acre. Do not feed or graze livestock on treated crop floors. NOTE: Use of baits in Walnut Husk fly sprays is recommended where endorsed by local Agricultural Extension Service.					

SPECIFIC USES—VEGETABLE CROPS

Crop	Insect	Application Rate		Acres treated per gal of DuPont™ ASANA® XL	Last Application (days to harvest)
		lb ai/acre	fl oz/acre		
Artichoke	**Artichoke Plume Moth**	0.03 - 0.05	5.8 - 9.6	22 - 13	1
	Do not apply more often than each 14 days. Apply no more than 0.15 lb. ai/acre between bud formation and harvest of an individual fruit. Apply in a minimum of 10 gallons per acre by air and 50 - 200 gallons per acre by ground (use sufficient water to obtain coverage without excessive runoff).				
Beans, Dry (Including adzuki bean, blackeyed pea, broad bean (dry), chickpea, cow pea, crowder pea, field bean, kidney bean, lima bean (dry), mung bean, navy bean, pinto bean, southern pea, tepary bean) Peas, Dry Lentils	**Leafhoppers (except CA) Mexican Bean Beetle Saltmarsh Caterpillar**	0.015 - 0.03	2.9 - 5.8	44 - 22	21
	Beet Armyworm* Cabbage Looper Corn Earworm Corn Rootworm (Adults) Cowpea Curculio Cucumber Beetle Cutworms Grasshoppers Green Cloverworm Leafhoppers Painted Lady Butterfly (larvae) Pea Aphid Potato Leafhopper Soybean Aphid (except CA) Velvetbean Caterpillar Western Bean Cutworm	0.03 - 0.05	5.8 - 9.6	22 - 13	
	Pea Leaf Weevil (ID, OR & WA only) Pea Weevil (ID, OR & WA only)	0.025 - 0.05	4.8 - 9.6	26 - 13	
	*Aids in control. Do not apply more than 0.2 lb a.i. per acre per season. Do not feed or graze livestock on treated vines. **Pea Weevil & Pea Leaf Weevil (ID, OR & WA)** - Time of application is critical in achieving control of pea weevil. For optimum results, apply at bloom prior to detecting adult pea weevils. Once adult pea weevil populations reach a level of 2 or more adults per 25 sweeps, control may be reduced. **Grasshopper** - For control of first and second instar grasshopper nymphal stages a rate range of 3.9 to 5.8 fluid ounces of product per acre (0.02 - 0.03 lb ai/A) can be used. Correct timing of spray applications to the first and second instar nymphal stages and thorough coverage is critical to achieve optimum control. For grasshopper nymph stages larger than second instar, use ASANA® XL at use rates of 5.8 to 9.6 fluid ounces of product per acre (0.03 - 0.05 lb ai/A).				
Beans, Snap Also known as: (blue lake, bush, common, edible-podded, filet, flageolet, French, French horti-ultural, frijoles comunes, garden, green, haricot, haricot commun, Italian, judia comum, Kentucky wonder, magic, pole, romano, string, succulent, vainica, wax)	**Leafhoppers (except CA) Mexican Bean Beetle Saltmarsh Caterpillar**	0.015 - 0.03	2.9 - 5.8	44 - 22	3
	Beet Armyworm* Cabbage Looper Corn Earworm Corn Rootworm (adults) Cucumber Beetle Cucumber Beetle (adults) Cutworm (seedling spray) European Corn Borer Flea Beetle Grasshoppers Green Cloverworm Leafhopper Leafminer (Guam only) Pea Aphid Potato Leafhopper Soybean Aphid (except CA) Velvet Bean Caterpillar Western Bean Cutworm	0.03 - 0.05	5.8 - 9.6	22 - 13	
	*Aids in control. Do not apply more than 0.2 lb ai per acre per season. Do not allow livestock to graze treated bean fields. Do not harvest treated bean vines for livestock forage, fodder, or hay.				
Broccoli, (including chinese broccoli) Cabbage, Cauliflower, Chinese Cabbage (tight headed varieties only, e.g. Napa cabbage)	**Imported Cabbageworm**	0.015 - 0.03	2.9 - 5.8	44 - 22	3
	Alfalfa Looper Beet Armyworm* Cabbage Looper Cutworm Flea Beetle Grasshoppers	0.03 - 0.05	5.8 - 9.6	22 - 13	
	*Aids in control. Do not apply more than 0.4 lbs. a.i. per acre per season.				

SPECIFIC USES—VEGETABLE CROPS (cont'd)

Crop	Insect	Application Rate		Acres treated per gal of DuPont™ ASANA® XL	Last Application (days to harvest)
		lb ai/acre	fl oz/acre		
Carrots	**Aster Leafhopper** **Cutworms** **Leafhoppers**	0.03 - 0.05	5.8 - 9.6	22 - 13	7
	Carrot Weevil	0.05	9.6	13	
	Do not apply more than 0.5 lb ai/acre per season. For aerial application apply in a minimum of 5 gals water per acre. Thorough spray coverage of crown area is essential. Use of ground application is recommended. **Carrot Weevil** - Begin treatment when weevils become active.				
Collards	**Alfalfa Looper** **Beet Armyworm*** **Cabbage Looper** **Cutworm** **Flea Beetle** **Grasshopper** **Imported Cabbageworm**	0.03 - 0.05	5.8 - 9.6	22 - 13	7
	*Aids in control. Do not feed livestock on treated plant parts. Do not apply more than 0.2 lbs. a.i. per acre per season. For aerial application apply in a minimum of 5 gals water per acre.				
Cucumber, **Melons,** **(cantaloupe, honeydew melons, muskmelon, watermelon),** **Pumpkin,** **Squash (summer, winter)**	**Cabbage Looper** **Corn Earworm** **Cucumber Beetle (adults)** **Cutworms (seedling spray)** **Grasshoppers** **Leafhoppers** **Pickleworm** **Plant Bugs (Lygus Bugs, Stink Bugs)** **Rindworms** **Squash Bug** **Squash Vine Borer**	0.03 - 0.05	5.8 - 9.6	22 - 13	3
	Do not apply more than 0.25 lbs. a.i. per acre per season.				
Eggplant	**Colorado Potato Beetle** **Corn Earworm** **European Corn Borer** **Flea Beetles** **Loopers**	0.03 - 0.05	5.8 - 9.6	22 - 13	7
	Apply when insects are observed or when insect damage is observed. Repeat applications at 7 to 10 day intervals to achieve control. Do not apply more than 0.35 lbs. a.i. per acre per season.				
Kohlrabi	**Cabbage Looper**	0.03 - 0.05	5.8 - 9.6	22 - 13	3
	Do not apply more than 0.4 lbs. a.i. per acre per season.				
Lentils	**See "Beans, Dry"**				
Lettuce, Head AZ, CA, CO, FL, NM & TX ONLY	**Alfalfa Looper** **Beet Armyworm*** **Cabbage Looper** **Heliothis spp.**	0.025 - 0.05	4.8 - 9.6	26 - 13	7
	*Aids in control. Do not apply more than 0.35 lbs. a.i. per acre per season.				
Mustard Greens	**Cabbage Looper** **Imported Cabbageworm**	0.05	9.6	13	7
	Do not apply more than 0.2 lbs a.i. per acre per season.				
Okra (FL only)	**Cabbage Looper** **Corn Earworm** **Southern Armyworm**	0.03 - 0.05	5.8 - 9.6	22 - 13	1
Peas, Dry	**See "Beans, Dry"**				
Peas, Green	**Green Cloverworm** **Pea Aphid**	0.015 - 0.03	2.9 - 5.8	44 - 22	3
	Alfalfa Caterpillar **Alfalfa Looper** **Armyworm** **Cabbage Looper** **Celery Looper** **Corn Earworm** **Cutworms** **Imported Cabbageworm**	0.03 - 0.05	5.8 - 9.6	22 - 13	
	Pea Leaf Weevil (ID, OR & WA only) **Pea Weevil (ID, OR & WA only)**	0.025 - 0.05	4.8 - 9.6	26 - 13	
	Do not apply more than 0.1 lb ai/acre per season. Do not feed treated pea vines to livestock. **Pea Weevil & Pea Leaf Weevil (ID, OR & WA only)** - Time of application is critical in achieving control of pea weevil. For optimum results, apply at bloom prior to detecting adult pea weevils. Once adult pea weevil populations reach a level of 2 or more adults per 25 sweeps, control may be reduced.				

SPECIFIC USES—VEGETABLE CROPS (cont'd)

Crop	Insect	Application Rate		Acres treated per gal of DuPont™ ASANA® XL	Last Application (days to harvest)
		lb ai/acre	fl oz/acre		
Pepper	**Beet Armyworm* Colorado Potato Beetle Corn Earworm Cucumber Beetle (adults) European Corn Borer Flea Beetles Loopers Pepper Weevil* Southern Armyworm**	0.03 - 0.05	5.8 - 9.6	22 - 13	7
	*Aids in control. Apply when insects are observed or when insect damage is observed. Repeat applications at 7 to 10 day intervals to achieve control. Do not apply more than 0.35 lbs. a.i. per acre per season.				
Potato	**Leafhoppers (except CA) Potato Psyllid**	0.015 - 0.03	2.9 - 5.8	44 - 22	7
	Potato Tuberworm	0.015 - 0.05	2.9 - 9.6	44 - 13	
	Beet Armyworm* Buckthorn Aphid Cabbage Looper Colorado Potato Beetle Cucumber Beetle (adult control) Cutworms European Corn Borer Fleabeetles Grasshoppers Potato Aphid Potato Leafhopper Tarnished Plant Bug Western Yellow-Striped Armyworm	0.03 - 0.05	5.8 - 9.6	22 - 13	
	Colorado Potato Beetle (Long Island, NY only)	0.05	9.6	13	
	Grasshopper - For control of first and second instar grasshopper nymphal stages a rate range of 3.9 to 5.8 fluid ounces of product per acre (0.02 - 0.03 lb ai/A) can be used. Correct timing of spray applications to the first and second instar nymphal stages and thorough coverage is critical to achieve optimum control. For grasshopper nymph stages larger than second instar, use ASANA® XL at use rates of 5.8 to 9.6 fluid ounces of product per acre (0.03 - 0.05 lb ai/A). **Potato Tuberworm** - For control of Potato Tuberworm apply ASANA® XL insecticide when tuberworm larvae and/or moth counts reach locally established treatment threshold populations. Repeat applications of effective insecticides may be needed to keep tuberworm larvae populations as low as possible prior to harvest in order to reduce the risk of tuber damage. Failure to adequately control tuberworm larvae prior to crop senescence or vine kill increases the risk of tuber damage. *Aids in control. Do not apply more than 0.35 lb. a.i. per acre per season.				
Radishes	**Armyworms Beetles**	0.03 - 0.05	5.8 - 9.6	22 - 13	7
	Do not apply more than 0.1 lb. ai/acre per season.				

SPECIFIC USES—VEGETABLE CROPS (cont'd)

Crop	Insect	Application Rate		Acres treated per gal of DuPont™ ASANA® XL	Last Application (days to harvest)
		lb ai/acre	fl oz/acre		
Sweet Corn†	**Western Bean Cutworm**	0.015 - 0.03	2.9 - 5.8	44 - 22	1
	For additional information consult directions for use under field corn.				
	Armyworm **Banded Cucumber Beetle** **Beet Armyworm*** **Chinch Bugs** **Corn Earworm** **Corn Leaf Aphid** **Corn Rootworms (adults)** **Cutworms** **European Corn Borer** **Fall Armyworm (except CA) 1st and 2nd instar** **Flea Beetles** **Grasshoppers** **Oat Bird-Cherry Aphid** **Sap Beetles (adults)** **Southwestern Corn Borer** **Stalk Borer** **Tarnished Plant Bug**	0.03 - 0.05	5.8 - 9.6	22 - 13	
	Corn Silkfly (except CA)**	0.05	9.6	13	
	*Aids in control. **Suppression only. **For Ear Protection** - Begin applications either just before or at time of silking. For additional information consult directions for use under field corn. **Corn Leaf Aphid & Oat Bird-Cherry Aphid** - For optimum results, direct the spray at the aphid population so as to achieve maximum coverage of the exposed insects. Aphids not contacted by the spray, such as in whorls and leaf axils, may not be adequately controlled. **Corn Silkfly (except CA)** - Direct application to the ear zone to obtain thorough coverage of the corn silk. **Fall Armyworm (except CA)** - 1st and 2nd instar fall armyworm only. Direct the application to the ear zone to obtain thorough coverage of the corn silk.				
	† Do not apply more than 0.5 lb a.i. per acre per season.				
Tomato	**Tobacco Hornworm** **Tomato Hornworm**	0.015 - 0.03	2.9 - 5.8	44 - 22	1
	Beet Armyworm* **Cabbage Looper** **Colorado Potato Beetle** **Cutworms** **Flea Beetle** **Grasshoppers** **Potato Aphid** **Southern Armyworm** **Tomato Fruitworm** **Tomato Pinworm** **Western Yellow-Striped Armyworm** **Whitefly**	0.03 - 0.05	5.8 - 9.6	22 - 13	
	Vegetable Leafminer**	0.05	9.6	13	
	*Aids in control. **ASANA® XL is not recommended for use on the Vegetable Leafminer in Florida. Do not apply more than 0.5 lbs. a.i. per acre per season.				
Turnips	**Armyworm** **Fleabeetle** **Imported Cabbageworm**	0.03 - 0.05	5.8 - 9.6	22 - 13	7
	Do not apply more than 0.4 lbs a.i. per acre per season.				

SPECIALTY USES

Crop	Insect	Application Rate		
		High Volume Sprays		Low Volume Sprays
		lb ai/100 gal	fl oz/100 gal	lb ai/acre
Christmas tree plantings, Conifer plantations, Conifer seed orchards, Forest tree nurseries	**Balsam Twig Aphid** **Balsam Woolly Adelgid** **Cranberry Girdler (adult control)** **European Pine Sawfly** **Nantucket Pine Tip Moth and other Pine Tip Moths (except CA)** **Northern Pine Weevil** **Pales Weevil** **Pine Chafer** **Pine Conelet Bug** **Pine Needle Midge** **Pineleaf Chermid** **Red Pine Sawfly** **Redheaded Pine Sawfly** **Spittlebugs** **Spruce budworm**	0.03 - 0.05	5.8 - 9.6	0.03 - 0.05
	Spray in sufficient gallonage to obtain good coverage of entire tree.			
	Coneworm **Seed Chalcid** **Seedbug**	9.6 fl oz/100 gals water for high volume sprayers. 52 fl oz/100 gals water for low volume sprayers. 0.19 lb. ai/acre application in not less than 10 gals of water for aerial applications.		
	Apply first application within 1 week of female flower closure or peak pollen flight for Webbing Coneworm control. For other Coneworms and Seedbugs, apply first application within 30 days following female flower closure. Repeat application at intervals of 4 weeks but do not apply more than 1.6 lbs. ai per acre per year. For Seed Chalcid control, apply when all cones are pendant, and repeat at 1 - 2 week intervals for 2 or more sprays. Apply approximately 5 - 10 gals of the 9.6 fl oz/100 gal dilution per tree with high volume sprayers. With low volume sprayers apply 100 gals of the 52 fl oz/100 gal dilution per acre. Do not graze or harvest cover crop. Refer to Spray Recommendations and Precautions when applying to areas adjacent to water.			

Crop	Insect	Application Rate		Acres treated per gal of DuPont™ ASANA® XL
		lb ai/acre	fl oz/acre	
Non-Cropland (excluding public land such as forests, parks, or recreational)	**Grasshoppers** **Saltmarsh Caterpillar**	0.015 - 0.03	2.9 - 5.8	44 - 22
	Army Cutworms **Armyworms** **Chinch Bugs**	0.03 - 0.05	5.8 - 9.6	22 - 13
	Spray non-cropland adjacent to tilled areas to control migrating insects (Grasshoppers, Armyworms) which are a threat to crops. Do not apply more than 0.5 lbs. active ingredient per acre per year. Do not feed treated crop to livestock. Refer to Spray Recommendations and Precautions when applying to areas adjacent to water.			

STORAGE AND DISPOSAL

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

PESTICIDE STORAGE: Store in a secure, dry and temperate area. Store in original container. Keep container closed when not in use. Do not store near food or feed. Do not use or store around the home. Avoid contact with water. In case of spill or leak, soak up with sand, earth or synthetic absorbent (do not use alkaline absorbents) and dispose of wastes in compliance with local, State and Federal regulations.

PESTICIDE DISPOSAL: Pesticide wastes are toxic. Improper disposal of excess pesticide, spray mixture, or rinsate is a violation of Federal Law. If these wastes cannot be disposed of by use according to label instructions contact your State Pesticide or Environmental Control Agency, or the Hazardous Waste representative at the nearest EPA Regional Office for guidance.

CONTAINER HANDLING: Refer to the Net Contents section of this product's labeling for the applicable "Nonrefillable Container" or "Refillable Container" designation.

Nonrefillable Rigid Plastic and Metal Containers (Capacity Equal to or Less Than 5 Gallons): Nonrefillable container. Do not reuse or refill this container. Triple rinse container (or equivalent) promptly after emptying. Triple rinse as follows: Empty the remaining contents into application equipment or a mix tank and drain for 10 seconds after the flow begins to drip. Fill the container 1/4 full with water and recap. Shake for 10 seconds. Pour rinsate into application equipment or a mix tank or store rinsate for later use or disposal. Drain for 10 seconds after the flow begins to drip. Repeat this procedure two more times. Then, for Plastic Containers, offer for recycling if available or puncture and dispose of in a sanitary landfill, or by incineration. Do not burn, unless allowed by state and local ordinances. For Metal Containers, offer for recycling if available or reconditioning if appropriate, or puncture and dispose of in a sanitary landfill, or by other procedures approved by state and local authorities.

Nonrefillable Rigid Plastic and Metal Containers (Capacity Greater Than 5 Gallons): Nonrefillable container. Do not reuse or refill this container. Triple rinse container (or equivalent) promptly after emptying. Triple rinse as follows: Empty the remaining contents into application equipment or a mix tank. Fill the container 1/4 full with water. Replace and tighten closures. Tip container on its side and roll it back and forth, ensuring at least one complete revolution, for 30 seconds. Stand the container on its end and tip it back and forth several times. Turn the container over onto its other end and tip it back and forth several times. Empty the rinsate into application equipment or a mix tank or store rinsate for later use or disposal. Repeat this procedure two more times. Then, for Plastic Containers, offer for recycling if available or puncture and dispose of in a sanitary landfill, or by incineration. Do not burn, unless allowed by state and local ordinances. For Metal Containers, offer for recycling if available or reconditioning if appropriate, or puncture and dispose of in a sanitary landfill, or by other procedures approved by state and local authorities.

Nonrefillable Rigid Plastic and Metal Containers, e.g., Intermediate Bulk Containers [IBC] (Size or Shape Too Large to be Tipped, Rolled or Turned Upside Down): Nonrefillable container. Do not reuse or refill this container. Clean container promptly after emptying the contents from this container into application equipment or mix tank and before final disposal using the following pressure rinsing procedure. Insert a lance fitted with a suitable tank cleaning nozzle into the container and ensure that the water spray thoroughly covers the top, bottom and all sides inside the container. The nozzle manufacturer generally provides instructions for the appropriate spray pressure, spray duration and/or spray volume. If the manufacturer's instructions are not available, pressure rinse the container for at least 60 seconds using a minimum pressure of 30 PSI with a minimum rinse volume of 10% of the container volume. Drain, pour or pump rinsate into application equipment or rinsate collection system. Repeat this pressure rinsing procedure two more times. Then, for Plastic Containers, offer for recycling if available or puncture and dispose of in a sanitary landfill, or by incineration. For Metal Containers, offer for recycling if available or reconditioning if appropriate, or puncture and dispose of in a sanitary landfill, or by other procedures approved by state and local authorities.

All Refillable Containers: Refillable container. *Refilling Container:* Refill this container with DuPont™ ASANA® XL containing esfenvalerate only. Do not reuse this container for any other purpose. Cleaning before refilling is the responsibility of the refiller. Prior to refilling, inspect carefully for damage such as cracks, punctures, abrasions, worn out threads and closure devices. If damage is found, do not use container, contact DuPont at the number below for instructions. Check for leaks after refilling and before transporting. If leaks are found, do not reuse or transport container, contact DuPont at the number below for instructions. *Disposing of Container:* Do not reuse this container for any other purpose other than refilling (see preceding). Cleaning the container before final disposal is the responsibility of the person disposing of the container. To clean the container before final disposal, use the following pressure rinsing procedure. Insert a lance fitted with a suitable tank cleaning nozzle into the container and ensure that the water spray thoroughly covers the top, bottom and all sides inside the container. The nozzle manufacturer generally provides instructions for the appropriate spray pressure, spray duration and/or spray volume. If the manufacturer's instructions are not available, pressure rinse the container for at least 60 seconds using a minimum pressure of 30 PSI with a minimum rinse volume of 10% of the container volume. Drain, pour or pump rinsate into application equipment or rinsate collection system. Repeat this pressure rinsing procedure two more times. Then, for Plastic Containers, offer for recycling if available or puncture and dispose of in a sanitary landfill, or by incineration. Do not burn, unless allowed by state and local ordinances. For Metal Containers, offer for recycling if available or reconditioning if appropriate, or puncture and dispose of in a sanitary landfill, or by other procedures approved by state and local authorities.

Do not transport if container is damaged or leaking. If the container is damaged, leaking or obsolete, or in the event of a major spill, fire or other emergency, contact DuPont at 1-800-441-3637, day or night.

SL - 1542 030310 04-23-10

LIMITATION OF WARRANTY AND LIABILITY

NOTICE: Read This Limitation of Warranty and Liability Before Buying or Using This Product. If the Terms Are Not Acceptable, Return the Product at Once, Unopened, and the Purchase Price Will Be Refunded.

It is impossible to eliminate all risks associated with the use of this product. Such risks arise from weather conditions, soil factors, off target movement, unconventional farming techniques, presence of other materials, the manner of use or application, or other unknown factors, all of which are beyond the control of DuPont. These risks can cause: ineffectiveness of the product; crop injury, or; injury to non-target crops or plants.

DuPont does not agree to be an insurer of these risks. TO THE FULLEST EXTENT PERMITTED BY LAW, WHEN YOU BUY OR USE THIS PRODUCT, YOU AGREE TO ACCEPT THESE RISKS.

DuPont warrants that this product conforms to the chemical description on the label thereof and is reasonably fit for the purpose stated in the Directions for Use, subject to the inherent risks described above, when used in accordance with the Directions for Use under normal conditions.

DUPONT MAKES NO OTHER EXPRESS OR IMPLIED WARRANTY OF FITNESS OR OF MERCHANTABILITY OR ANY OTHER EXPRESS OR IMPLIED WARRANTY.

TO THE FULLEST EXTENT PERMITTED BY LAW, IN NO EVENT SHALL DUPONT OR SELLER BE LIABLE FOR ANY INCIDENTAL, CONSEQUENTIAL OR SPECIAL DAMAGES RESULTING FROM THE USE OR HANDLING OF THIS PRODUCT. BUYER'S OR USER'S BARGAINED-FOR EXPECTATION IS CROP PROTECTION. THE EXCLUSIVE REMEDY OF THE USER OR BUYER AND THE EXCLUSIVE LIABILITY OF DUPONT OR SELLER, FOR ANY AND ALL CLAIMS, LOSSES, INJURIES OR DAMAGES (INCLUDING CLAIMS BASED ON BREACH OF WARRANTY OR CONTRACT, NEGLIGENCE, TORT OR STRICT LIABILITY), WHETHER FROM FAILURE TO PERFORM OR INJURY TO CROPS OR OTHER PLANTS, AND RESULTING FROM THE USE OR HANDLING OF THIS PRODUCT, SHALL BE THE RETURN OF THE PURCHASE PRICE OF THE PRODUCT, OR AT THE ELECTION OF DUPONT OR SELLER, THE REPLACEMENT OF THE PRODUCT.

DuPont or its Ag Retailer must have prompt notice of any claim so that an immediate inspection of buyer's or user's growing crops can be made. Buyer and all users shall promptly notify DuPont or a DuPont Ag Retailer of any claims, whether based on contract, negligence, strict liability, other tort or otherwise or be barred from any remedy.

This Limitation of Warranty and Liability may not be amended by any oral or written agreement.

For product information call: 1-888-6-DUPONT

Internet address: http://cropprotection.dupont.com/

Product Use Recommendation

5413 - 2308466 **(Rec No. 2308466)**

LEAVITT AG. INC. **560 N. 8th St. Ste. B** **Brawley, CA 92227** **Phone: 760-344-5227** **Fax: 760-344-5272**	Proposed Date / Timing **2014-10-14**	Expire Date **2015-10-14**	PCA & License **Matthew Leavitt 72862**
	Applicator **Farm Aviation Inc** **P.O. Box 1690** **Brawley, CA 92227** **Phone: 760-351-2462** **Cell: 760-455-8081** **Fax: 760-351-9398**		Grower & Permit Number **CAMERON RANCHES, PAUL** **131233a** **P. O. Box 1** **Brawley, CA 92227** **Phone:**

County	Site Commodity	Method	Proposed	Treated	Tank Volume	No. Tanks	Spray Volume
Imperial	**SUGARBEET**	**Air**	**69 Acres**	**69 Acres**			**5 Ga**

Site ID / STR	Location	Planted Area	Proposed Area	Treated Area	Row	Band
7TH13 19,13S,13E S	THISTLE 7-13	69 Acres	69 Acres	69 Acres		

* * * **ALWAYS READ AND FOLLOW LABEL DIRECTIONS** * * *

* * In addition, adhere to all State and local regulations governing the use of these products * *

The execution of this recommendation certifies that alternative and mitigation measures that would substantially lessen any significant adverse impact on the environment have been considered and, if feasible, adopted.

Product Name	Signal Word	Labeled Commodity	Pest	Rate	Per Full Tank	Mat. Req.
Monterey Ag Monterey Nutrient Buffer 10-12-0 ZNP (17545-50020) 10N N/AP N/AFe N/AMn N/AZn	Caution	Beet, Sugar	Na	1.855 Floz / A		1 Ga
Dow Lorsban Advanced (62719-591) (40.20% - Chlorpyrifos O,o-Diethyl- O-(3,5,6-)	Warning	Beet, Sugar	Beetle, Flea	1.739 Pt / A		15 Ga
DuPont DuPont Asana XL Insecticide (352-515) (8.40% - Esfenvalerate)	Warning	Beet, Sugar	Armyworm, Beet	9.275 Floz / A		5 Ga

Pre-Harvest Interval : 30 Days

Re-Entry Interval : 24 Hours

Restrictions: Avoid Drift -- Posting Required -- See Label Regarding Feeding/Grazing

Species Toxic To: Fish; Bees; Aquatic Organisms; Aquatic Invertebrates; Small Mammals; Bird

Criteria Used For Determining Recommendation: Field Observation

Advisor Comments: Rockwood Supplies

I certify that the product recommendations contained in this document are consistent with my review and understanding of the product notices beginning on the following page and the product(s) label.

Signature : _____

Date : 2014-10-13

Matthew Leavitt PCA Lic. #72862

Rec No. 2308466

This document has warning(s) and/or manufacturer approved label notice(s) that were not printed. Notices and Warnings are available upon request.

Additional Notices **Rec No. 2308466**

To determine if the product in your possession is the "Old" label version or "newer" label version, first verify that the Dow Logo on the product container is either a green circle or a red diamond next to the words Dow AgroSciences.

The green circle indicates the "Old" label version and the red diamond indicates the newer label version.
Select the appropriate label version based on the product in your possession.

Product use and requirements vary based on which logo is on the product you are applying so please read and follow the corresponding label.

Application Conditions **Rec No. 2308466**

Lorsban Advanced:
- Broadcast

DuPont Asana XL Insecticide:
- Other cases
- NA

Specimen Label

RESTRICTED USE PESTICIDE

For retail sale to and use only by Certified Applicators or persons under their direct supervision and only for those uses covered by the Certified Applicator's certification.

Dow AgroSciences

Lorsban® Advanced

INSECTICIDE

®Trademark of The Dow Chemical Company ("Dow") or an affiliated company of Dow

For control of listed insects infesting certain field, fruit, nut, and vegetable crops.

Group	1B	INSECTICIDE

Active Ingredient:
chlorpyrifos: O,O-diethyl-O-(3,5,6-trichloro-2-pyridinyl) phosphorothioate 40.2%
Other Ingredients 59.8%
Total 100.0%

Contains 3.755 lb of chlorpyrifos per gallon.
Contains petroleum distillates.

Precautionary Statements

Hazard to Humans and Domestic Animals

EPA Reg. No. 62719-591

WARNING

May Be Fatal If Swallowed • Causes Skin Irritation • Causes Moderate Eye Irritation • Harmful If Inhaled • Prolonged Or Frequently Repeated Skin Contact May Cause Allergic Reactions In Some Individuals

Do not get on skin or on clothing. Avoid contact with eyes and breathing vapor or spray mist. Wash thoroughly with soap and water after handling and before eating, drinking, chewing gum, using tobacco or using the toilet.

First Aid

Organophosphate

If swallowed: Immediately call a poison control center or doctor. Do not induce vomiting unless told to do so by a poison control center or doctor. Do not give **any** liquid to the person. Do not give anything by mouth to an unconscious person.

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 advice.

If in eyes: Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye. Call a poison control center or doctor for treatment advice.

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 further treatment advice.

Note to physician: Chlorpyrifos is a cholinesterase inhibitor. Treat symptomatically. If exposed, plasma and red blood cell cholinesterase tests may indicate significance of exposure (baseline data are useful). Atropine, only by injection, is the preferable antidote. Oximes, such as 2-PAM/protopam, may be therapeutic if used early; however, use only in conjunction with atropine. In case of severe acute poisoning, use antidote immediately after establishing an open airway and respiration.

First Aid (Cont.)

Note to physician: Contains petroleum distillate – vomiting may cause aspiration pneumonia.

Have the product container or label with you when calling a poison control center or doctor, or going for treatment. You may also contact 1-800-992-5994 for emergency medical treatment information.

Personal Protective Equipment (PPE)

Materials that are chemical resistant to this product are barrier laminate and viton ≥14 mils.

Mixers and loaders using a mechanical transfer loading system and applicators using aerial application equipment must wear:
- Long-sleeved shirt and long pants
- Shoes and socks

In addition to the above, **mixers and loaders** using a mechanical transfer loading system must wear:
- Chemical-resistant gloves
- Chemical-resistant apron
- A NIOSH-approved dust mist filtering respirator with MSHA/NIOSH approval number prefix TC-21C or a NIOSH-approved respirator with any R, P, or HE filter

See Engineering Controls for additional requirements.

All **other mixers, loaders, applicators and handlers** must wear:
- Coveralls over long-sleeved shirt and long pants
- Chemical-resistant gloves
- Chemical-resistant apron when mixing or loading or exposed to the concentrate
- Chemical-resistant footwear plus socks
- Chemical-resistant headgear for overhead exposure
- A NIOSH-approved dust mist filtering respirator with MSHA/NIOSH approval number prefix TC-21C or a NIOSH-approved respirator with any R, P, or HE filter.

Discard clothing and other absorbent materials that have been drenched or heavily contaminated with this product's concentrate. Do not reuse them. Follow manufacturer's instructions for cleaning/maintaining PPE. If no such instructions for washables exist, use detergent and hot water. Keep and wash PPE separately from other laundry.

Engineering Controls

Mixers and loaders supporting aerial applications must use a mechanical transfer system that meets the requirements listed in the Worker Protection Standard (WPS) for agricultural pesticides [40 CFR 170.240(d)(4)] for dermal protection, and must:
- Wear the personal protective equipment required above for mixers/loaders
- Wear protective eyewear if the system operates under pressure, and
- Be provided and have immediately available for use in an emergency, such as broken package, spill, or equipment breakdown: coveralls, chemical resistant footwear and chemical-resistant headgear if overhead exposure

Pilots must use an enclosed cockpit in a manner that meets the requirements listed in the WPS for agricultural pesticides [40 CFR 170.240(d)(6).

Use of human flaggers is prohibited. Mechanical flagging equipment must be used.

When handlers use closed cab motorized ground application equipment in a manner that meets the requirements listed in the WPS for agricultural pesticides [40 CFR 170.240(d)(4-6)], the handler PPE requirements may be reduced or modified as specified in the WPS.

User Safety Recommendations

Users should:
- Wash hands before eating, drinking, chewing gum, using tobacco, or using the toilet.
- Remove clothing/PPE immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing.
- Remove PPE immediately after handling this product. Wash the outside of gloves before removing. As soon as possible, wash thoroughly and change into clean clothing.

Environmental Hazards

This pesticide is toxic to fish, aquatic invertebrates, small mammals and birds. Do not apply directly to water, or to areas where surface water is present, or to intertidal areas below the mean high water mark. Drift and runoff from treated areas may be hazardous to aquatic organisms in water adjacent to treated areas. Do not contaminate water when disposing of equipment washwaters or rinsate. This product is highly toxic to bees exposed to direct treatment or residues on blooming crops or weeds. Do not apply this product or allow it to drift to blooming crops or weeds if bees are visiting the treatment area.

DUPONT®

DuPont™ Asana® XL

insecticide

RESTRICTED USE PESTICIDE
DUE TO TOXICITY TO FISH AND AQUATIC ORGANISMS.
For retail sale to and use only by Certified Applicators or persons under their direct supervision and only for those uses covered by the Certified Applicator's certification.

DUPONT®

GROUP	3	INSECTICIDE

DuPont™ Asana® XL

insecticide

This product contains 0.66 lbs. Active Ingredient per gallon.
0.66 Emulsible Concentrate

Active Ingredient	*By Weight*
Esfenvalerate (S)-cyano (3-phenoxyphenyl) methyl (S)-4-chloro-alpha-(1-methylethyl) benzeneacetate	8.4%
*Inert Ingredients**	91.6%
TOTAL	100 %

* CONTAINS XYLENE RANGE AROMATIC SOLVENT

EPA Reg. No. 352-515 EPA Est. No. _____

Nonrefillable Container
Net: _____
OR
Refillable Container
Net: _____

KEEP OUT OF REACH OF CHILDREN

WARNING AVISO

Si usted no entiende la etiqueta, busque a alguien para que se la explique a usted en detalle. (If you do not understand this label, find someone to explain it to you in detail.)

FIRST AID

IF SWALLOWED
Call a poison control center or doctor immediately for treatment advice. Do not give any liquid to the person. Do not induce vomiting unless told to do so by a poison control center or a doctor. Do not give anything by mouth to an unconscious person.

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 further treatment advice.

IF IN EYES
Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eyes. Call a poison control center for treatment advice.

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 advice.

NOTE TO PHYSICIAN
If on skin, after drying apply vitamin E cream or oil if available. If not available, apply vegetable oil liberally over painful areas. The oil or cream may be used repeatedly until relief is achieved.
Contains xylene range aromatic solvent - vomiting may cause aspiration pneumonia.
Have the product container or label with you when calling a poison control center or doctor, or going for treatment. You may also contact 1-800-441-3637 for emergency medical treatment information.

PRECAUTIONARY STATEMENTS

HAZARDS TO HUMANS AND DOMESTIC ANIMALS

WARNING ! May be fatal if swallowed. Harmful if inhaled. Do not get in eyes, on skin, or on clothing. Avoid breathing vapor or spray mist. Wash thoroughly with soap and water after handling and before eating, drinking, chewing gum, using tobacco or using the toilet. Remove contaminated clothing and wash clothing before reuse.
For medical emergencies involving this product, call toll free 1-800-441-3637.

PERSONAL PROTECTIVE EQUIPMENT

Some materials that are chemical-resistant to this product are listed below. If you want more options, follow the instructions for category E on an EPA chemical-resistance category selection chart.

Applicators and other handlers must wear:
Long-sleeved shirt and long pants.
Chemical-resistant gloves, such as Barrier Laminate or Neoprene Rubber or Nitrile Rubber or Viton.
Shoes plus socks.
Protective eyewear.

Discard clothing or other absorbent materials that have been drenched or heavily contaminated with this product's concentrate. Do not reuse them. Follow manufacturer's instructions for cleaning/maintaining PPE. If no such instructions for washables, use detergent and hot water. Keep and wash PPE separately from other laundry.

USER SAFETY RECOMMENDATIONS

USERS SHOULD: Wash thoroughly with soap and water after handling and before eating, drinking, chewing gum, using tobacco or using the toilet. Remove clothing immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing.

ENGINEERING CONTROL STATEMENTS

When handlers use closed systems, enclosed cabs, or aircraft in a manner that meets the requirements listed in the Worker Protection Standard (WPS) for agricultural pesticides [40 CFR part 170.240 (d)(4-6)], the handler PPE requirements may be reduced or modified as specified in the WPS.

ENVIRONMENTAL HAZARDS

This pesticide is extremely toxic to fish and aquatic invertebrates. Do not apply directly to water, or 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 areas may be hazardous to aquatic organisms in neighboring areas. Do not contaminate water when cleaning equipment or when disposing of equipment washwaters.

This product is highly toxic to bees exposed to direct treatment or residues on blooming crops or weeds. Do not apply this product or allow it to drift to blooming crops if bees are visiting the treatment area.

WILDLIFE PROTECTION IS EVERYONE'S RESPONSIBILITY

Monterey Nutrient Buffer 10-12-0 ZNP

CA Reg. No. 17545-50020

COMPOSITION AS SPRAY ADJUVANT

PRINCIPAL FUNCTIONING AGENTS:
Phosphoric acid, iron sulfate, manganese sulfate, zinc sulfate, and coconut imidazoline sodium carboxylate 28.9%
CONSTITUENTS INEFFECTIVE AS SPRAY ADJUVANT: 71.1%
TOTAL: 100.0%

COMPOSITION AS NUTRIENT SPRAY

GUARANTEED ANALYSIS
10-12-0

Total Nitrogen (N) 10.0%
10.0% Urea Nitrogen
Available Phosphoric Acid (P_2O_5) ... 12.0%
Manganese (Mn) 1.0%
Zinc (Zn) 2.0%

Derived from urea, phosphoric acid, manganese sulfate and zinc sulfate.

Information regarding the contents and levels of metals in this product is available on the Internet at http://www.regulatory-info-monterey.com

KEEP OUT OF REACH OF CHILDREN

CAUTION

FIRST AID

IF IN EYES: Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing. Call a Poison Control Center or doctor for treatment advice.

IF ON SKIN: Take off contaminated clothing. Rinse skin immediately with plenty of water for 15-20 minutes. 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.

ATTENTION: This product contains chemicals known to the State of California to cause cancer and birth defects or other reproductive harm.

PRECAUTIONARY STATEMENTS

HAZARDS TO HUMANS AND DOMESTIC ANIMALS

CAUTION: Causes skin irritation. Harmful if swallowed. Avoid contact with skin, eyes or clothing. Wear long sleeved shirt, long pants, and shoes plus socks when mixing or handling concentrate. Wash thoroughly with soap and water after handling and before eating, drinking, chewing gum, or using tobacco. Remove and wash contaminated clothing before reuse.

ENVIRONMENTAL HAZARDS

Do not contaminate water when cleaning equipment or disposing of equipment washwaters.

DIRECTIONS FOR USE

MONTEREY NUTRIENT BUFFER 10-12-0 ZNP is designed specifically as a clear, foliar nutrient-buffer system containing nitrogen, phosphorus, zinc and manganese. MONTEREY NUTRIENT BUFFER 10-12-0 ZNP, when used as directed, acidifies alkaline waters while providing a well balanced supply of foliar nutrients. Urea is utilized as the sole source of nitrogen to enhance uptake of all contained nutrients.

MONTEREY NUTRIENT BUFFER 10-12-0 ZNP is a superior acidifying-buffering agent. Normal rates of 1-2 pints per 100 gallons of spray mix will lower the pH of alkaline water to levels more optimal for maximum performance of most insecticides. Certain fungicides may also benefit from the addition of MONTEREY NUTRIENT BUFFER 10-12-0 ZNP.

Read and follow the precautions, restrictions and recommendations on the labels of pesticides used with MONTEREY NUTRIENT BUFFER 10-12-0 ZNP. Use according to the most restrictive label directions for each product in any tank mix.

COMPATIBILITY: MONTEREY NUTRIENT BUFFER 10-12-0 ZNP is compatible with most insecticides and minor elements with the exception of compounds containing sabadilla used on citrus. However, if the desired combination has not been previously used, a compatibility test is recommended. Caution should be used with copper fungicides as this material may increase their solubility.

MIXING: Shake well before using. Fill spray tank ½ full of water and begin agitation. Add the recommended amount of MONTEREY NUTRIENT BUFFER 10-12-0 ZNP. Add products as directed by label or in the following sequence and continue filling tank: (1) Dry flowables or water dispersing granules, (2) Wettable powders, (3) Flowables, (4) Solutions, (5) Emulsifiable concentrates. Continue agitation until spray solution is completely mixed. Continuous agitation of finished spray is recommended. If spray solution has been allowed to stand, thoroughly agitate and remix before application. Thoroughly rinse the spray system with clean water after use to reduce corrosion.

RECOMMENDATIONS: A wetting agent or spreader should be used when applying MONTEREY NUTRIENT BUFFER 10-12-0 ZNP to prevent beading of droplets. Avoid making applications to crops stressed from heat, drought, salinity, etc.

MONTEREY NUTRIENT BUFFER 10-12-0 ZNP may be used as a foliar nutrient spray or buffer adjuvant on all field, fiber, forage, fruit, nut and vegetable crops.

Alfalfa: For seed formation, apply 1-2 quarts per acre in 10-30 gallons water just prior to bloom, followed by 3-4 applications every 10 days.

Asparagus, spinach, carrots, celery, garlic, onions, peppers, potatoes, artichokes: Apply 1-2 quarts per acre as needed.

Barley, wheat, rice, milo, oats: Apply 1-2 quarts per acre during early tiller to early boot stages of growth.

Beans, peas, lentils: Apply 1-2 quarts per acre just prior to bloom stage.

Boysenberries, blackberries, strawberries: Apply 1-2 quarts per acre as needed.

Specimen Label

RESTRICTED USE PESTICIDE

For retail sale to and use only by Certified Applicators or persons under their direct supervision and only for those uses covered by the Certified Applicator's certification.

Dow AgroSciences

Lorsban® Advanced

INSECTICIDE

®Trademark of The Dow Chemical Company ("Dow") or an affiliated company of Dow

For control of listed insects infesting certain field, fruit, nut, and vegetable crops.

Group	1B	INSECTICIDE

Active Ingredient:
chlorpyrifos: O,O-diethyl-O-(3,5,6-trichloro-2-pyridinyl) phosphorothioate 40.2%
Other Ingredients 59.8%
Total 100.0%

Contains 3.755 lb of chlorpyrifos per gallon.
Contains petroleum distillates.

Precautionary Statements

Hazard to Humans and Domestic Animals

EPA Reg. No. 62719-591

WARNING

May Be Fatal If Swallowed • Causes Skin Irritation • Causes Moderate Eye Irritation • Harmful If Inhaled • Prolonged Or Frequently Repeated Skin Contact May Cause Allergic Reactions In Some Individuals

Do not get on skin or on clothing. Avoid contact with eyes and breathing vapor or spray mist. Wash thoroughly with soap and water after handling and before eating, drinking, chewing gum, using tobacco or using the toilet.

First Aid

Organophosphate
If swallowed: Immediately call a poison control center or doctor. Do not induce vomiting unless told to do so by a poison control center or doctor. Do not give **any** liquid to the person. Do not give anything by mouth to an unconscious person.
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 advice.
If in eyes: Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye. Call a poison control center or doctor for treatment advice.
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 further treatment advice.
Note to physician: Chlorpyrifos is a cholinesterase inhibitor. Treat symptomatically. If exposed, plasma and red blood cell cholinesterase tests may indicate significance of exposure (baseline data are useful). Atropine, only by injection, is the preferable antidote. Oximes, such as 2-PAM/protopam, may be therapeutic if used early; however, use only in conjunction with atropine. In case of severe acute poisoning, use antidote immediately after establishing an open airway and respiration.

First Aid (Cont.)

Note to physician: Contains petroleum distillate – vomiting may cause aspiration pneumonia.

Have the product container or label with you when calling a poison control center or doctor, or going for treatment. You may also contact 1-800-992-5994 for emergency medical treatment information.

Personal Protective Equipment (PPE)

Materials that are chemical resistant to this product are barrier laminate and viton ≥14 mils.

Mixers and loaders using a mechanical transfer loading system and applicators using aerial application equipment must wear:
- Long-sleeved shirt and long pants
- Shoes and socks

In addition to the above, **mixers and loaders** using a mechanical transfer loading system must wear:
- Chemical-resistant gloves
- Chemical-resistant apron
- A NIOSH-approved dust mist filtering respirator with MSHA/NIOSH approval number prefix TC-21C or a NIOSH-approved respirator with any R, P, or HE filter

See Engineering Controls for additional requirements.

All **other mixers, loaders, applicators and handlers** must wear:
- Coveralls over long-sleeved shirt and long pants
- Chemical-resistant gloves
- Chemical-resistant apron when mixing or loading or exposed to the concentrate
- Chemical-resistant footwear plus socks
- Chemical-resistant headgear for overhead exposure
- A NIOSH-approved dust mist filtering respirator with MSHA/NIOSH approval number prefix TC-21C or a NIOSH-approved respirator with any R, P, or HE filter.

Discard clothing and other absorbent materials that have been drenched or heavily contaminated with this product's concentrate. Do not reuse them. Follow manufacturer's instructions for cleaning/maintaining PPE. If no such instructions for washables exist, use detergent and hot water. Keep and wash PPE separately from other laundry.

Engineering Controls

Mixers and loaders supporting aerial applications must use a mechanical transfer system that meets the requirements listed in the Worker Protection Standard (WPS) for agricultural pesticides [40 CFR 170.240(d)(4)] for dermal protection, and must:

- Wear the personal protective equipment required above for mixers/loaders
- Wear protective eyewear if the system operates under pressure, and
- Be provided and have immediately available for use in an emergency, such as broken package, spill, or equipment breakdown: coveralls, chemical resistant footwear and chemical-resistant headgear if overhead exposure

Pilots must use an enclosed cockpit in a manner that meets the requirements listed in the WPS for agricultural pesticides [40 CFR 170.240(d)(6).

Use of human flaggers is prohibited. Mechanical flagging equipment must be used.

When handlers use closed cab motorized ground application equipment in a manner that meets the requirements listed in the WPS for agricultural pesticides [40 CFR 170.240(d)(4-6)], the handler PPE requirements may be reduced or modified as specified in the WPS.

User Safety Recommendations

Users should:
- Wash hands before eating, drinking, chewing gum, using tobacco, or using the toilet.
- Remove clothing/PPE immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing.
- Remove PPE immediately after handling this product. Wash the outside of gloves before removing. As soon as possible, wash thoroughly and change into clean clothing.

Environmental Hazards

This pesticide is toxic to fish, aquatic invertebrates, small mammals and birds. Do not apply directly to water, or to areas where surface water is present, or to intertidal areas below the mean high water mark. Drift and runoff from treated areas may be hazardous to aquatic organisms in water adjacent to treated areas. Do not contaminate water when disposing of equipment washwaters or rinsate. This product is highly toxic to bees exposed to direct treatment or residues on blooming crops or weeds. Do not apply this product or allow it to drift to blooming crops or weeds if bees are visiting the treatment area.

Directions for Use

Restricted Use Pesticide

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.
Read all Directions for Use carefully before applying.

This product cannot be reformulated or repackaged into other end-use products.

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. For any requirements specific to your state or tribe, consult the agency responsible for pesticide regulation.

Agricultural Use Requirements

Use this product only in accordance with its labeling and with the Worker Protection Standard, 40 CFR Part 170. This Standard contains requirements for the protection of agricultural workers on farms, forests, nurseries, and greenhouses, and handlers of agricultural pesticides. It contains requirements for training, decontamination, notification, and emergency assistance. It also contains specific instructions and exceptions pertaining to the statements on this label about personal protective equipment (PPE) and restricted-entry interval. The requirements in this box only apply to uses of this product that are covered by the Worker Protection Standard.

Do not enter or allow entry into treated areas during the restricted entry interval (REI). The REI for each crop is listed in the directions for use associated with each crop..

Exception: If the product is soil-injected or soil-incorporated, the Worker Protection Standard, under certain circumstances, allows workers to enter the treated area if there will be no contact with anything that has been treated.

Certified crop advisors or persons entering under their direct supervision under certain circumstances may be exempt from the early reentry requirements pursuant to 40 CFR Part 170.

PPE required for early entry into treated areas that is permitted under the Worker Protection Standard and involves contact with anything that has been treated, such as plants, soil, or water, is:

- Coveralls over short-sleeved shirt and short pants
- Chemical-resistant gloves made out of any waterproof material
- Chemical-resistant footware plus socks
- Chemical-resistant headgear for overhead exposure

Notify workers of the application by warning them orally and by posting warning signs at entrances to treated areas.

Storage and Disposal

Do not contaminate water, food, or feed by storage and disposal.
Pesticide Storage: Store in original container in secured dry storage area. Prevent cross-contamination with other pesticides and fertilizers.
Pesticide Disposal: Wastes resulting from the use of this product must be disposed of on site or at an approved waste disposal facility.

Nonrefillable containers 5 gallons or less:
Container Handling: Nonrefillable container. Do not reuse or refill this container.
Triple rinse or pressure rinse container (or equivalent) promptly after emptying. **Triple rinse** as follows: Empty the remaining contents into application equipment or a mix tank and drain for 10 seconds after the flow begins to drip. Fill the container 1/4 full with water and recap. Shake for 10 seconds. Pour rinsate into application equipment or a mix tank or store rinsate for later use or disposal. Drain for 10 seconds after the flow begins to drip. Repeat this procedure two more times. **Pressure rinse** as follows: Empty the remaining contents into application equipment or a mix tank and continue to drain for 10 seconds after the flow begins to drip. Hold container upside down over application equipment or mix tank or collect rinsate for later use or disposal. Insert pressure rinsing nozzle in the side of the container, and rinse at about 40 psi for at least 30 seconds. Drain for 10 seconds after the flow begins to drip. Then offer for recycling if available or puncture and dispose of in a sanitary landfill, or by incineration, or by other procedures allowed by state and local authorities.

Refillable containers 5 gallons or larger:
Container Handling: Refillable container. Refill this container with pesticide only. Do not reuse this container for any other purpose. Cleaning the container before final disposal is the responsibility of the person disposing of the container. Cleaning before refilling is the responsibility of the refiller. To clean the container before final disposal, empty the remaining contents from this container into application equipment or a mix tank. Fill the container about 10% full with water and, if possible, spray all sides while adding water. If practical, agitate

Storage and Disposal (Cont.)

vigorously or recirculate water with the pump for two minutes. Pour or pump rinsate into application equipment or rinsate collection system. Repeat this rinsing procedure two more times. Then offer for recycling if available, or puncture and dispose of in a sanitary landfill, or by incineration, or by other procedures allowed by state and local authorities.

Nonrefillable containers 5 gallons or larger:
Container Handling: Nonrefillable container. Do not reuse or refill this container.
Triple rinse or pressure rinse container (or equivalent) promptly after emptying. **Triple rinse** as follows: Empty the remaining contents into application equipment or a mix tank. Fill the container 1/4 full with water. Replace and tighten closures. Tip container on its side and roll it back and forth, ensuring at least one complete revolution, for 30 seconds. Stand the container on its end and tip it back and forth several times. Turn the container over onto its other end and tip it back and forth several times. Empty the rinsate into application equipment or a mix tank or store rinsate for later use or disposal. Repeat this procedure two more times. **Pressure rinse** as follows: Empty the remaining contents into application equipment or a mix tank and continue to drain for 10 seconds after the flow begins to drip. Hold container upside down over application equipment or mix tank or collect rinsate for later use or disposal. Insert pressure rinsing nozzle in the side of the container, and rinse at about 40 psi for at least 30 seconds. Drain for 10 seconds after the flow begins to drip. Then offer for recycling if available, or puncture and dispose of in a sanitary landfill, or by incineration, or by other procedures allowed by state and local authorities.

Product Information

Lorsban® Advanced insecticide is an emulsion in water for use in listed crops. This product resists washoff once it is dry. Target pests and application rates are provided in the accompanying tables.

Use Precautions and Restrictions

Insect control may be reduced at low spray volumes under high temperature and wind conditions.

Some reduction in insect control may occur under unusually cool conditions.

Flood irrigation: To avoid contamination of irrigation tail waters, do not flood irrigate within 24 hours following a soil surface or foliar application of Lorsban Advanced.

Do not aerially apply this product in Mississippi.

Insecticide Resistance Management (IRM)
Lorsban Advanced contains a Group 1B insecticide. Insect/mite biotypes with acquired resistance to Group 1B may eventually dominate the insect/mite population if Group 1B insecticides are used repeatedly in the same field or in successive years as the primary method of control for targeted species. This may result in partial or total loss of control of those species by Lorsban Advanced or other Group 1B insecticides.

To delay development of insecticide resistance:

- Avoid consecutive use of insecticides with the same mode of action (same insecticide group) on the same insect species.
- Use tank mixtures or premix products containing insecticides with different modes of action (different insecticide groups) provided the products are registered for the intended use.
- Base insecticide use upon comprehensive Integrated Pest Management (IPM) programs.
- Monitor treated insect populations in the field for loss of effectiveness.
- Contact your local extension specialist, certified crop advisor, and or manufacturer for insecticide resistance management and/or IPM recommendations for the specific site and resistant pest problems.
- For further information or to report suspected resistance, you may contact Dow AgroSciences by calling 800-258-3033.

Spray Drift Management
Do not allow spray to drift from the application site and contact people, structures people occupy at any time and the associated property, parks and recreation areas, non-target crops, aquatic and wetland sites, woodlands, pastures, rangelands, or animals.

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 is responsible for considering all of these factors when making the decision to apply this product.

Observe the following precautions when spraying Lorsban Advanced adjacent to permanent bodies of water such as rivers, natural ponds, lakes, streams, reservoirs, marshes, estuaries, and commercial fish ponds.

The following treatment setbacks or buffer zones must be utilized for applications around the above-listed aquatic areas with the following application equipment:

Application Method	Required Setback (Buffer Zone) (feet)
ground boom	25
chemigation	25
orchard airblast	50
aerial (fixed wing or helicopter)	150

Making applications when wind is blowing away from sensitive areas is the most effective way to reduce the potential for adverse effects.

The buffer distances specified in the below table are the distances in feet that must exist to separate sensitive sites from the targeted application site. Buffers are measured from the edge of the sensitive site to the edge of the application site.

Sensitive sites are areas frequented by non-occupational bystanders (especially children). These include residential lawns, pedestrian sidewalks, outdoor recreational areas such as school grounds, athletic fields, parks and all property associated with buildings occupied by humans for residential or commercial purposes. Sensitive sites include homes, farmworker housing, or other residential buildings, schools, daycare centers, nursing homes, and hospitals. Non-residential agricultural buildings, including barns, livestock facilities, sheds, and outhouses are not included in this prohibition.

Application Rate (lb ai/A)	Nozzle Droplet Type	Required Setback (Buffer Zones) (feet)		
		Aerial	Airblast	Ground
>0.5 – 1	coarse or very coarse	10	10	10
>0.5 – 1	medium	25	10	10
>1 – 2	coarse or very coarse	50	10	10
>1 – 2	medium	80	10	10
>2 – 3	coarse or very coarse	80[1]	10	10
>2 – 3	medium	100[1]	10	10
>3 – 4	medium or coarse	NA[2]	25	10
>4	medium or coarse	NA	50	10

[1]Aerial application of greater than 2 lb ai/A is only permitted for Asian Citrus Psylla control, up to 2.3 lb ai/A.
[2]NA is not allowed.

Only pesticide handlers are permitted in the setback area during application of this product. Do not apply this product if anyone other than a mixer, loader, or applicator, is in the setback area. Exception: Vehicles and persons riding bicycles that are passing through the setback area on public or private roadways are permitted.

Follow these spray drift **best management practices** to avoid off-target drift movement from applications.

Aerial Application

- The boom width must not exceed 75% of the wingspan or 90% of the rotor blade.
- Nozzles must always point backward, parallel with the air stream, and never be pointed downward more than 45 degrees.
- Nozzles must produce a medium or coarser droplet size (255 to 340 microns volume median diameter) per ASABE Standard 572.1 under application conditions. Airspeed, pressure, and nozzle angle can all effect droplet size. See manufacturer's catalog or USDA/NAAA Applicator's Guide for spray size quality ratings.
- Do not make applications at a height greater than 10 feet above the top of the target plants unless a greater height is required for aircraft safety. Making applications at the lowest height that is safe reduces exposure of droplets to evaporation and wind.
- Use upwind swath displacement and apply only when wind speed is 3 to 10 mph as measured by an anemometer. Do not apply product when wind speed exceeds 10 mph.
- If application includes a no-spray zone, do not release spray at a height greater than 10 feet above the ground or crop canopy.

Where states have more stringent regulations, they must be observed.

The applicator should be familiar with and take into account the information covered in the Aerial Drift Reduction Advisory.

Aerial Drift Reduction Advisory
This section is advisory in nature and does not supercede the mandatory label requirements.

Information on Droplet Size: The most effective way to reduce drift potential is to apply large droplets. The best drift management strategy is to apply the largest droplets that provide sufficient coverage and control. Applying larger droplets reduces drift potential, but will not prevent adverse effects from drift if applications are made improperly, or under unfavorable environmental conditions (see Wind, Temperature and Humidity, and Temperature Inversions).

Controlling Droplet Size:

- Volume - Use high flow rate nozzles to apply the highest practical spray volume. Nozzles with higher rated flows produce larger droplets.
- Pressure - Do not exceed the nozzle manufacturer's specified pressures. For many nozzle types, lower pressure produces larger droplets. When higher flow rates are needed, use higher flow rate nozzles instead of increasing pressure.
- Number of nozzles - Use the minimum number of nozzles that provide uniform coverage.
- Nozzle orientation - Orienting nozzles so that the spray is released parallel to the airstream produces larger droplets than other orientations and is the best practice. Significant deflection from horizontal will reduce droplet size and increase drift potential.
- Nozzle type - Use a nozzle type that is designed for the intended application. With most nozzle types, narrower spray angles produce larger droplets. Consider using low-drift nozzles. Solid stream nozzles oriented straight back produce the largest droplets and the lowest drift.

Boom Length: For some use patterns, reducing the effective boom length to less than 3/4 of the wingspan or rotor length may further reduce drift without reducing swath width.

Application Height: Do not make applications at a height greater than 10 feet above the top of the target plants unless a greater height is required for aircraft safety. Making applications at the lowest height that is safe reduces exposure of droplets to evaporation and wind.

Swath Adjustment: When applications are made with a crosswind, the swath will be displaced downwind. Therefore, on the up and downwind edges of the field, the applicator should compensate for this displacement by adjusting the path of the aircraft upwind. Increase swath adjustment distance with increasing drift potential (higher wind, smaller drops, etc.).

Wind: Drift potential is lowest between wind speeds of 2 to 10 mph. However, many factors, including droplet size and equipment type, determine drift potential at any given speed. Do not apply below 1.5 mph due to variable wind direction and high inversion potential. **Note:** Local terrain can influence wind patterns. Every applicator should be familiar with local wind patterns and how they affect spray drift.

Temperature and Humidity: When making applications in low relative humidity, set up equipment to produce larger droplets to compensate for evaporation. Droplet evaporation is most severe when conditions are both hot and dry.

Temperature Inversions: Do not make applications during a temperature inversion because drift potential is high. Temperature inversions restrict vertical air mixing, which causes small suspended droplets to remain in a concentrated cloud. This cloud can move in unpredictable directions due to the light variable winds common during inversions. Temperature inversions are characterized by increasing temperatures with altitude and are common on nights with limited cloud cover and light to no wind. They begin to form as the sun sets and often continue into the morning. Their presence can be indicated by ground fog; however, if fog is not present, inversions can also be identified by the movement of smoke from a ground source or an aircraft smoke generator. Smoke that layers and moves laterally in a concentrated cloud (under low wind conditions) indicates an inversion, while smoke that moves upward and rapidly dissipates indicates good vertical air mixing.

Sensitive Areas: Apply the pesticide only when the potential for drift to adjacent sensitive areas (e.g., residential areas, bodies of water, known habitat for threatened or endangered species, non-target crops) is minimal (e.g., when wind is blowing away from the sensitive areas).

Ground Boom Application
The following mandatory spray drift **best management practices** are required to reduce the likelihood of off-target drift movement from ground applications.

- Choose only nozzles and pressures that produce a medium or coarse droplet size (255 to 400 microns volume median diameter) per ASABE Standard 572.1. See manufacturer's catalog or USDA/NAAA Applicator's Guide for spray size quality ratings.
- Apply with nozzle height no more than 4 feet above the ground or crop canopy.
- Do not apply product when wind speed exceeds 10 mph as measured by an anemometer.

Orchard Airblast Application
The following mandatory spray drift **best management practices** are required to reduce the likelihood of off-target drift movement from airblast applications.

- Direct nozzles so spray is not projected above the canopies.
- Apply only when wind speed is 3 to 10 mph at the application site as measured by an anemometer outside of the orchard/vineyard on the upwind side.
- Outward pointing nozzles must be shut off when turning corners at row ends.

The applicator should take into account the following **best management practices** to reduce off-site spray drift. This section is advisory and does not supercede mandatory label requirements.

- Number of nozzles, nozzle orientation and spray volume, air speed and wind direction are key factors in adjusting airblast spray delivery to match the height and density of the crop canopy. Adjust airblast equipment to provide uniform coverage while minimizing the amount of spray movement over the top or completely through the crop canopy.
  - High air volumes deliver spray more efficiently than air at high speed. Reducing forward travel speed decreases the air speed necessary to deliver the spray to the top of the crop canopy.
  - Use air guides along with the number and orientation of spray nozzles to achieve the desired spray coverage and directional control.
- Take the following steps to minimize drift and the amount of non-target spray:
  - Orient nozzles and adjust air speed/volume/direction to force the spray through the crop canopy but not allow drift past the canopy.
  - Shut off spray delivery when passing gaps in crop canopy within rows.
  - Spray the outside rows of orchards from outside in, directing the spray into the orchard and shutting off nozzles on the side of the sprayer away from the orchard.
  - When treating smaller trees, vines or bushes, shut off top nozzles to minimize over the top spray movement.

Application Directions

Broadcast Foliar Application
Apply with conventional power-operated spray equipment using nozzles and spray pressures specified for insecticides. Apply Lorsban Advanced in a spray volume of not less than 2 gallons per acre (gpa) for aerial application equipment (fixed wing or helicopter) or not less than 10 gpa for ground equipment, unless otherwise specified. Increase spray volume to ensure adequate coverage with increased density and height of crop canopy.

Ground Application: Orient the boom and nozzles so that uniform coverage is obtained. The swath width should not be wider than the boom. Follow nozzle manufacturer's specifications for insecticide nozzles with respect to nozzle type, pressure, and spacing.

Broadcast Soil Application
Apply with conventional power-operated spray equipment that will apply the product uniformly to the soil surface. Use nozzles that produce medium or coarse droplets (255 to 400 microns). Unless otherwise indicated, a spray volume of 10 gpa or more is needed. For band application, use proportionally less spray volume.

Aerial Application
Use a minimum spray volume of 2 gpa. Mark swaths by mechanical flagging, permanent markers or GPS equipment.

Chemigation Application
Apply Lorsban Advanced through properly equipped chemigation systems for insect control in alfalfa, almond (orchard floors only), citrus (orchard floors only), corn (field and sweet), cotton, cranberry, peppermint, sorghum, soybeans, spearmint, sugarbeet, orchard floors (pecan and walnut), and wheat, or other crops as specified in Dow AgroSciences supplemental labeling. Do not apply this product by chemigation unless specified in crop-specific directions in this label or Dow AgroSciences supplemental labeling. Do not apply to labeled crops through any other type of irrigation system.

Note: Unless otherwise indicated in specific use directions, the application rates for chemigation are the same as those specified for broadcast application.

Directions for Sprinkler Chemigation: Apply this product only through the following sprinkler irrigation systems: center pivot, lateral move, end tow, side (wheel) roll, traveler, big gun, solid set, micro sprinkler, or hand move. Do not apply this product through any other type of irrigation system. Do not apply through sprinkler systems that deliver a low coefficient of uniformity such as certain water drive units.

Chemigation Equipment Preparation: The following use directions must be followed when Lorsban Advanced is applied through sprinkler irrigation systems. Thoroughly clean the chemigation system and tank of any fertilizer or chemical residues, and dispose of the residues according to state and federal laws. Flush the injection system with soap or a cleaning agent and water. Determine the amount of Lorsban Advanced needed to cover the desired acreage. Mix according to instructions in the Mixing Directions section and bring mixture to desired volume. Maintain continuous agitation during mixing and throughout the application period.

Chemigation Equipment Calibration: In order to calibrate the irrigation system and injector to apply the mixture containing Lorsban Advanced, determine the following: 1) Calculate the number of acres irrigated by the system; 2) Calculate the amount of product required and premix; 3) Determine the irrigation rate and determine the number of minutes for the system to cover the intended treatment area; 4) Calculate the total gallons of insecticide mixture needed to cover the desired acreage. Divide the total gallons of insecticide mixture needed by the number of minutes (minus time to flush out) to cover the treatment area. This value equals the gallons per minute output that the injector or eductor must deliver. Convert the gallons per minute to milliliters or ounces per minute if needed. 5) Calibrate the injector pump with the system in operation at the desired irrigation rate. It is suggested that the timed output of the injector pump be checked at least twice before operation, and the system monitored during operation.

Chemigation Equipment Requirements:

- The system must contain an air gap, an approved backflow prevention device, a functional check valve, vacuum relief valve (including inspection port), and low-pressure drain appropriately located on the irrigation pipeline to prevent water source contamination from back flow. Refer to the American Society of Agricultural Engineer's Engineering Practice 409 for more information or state specific regulations.
- The pesticide injection pipeline must contain a functional, automatic, quick-closing check valve to prevent the flow of fluid back toward the injection pump.
- The pesticide injection pipeline must also contain a functional, normally closed, solenoid-operated valve located on the intake side of the injection pump and connected to the system interlock to prevent fluid from being withdrawn from the supply tank when the irrigation system is either automatically or manually shut down.
- The system must contain functional interlocking controls to automatically shut off the pesticide injection pump when the water pump motor stops.
- The irrigation line or water pump must include a functional pressure switch that will stop the water pump motor when the water pressure decreases to the point where pesticide distribution is adversely affected.
- Systems must use a metering pump, such as a positive displacement injection pump (e.g., diaphragm pump) effectively designed and constructed of materials that are compatible with pesticides and capable of being fitted with a system interlock.
- To ensure uniform mixing of the insecticide into the water line, inject the mixture through a nozzle placed in the fertilizer injection port or just ahead of an elbow or tee in the irrigation line so that the turbulence will assist in mixing. The injection point must be located after all back-flow prevention devices on the water line.
- The tank holding the insecticide mixture must be free of rust, fertilizer, sediment, and foreign material, and equipped with an in-line strainer situated between the tank and the injector point.

Chemigation Operation: Start the water pump and irrigation system, and let the system achieve the desired pressure and speed before starting the injector. Check for leaks and uniformity and make repairs before any chemigation takes place. Start the injector system and calibrate according to manufacturer's specifications. This procedure is necessary to deliver the desired rate per acre in a uniform manner. When the application is finished, flush and clean the entire irrigation and injector system prior to shutting down the system.

Chemigation Precautions:

- Crop injury, lack of effectiveness, or illegal pesticide residues in the crop can result from non-uniform distribution of treated water.
- If you have questions about calibration, contact state extension service specialists, equipment manufacturers, or other experts.
- A person knowledgeable of the chemigation system and responsible for its operation, or under the supervision of the responsible person, shall operate the system and make necessary adjustments should the need arise and continuously monitor the injection.

Chemigation Restrictions:

- Do not add crop oil when Lorsban Advanced is applied by chemigation.
- Do not connect an irrigation system (including greenhouse systems) used for pesticide application to a public water system.
- The pesticide injection pipeline must contain a functional, automatic, quick-closing check valve to prevent the flow of fluid back toward the injection.

- The pesticide injection pipeline must contain a functional, normally closed, solenoid-operated valve located on the intake side of the injection pump and connected to the system interlock to prevent fluid from being withdrawn from the supply tank when the irrigation system is either automatically or manually shut down.
- The system must contain functional interlocking controls to automatically shut off the pesticide injection pump when the water pump motor stops, or in cases where there is no water pump, when the water pressure decreases to the point where pesticide distribution is adversely affected.
- Systems must use a metering pump, such as a positive displacement injection pump (e.g., diaphragm pump) effectively designed and constructed of materials that are compatible with pesticides and capable of being fitted with a system interlock.
- Do not apply when wind speed favors drift beyond the area intended for treatment. End guns must be turned off during the application if they irrigate non-target areas.
- Do not allow irrigation water to collect or runoff and pose a hazard to livestock, wells, or adjoining crops.
- Do not enter treated area during the reentry interval specified in the Agricultural Use Requirements section of this label unless required PPE is worn.
- Do not apply through sprinkler systems that deliver a low coefficient of uniformity such as certain water drive units.

Mixing Directions

Lorsban Advanced – Alone
To prepare the spray, add a portion of the required amount of water to the spray tank and, with the spray tank agitator operating, add Lorsban Advanced. Complete filling the tank with the balance of water needed. Maintain sufficient agitation during both mixing and application to ensure uniformity of the spray mixture.

Lorsban Advanced – Tank Mix
Lorsban Advanced is compatible with insecticides, miticides, and fungicides and non-pressure fertilizer solutions except for alkaline materials, such as bordeaux mixture and lime. Conduct a small jar compatibility test prior to tank mixing. Prepare tank mixtures in the same manner as directed above for use of Lorsban Advanced alone. When tank mixing Lorsban Advanced with herbicides, add wettable powders first, flowables second, and emulsifiable concentrates last. For best results when a fertilizer solution is involved, use a fertilizer pesticide compatibility agent, such as Unite or Complex. Maintain constant agitation during both mixing and application to ensure uniformity of the spray mixture. Do not allow spray mixtures to stand overnight.

Tank Mix Compatibility Test: Test compatibility of the intended tank mixture before adding Lorsban Advanced to the spray or mix tank. Add proportional amounts of each tank mix ingredient to a clear glass pint or quart jar with a lid, cap it, invert the jar several times. Observe the mixture for approximately 1/2 hour. If the mixture balls-up, forms flakes, sludges, jels, oily films or layers, or other precipitates that do not readily redisperse, it is an incompatible mixture that must not be used.

Uses

Alfalfa
(Not for use in Mississippi)

Worker Restricted Entry Interval: Do not enter or allow worker entry into treated areas during the restricted entry interval (REI) of 24 hours unless PPE required for early entry is worn.

Apply as a broadcast foliar spray using aircraft or ground spray equipment. Use a higher rate in the rate range for increased pest pressure. Use a minimum spray volume of 2 gpa for aerial application (fixed wing or helicopter) or 10 gpa for ground equipment. Use a spray volume of 5 gpa or more by air or up to 20 gpa by ground when foliage is dense and/or pest population is high and/or under high temperature and wind conditions. Some reduction in insect control may occur under unusually cool conditions.

Chemigation: Lorsban Advanced may be applied through sprinkler irrigation systems to control listed foliar pests. Use specified broadcast application rates. See Chemigation Application section.

Target Pests	Lorsban Advanced (pint/acre)
corn rootworm adults (spotted cucumber beetle) grasshoppers leafhoppers	0.5 - 1
alfalfa blotch leaf miner alfalfa caterpillar alfalfa weevil larvae and adults armyworms blue alfalfa aphid chinch bug cowpea aphid crickets cutworms Egyptian alfalfa weevil larvae and adults (1) greenbugs green June beetle grubs mites (Bermuda grass stunt) (clover) (two-spotted) (winter grain) pea aphid plant bugs sod webworm sowbugs spittlebugs spotted alfalfa aphid (suppression) (not for use in California)	1 - 2
alfalfa webworm	1.5

Numbers in parentheses (-) refer to Pest-Specific Use Directions.

Pest-Specific Use Directions:
1. **In California:** For Egyptian alfalfa weevil control, apply the specified dosage in a minimum of 5 gpa of water when larvae are actively feeding.

Specific Use Precautions:
- Do not tank mix Lorsban Advanced with other pesticides, surfactants, or fertilizer formulations unless prior use has shown the combination to be non-injurious to alfalfa under current conditions of use. Some phytotoxic symptoms may be observed on young, tender, rapidly growing alfalfa treated with Lorsban Advanced. Alfalfa will outgrow these symptoms and no yield loss should be expected.
- This product is highly toxic to bees exposed to direct treatment on alfalfa. Do not apply if nearby bees are clustered outside of hives and bees are foraging in the treated area. Protective information may be obtained from your Agricultural Extension Service.
- To avoid contamination of irrigation tail waters, do not flood irrigate within 24 hours following an application of Lorsban Advanced.

Specific Use Restrictions:
- **Preharvest Interval:** Do not cut or graze treated alfalfa within 7 days after application of 1/2 pint of Lorsban Advanced per acre, within 14 days after application of 1 pint per acre, or within 21 days after application of rates above 1 pint per acre.
- Do not make more than four applications of Lorsban Advanced or other product containing chlorpyrifos per season or apply any product containing chlorpyrifos more than once per alfalfa cutting.
- Maximum single application rate is 0.94 lb ai chlorpyrifos (2 pints of Lorsban Advanced) per acre.
- Do not make a second application of Lorsban Advanced or other product containing chlorpyrifos within 10 days of the first application.

Apple Tree Trunk
(Not for use in Mississippi)

Worker Restricted Entry Interval: Do not enter or allow worker entry into treated areas during the restricted entry interval (REI) of 4 days unless PPE required for early entry is worn.

Apply as a post-bloom application to the lower 4 feet of the apple tree trunk for borer control in states east of the Rockies only (except Mississippi). Mix with water and apply directly to trunk from a distance of no more than 4 feet using low volume handgun or shielded spray equipment. Do not allow spray to contact foliage or fruit.

Target Pests	Lorsban Advanced (quart/100 gal)
American plum borer apple bark borer broad necked root borer dogwood borer flatheaded appletree borer roundheaded apple tree borer tilehorned prionus	1.5

Specific Use Restrictions:
- **Preharvest Interval:** Do not apply within 28 days before harvest.
- Do not make more than one application of Lorsban Advanced to the apple tree trunk per year as either a prebloom or post-bloom application.
- This product may not be used if a prebloom application of any other product containing chlorpyrifos has been made during the year.
- Do not allow meat or dairy animals to graze in treated orchards.
- Treat only the lower 4 feet of the apple tree trunk.
- Do not apply when wind speed is greater than 10 mph.

Asparagus

(For use only in Arizona, California, Idaho, Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, Oregon, South Dakota, Washington, and Wisconsin)

Worker Restricted Entry Interval: Do not enter or allow worker entry into treated areas during the restricted entry interval (REI) of 24 hours unless PPE required for early entry is worn.

Apply as a ground broadcast foliar spray. Use sufficient volume of finished spray to ensure thorough coverage of crop foliage. **Note:** Lorsban Advanced may be applied aerially or with ground equipment for control of armyworms and grasshoppers.

Pests	Lorsban Advanced (pint/acre)
armyworms (1) asparagus aphids (1) asparagus beetles (1) cutworms (2) grasshoppers (1) symphylans (3)	2

Numbers in parentheses (-) refer to Pest-Specific Use Directions.

Pest-Specific Use Directions:
1. **Armyworms, asparagus beetles, asparagus aphids**, and **grasshoppers:** Apply during the fern stage when field counts or crop injury indicates that damaging pest populations are developing or present.
2. **Cutworms:** For best results, apply when the soil is moist and worms are active on or near the soil surface.
3. **Symphylans:** Apply it at least two weeks before harvest for optimum control.

Specific Use Restrictions:
- **Preharvest Interval:** Do not apply within 1 day before harvest.
- Do not make more than one preharvest application per season.
- Do not make more than two postharvest applications during the fern stage.
- Maximum single application rate preharvest or postharvest is 0.94 lb ai chlorpyrifos (2 pints of Lorsban Advanced) per acre.
- Do not make a second application of Lorsban Advanced or other product containing chlorpyrifos within 10 days of the first application.

Brassica (Cole) Leafy Vegetables[1], Radish, Rutabaga, and Turnip

Worker Restricted Entry Interval: Do not enter or allow worker entry into treated areas during the restricted entry interval (REI) of 24 hours (3 days for cauliflower) unless PPE required for early entry is worn.

[1]*Brassica* (cole) leafy vegetables including broccoli, broccoli raab, Brussels sprout, cabbage, cauliflower, cavalo broccolo, Chinese broccoli, Chinese cabbage, collards, kale, kohlrabi, mizuna, mustard greens, mustard spinach, rape greens

Specific Use Restriction: If a preplant incorporation application for direct seeded or transplanted crops is made, **do not** apply this product as an at-plant or post plant soil application. If an at-plant or post plant soil application is made, **do not** apply this product as a preplant incorporation application for direct seeded or transplanted crops.

Preplant Incorporation Application for Direct Seeded or Transplanted Crops

Apply Lorsban Advanced as a broadcast spray to the soil surface using power-operated ground spray equipment. Use a total spray volume of 10 gpa or more. On the day of treatment, incorporate Lorsban Advanced into the top 2 to 4 inches of soil using a disc, field cultivator, or equivalent equipment.

Crop	Target Pests	Lorsban Advanced (pints/acre)
cauliflower	billbugs cutworms grubs root maggot symphylans wireworms	4
broccoli broccoli raab Brussels sprout cabbage cavalo broccolo Chinese broccoli Chinese cabbage collards kale kohlrabi mizuna mustard greens mustard spinach rape greens turnip		4.5
radish		5.5
rutabaga		4.5

Specific Use Precautions:

Insecticides, including Lorsban Advanced, may contribute to the stress of plants under certain environmental conditions. This stress may reduce plant stand or interfere with normal plant development. Herbicides used preplant incorporated may interact with insecticides and enhance this stress.

At-Plant or Post Plant Soil Application

Apply as indicated in Pest-Specific Use Directions. Use a higher rate in the rate range when there is increased pest pressure.

Crop	Target Pests	Lorsban Advanced (fl oz/1000 ft of row)
cauliflower	root maggot (1)	1.6 – 2.4
broccoli broccoli raab Brussels sprout cabbage cavalo broccolo Chinese broccoli Chinese cabbage collards kale kohlrabi mizuna mustard greens mustard spinach rape greens turnip		1.6 – 2.75
broccoli cabbage	root aphid (2)	1.2 (2.4 for double row plantings)
Radish	root maggot (3)	1
Rutabaga	root maggot (1)	1.6 – 3.3

Numbers in parentheses (-) refer to Pest-Specific Use Directions.

Pest-Specific Use Directions:
1. **Root maggot:**
   - **Direct seeded crops [broccoli, broccoli raab, Brussels sprout, cabbage, cauliflower, cavalo broccolo, Chinese broccoli, Chinese cabbage, collards, kale, kohlrabi, mizuna, mustard greens, mustard spinach, rape greens, rutabaga, turnip]:** Apply the specified dosage in a water-based spray as a 4-inch wide band over the row at planting time. Place band behind the planter shoe and in front of the press wheel to achieve shallow incorporation. Use a minimum of 40 gpa total spray volume.
   - **Transplanted crops [broccoli, broccoli raab, Brussels sprout, cabbage, cauliflower, cavalo broccolo, Chinese broccoli, Chinese cabbage, collards, kale, kohlrabi, mizuna, mustard greens, mustard spinach, rape greens, turnip]:** Apply

Lorsban Advanced as a water-based spray directed to the base of the plants immediately after setting. Use a minimum of 40 gpa total spray. Do not add any additional adjuvants, surfactants or spreader stickers. Do not apply as a foliage application.

2. **Root aphid (broccoli, cabbage):** Apply Lorsban Advanced in water or with liquid fertilizer injected as a sidedress on each side of the row after plants are established. See Mixing Directions section for Mixing Instructions for Liquid Fertilizer. Avoid mechanical damage to crop roots. Use a minimum of 15 gpa of total spray volume.
3. **Root maggot (radish):** Apply the specified dosage as a water-based drench in the seed furrows with the seed at planting time. Use a minimum of 40 gpa of total drench.

Specific Use Restrictions for Preplant Incorporation and At-Plant or Post Plant Soil Applications:

- **Soil applications (all labeled crops):**
  - ◊ **Preharvest Interval:** Do not apply within 30 days before harvest.
  - ◊ Do not foliarly apply any chlorpyrifos product labeled for foliar application (e.g., Lorsban 50W) within 10 days of a soil application of Lorsban Advanced.
  - ◊ Do not aerially apply this product in Mississippi.
- **Cauliflower:** Do not apply more than 2 pints of Lorsban Advanced to cauliflower planted in 40-inch rows. Use proportional amounts for other row spacings, but do not exceed 4 pints of Lorsban Advanced per acre. The maximum single application rate for cauliflower is 1.2 oz ai chlorpyrifos (2.4 fl oz of Lorsban Advanced) per 1000 ft of row.
- **Broccoli, broccoli raab, Brussels sprout, cabbage, cavalo broccolo, Chinese broccoli, Chinese cabbage, collards, kale, kohlrabi, mizuna, mustard greens, mustard spinach, rape greens, turnip:** Do not apply more than 2.6 pints of Lorsban Advanced per acre when planted in 40-inch rows. Do not apply more than 4.5 pints of Lorsban Advanced per acre to these crops when in 20-inch rows (or two rows per bed). Use proportional amounts for other row spacings, but do not exceed 4.5 pints of Lorsban Advanced per acre.
- **Radish:** Do not apply more than 5.5 pints of Lorsban Advanced per acre. The maximum single application rate for radish is 0.5 oz ai chlorpyrifos (1 fl oz of Lorsban Advanced) per 1000 ft of row.
- **Rutabaga:** Do not apply more than 4.5 pints of Lorsban Advanced per acre. The maximum single application rate for rutabaga is 1.6 oz ai chlorpyrifos (3.2 fl oz of Lorsban Advanced) per 1000 ft of row. Do not use rutabaga tops for food or feed purposes.

Foliar Application [*Brassica* (Cole) Leafy Vegetables Only]
Apply with conventional power-operated spray equipment in 20 to 150 gpa of water. For aerial applications, apply in a minimum of 5 gpa of water. Use a higher rate in the rate range when there is increased pest pressure. Consult your state agricultural experiment station, extension service specialist, or integrated pest control advisor for proper time to treat in your area.

To avoid phytotoxicity, do not treat plants under stress from extreme heat and/or lack of moisture. For best results, tank mix only if previous experience indiates that the combination will not result in phytotoxicity under the current conditions of use and the other pesticides and spray adjuvants are registered for this use. Read and carefully follow all applicable directions, restrictions, and precautions on other product labels used in combination with Lorsban Advanced. Tank mixing Thiodan 3EC, Thiodan 50WP, or cottonseed oil is not recommended.

Target Pests	Lorsban Adavnced (pint/acre)
armyworms cabbage aphid cutworms imported cabbage worm striped flea beetle (adult)	1 – 2

Specific Use Restrictions:

- **Preharvest Interval:** Do not apply within 21 days before harvest.
- Do not make more than three applications of any product containing chlorpyrifos per crop.
- Do not make a second application of Lorsban Advanced or other product containing chlorpyrifos within 10 days of the first application.
- Do not aerially apply this product in Mississippi.

Christmas Trees (Plantations Only)
(Not for use in Mississippi)

Worker Restricted Entry Interval: Do not enter or allow worker entry into treated areas during the restricted entry interval (REI) of 24 hours unless PPE required for early entry is worn.

Unless otherwise indicated, apply as a foliar spray using power-operated ground equipment. Thorough coverage of foliage is essential. Use a minimum 10 gpa of finished spray with ground equipment. Use higher volume of finished spray, 20 gpa or more, when foliage is dense and/or pest density is high and/or under high temperature and wind conditions.

Target Pests		Lorsban Advanced

ants (4)
aphids
adelgids
  cooley
  eastern spruce gall
Douglas fir needle midge
European pine sawfly
European pine shoot
  moth
grasshoppers
gypsy moth
mites (1)
  European red spider
  two spotted spider
	pales weevil (adult)
	pine needle midge
	pine spittlebug
	plant bugs
	scale (2)
	  black pine
	  pine needle
	  pine tortoise
	  spruce bud
	  striped pine
	spittlebugs
	spruce budworm
	spruce needleminer
		1 quart/acre

pales weevil (3)		3 quarts/100 gal

Numbers in parentheses (-) refer to Pest-Specific Use Directions.

Pest-Specific Use Directions:

1 **Spider mites:** When large numbers of eggs are present at the first application, a second application after 7 to 10 days may be required to control newly hatched nymphs and maintain effective control. **Not for control of mites in Washington and Oregon.**
2. **Scale:** For control, apply when scale crawlers are active.
3. Apply as a cut stump drench.
4. Excludes fire, harvester, carpenter, and pharaoh ants.

Specific Use Precautions:
Phytotoxicity: Do not apply under conditions of extreme heat or drought stress. Environmental factors and varietal differences significantly influence potential phytotoxic expression. **Testing has shown that Lorsban Advanced may be used at specified rates on the following conifer species without serious phytotoxicity: balsam fir, concolor fir, Douglas fir, eastern white pine, Fraser fir, grand fir, noble fir, Scotch pine, white spruce**. Before treating large numbers of other conifer species, treat a small block of plants and observe them 7 to 10 days for symptoms of phytotoxicity. **Note:** The user assumes responsibility for determining if it is safe to treat other conifer species with Lorsban Advanced under commercial growing conditions.

Specific Use Restrictions:

- Do not make more than three applications of Lorsban Advanced or other product containing chlorpyrifos per season.
- Do not make a second application of Lorsban Advanced or other product containing chlorpyrifos within 7 days of the first application.
- Do not allow meat or dairy animals to graze in treated areas.

Citrus Fruits[1]
(Not for use in Mississippi)

Worker Restricted Entry Interval: Do not enter or allow worker entry into treated areas during the restricted entry interval (REI) of 5 days unless PPE required for early entry is worn.

[1]Citrus fruits including calamondin, chironja, citrus citron, citrus hybrids, grapefruit, kumquat, lemon, lime, mandarin (tangerine), pummelo, satsuma mandarin, sour orange, sweet orange, tangelo, tangor

Apply as a concentrate or dilute spray using conventional, power-operated spray equipment. Use a higher rate in the rate range when there is increased pest pressure. Use sufficient water to ensure thorough and complete coverage of the foliage and fruit. For dilute sprays (greater than 200 gpa), use a spray concentration of at least 0.5 pints of Lorsban Advanced per 100 gallons of finished spray. Complete coverage is not necessary for outside canopy sprays targeting certain pests such as lepidoptera insects and katydids. Treat when pests become a problem or in accordance with the local spray schedule as specified by your State Agricultural Experiment Station, certified Pest Control Advisor, or Extension Service Specialist. To avoid excessive ridging, do not apply Lorsban Advanced to citrus from December 1 up to the initiation of bloom (5% visible bloom).

Low Volume Application (for use in Florida only): Apply Lorsban Advanced at the rate of 3 to 5 pints per acre as a low volume application (e.g., 2 to 5 gallons of water) to control Asian citrus psyllid. Do not make low volume applications when wind speed is more than 5 mph. Regardless of the application method used (air, low volume, airblast), treat only a few acres when using the lower rate or a new application method to determine the effectiveness in the citrus grove.

Use of Spray Oils: To improve control of aphids, mealybugs, scale insects, and thrips, a petroleum spray oil specified for use on citrus trees may be added to spray mixtures at up to 1 gallon per 100 gallons of spray.

Target Pests	Lorsban Advanced (pint/acre)
aphids (including brown citrus aphid) brown marmorated stink bug glassywinged sharpshooter grasshoppers (1) katydids lepidopterous larvae avocado leafroller cutworms fruit tree leafroller orange dogs orange tortrix western tussock moth mealybugs (see below for California and Arizona) scale insects black scale brown soft scale (California red scale (see below for California and Arizona) chaff scale Florida red scale long scale purple scale snow scale thrips (see below for California and Arizona)	2 - 7
citrus rust mites (2) (3)	4 - 7
citrus psylla (4)	5
thrips suppression and mealybugs (California and Arizona, see restrictions)	6 - 12
California red scale (California and Arizona, see restrictions)	8 -12

Numbers in parentheses (-) refer to Pest-Specific Use Directions.

Pest-Specific Use Directions:

1. **Lubber grasshoppers:** Effective control requires direct contact with spray when grasshoppers are small (less than 1 inch in length).
2. **Citrus rust mites:** For control, use a spray concentration of at least 1 pint of Lorsban Advanced per 100 gallons.
3. In Los Angeles, Monterey, Orange, San Diego, San Luis Obispo, Santa Barbara, and Ventura Counties in California, Lorsban Advanced may be tank mixed with petroleum spray oils registered for control of mites in citrus. Follow all label directions and precautions for Lorsban Advanced and tank mix partners. Do not exceed 1.8% oil v/v or 1.8 gallons of oil per 100 gallons of spray. Use only on citrus species and varieties for which Lorsban Advanced is registered.
4. **Citrus psylla:** For control, add citrus oil at 2% v/v in a tank mix with Lorsban Advanced.

Specific Use Precautions:

- Observe local recommendations for tank mix combinations especially with regard to use of Lorsban Advanced with spray oil. Do not use penetrating surfactants in tank mixes with Lorsban Advanced. Consult with a county farm advisor, county agency, extension service personnel, agricultural commissioner, pest control advisor, or local Dow AgroSciences representative for local recommendations.
- Do not apply when trees are stressed by drought or high temperatures.
- Lorsban Advanced is highly toxic to bees exposed to direct treatment and must not be applied when bees are actively visiting the area. During the citrus bloom period in California, apply from 1 hour after sunset until 2 hours before sunrise.
- Do not use Lorsban Advanced in combination with spray oil when temperatures are expected to exceed 95°F on the day of application or for several consecutive days thereafter.

Specific Use Restrictions:

- **Preharvest Interval:** Do not apply within 21 days before harvest for applications of up to 7 pints of Lorsban Advanced per acre or within 35 days for application of rates above 7 pints per acre.
- Do not make more than two applications of Lorsban Advanced or other product containing chlorpyrifos per year (does not include citrus orchard floors).
- Do not apply more than a total of 7.04 lb ai chlorpyrifos (16 pints of Lorsban Advanced) per acre per year.
- Do not make a second foliar application of Lorsban Advanced or other product containing chlorpyrifos within 30 days of the first application.
- The use of application rates greater than 4 lb ai chlorpyrifos (8.5 pints of Lorsban Advanced) per acre are allowed only in the following counties in California: Fresno, Tulare, Kern, Kings, and Madera.
- Do not allow meat or dairy animals to graze in treated areas.

Citrus[1] Orchard Floors
(Not for use in Mississippi)

Worker Restricted Entry Interval: Do not enter or allow worker entry into treated areas during the restricted entry interval (REI) of 5 days unless PPE required for early entry is worn.

[1]Citrus fruits including calamondin, chironja, citrus citron, citrus hybrids, grapefruit, kumquat, lemon, lime, mandarin (tangerine), pummelo, satsuma mandarin, sour orange, sweet orange, tangelo, tangor

Apply as a ground broadcast spray directed to the orchard floor to control foraging ants (excluding fire, harvester, carpenter and pharaoh ants). Do not apply spray to contact foliage or fruit. Apply in a total spray volume of 25 gpa or more using equipment that will apply the spray uniformly to the soil surface. Use a higher rate in the rate range for increased pest pressure. For best results, remove weed growth or other obstructions that might prevent the spray from reaching the soil surface. Foliar applications of Lorsban Advanced or other products containing chlorpyrifos may be made in addition to the orchard floor treatments but must comply with the 10 day re-treatment interval (see Specific Use Restrictions).

Chemigation: Lorsban Advanced may be applied to citrus orchard floors through sprinkler irrigation systems only if the system uniformly covers the soil surface at the base of the tree. Apply at specified broadcast application rates to control listed pests. See Chemigation Application section.

Note: Do not apply in tank mixture with Evik herbicide.

Target Pests	LorsbanAdvanced (pint/acre)
ants (1)	1.5 - 2

Numbers in parentheses (-) refer to Pest-Specific Use Directions.

Pest-Specific Use Directions:

1. Excludes fire, harvester, carpenter, and pharaoh ants.

Application with Dry Bulk Fertilizer: Most dry fertilizers can be used for impregnation with Lorsban Advanced. Apply Lorsban Advanced at the equivalent broadcast rate using a minimum of 200 lb per acre of dry bulk fertilizer.

Impregnation of Dry Bulk Fertilizer: Use a closed rotary drum mixer suitable for blending of dry bulk fertilizer equipped with an internal spray nozzle. Add the dry fertilizer to the mixer followed by the appropriate amount of Lorsban Advanced. After mixing the dry ingredients to ensure uniformity, add water through the spray nozzle in an amount sufficient to just dampen the mixture (4 to 8 pints of water per ton of fertilizer). Position the spray nozzle within the mixer to provide uniform coverage of the tumbling mixture of fertilizer and Lorsban Advanced. Addition of water will cause Lorsban Advanced to uniformly adhere to the dry bulk fertilizer. Apply bulk fertilizers impregnated with Lorsban Advanced immediately, **do not store it**. Foliar applications of Lorsban Advanced may be made in addition to the orchard floor treatments.

Compliance with any and all federal and state laws and regulations relating to the Lorsban Advanced and fertilizer mixture is the responsibility of the person offering such mixture for sale or distribution.

Specific Use Restrictions:

- **Preharvest Interval:** Do not apply within 28 days before harvest.
- Do not make more than three applications of Lorsban Advanced or other product containing chlorpyrifos per year (does not include foliar applications to citrus trees).
- Maximum single application rate is 1 lb ai chlorpyrifos (2 pints of Lorsban Advanced) per acre.
- Do not apply more than a total of 2.82 lb ai chlorpyrifos (3 quarts of Lorsban Advanced) per acre per year.
- Do not make a second application of Lorsban Advanced or other product containing chlorpyrifos within 10 days of the first application.
- Do not allow meat or dairy animals to graze in treated areas.

Corn (Field, Sweet, Seed)

Worker Restricted Entry Interval: Do not enter or allow worker entry into treated areas during the restricted entry interval (REI) of 24 hours unless PPE required for early entry is worn.

Conservation Tillage: Preplant, At-Plant, or Preemergence Applications

Apply as a broadcast spray to surface trash and exposed soil using power-operated ground spray equipment. Use a total spray volume of 20 gpa or more. Use a higher rate in the rate range to extend residual control.

Tank Mixing: Lorsban Advanced may also be applied in tank mixtures with paraquat or glyphosate and/or liquid fertilizer solutions. See Mixing Directions section for tank mixing instructions. Read and carefully follow all applicable directions, restrictions, and precautions on labeling for each product used in combination with Lorsban Advanced.

Target Pests	Lorsban Advanced (pint/acre)
armyworms cutworms	1 - 2

Postemergence Application
Apply as a postemergence broadcast spray using sufficient spray volume to ensure thorough coverage of treated plants, but no less than 15 gpa for ground spray equipment or 2 to 5 gpa for aircraft equipment. Control may be reduced at low spray volumes under high temperature and wind conditions. Lorsban Advanced may be tank mixed with glyphosate products, such as Duramax® herbicide or Durango® DMA® herbicide, when application is to be made to glyphosate-tolerant corn.

Chemigation: Lorsban Advanced may be broadcast applied postemergence through sprinkler irrigation systems at specified application rates to control listed foliar pests. For best results, tank mix Lorsban Advanced with 2 pints of non-emulsifiable oil. See Chemigation Application section.

Target Pests	Lorsban Advanced (pint/acre)
grasshoppers	0.5 – 1
aphids armyworms chinch bugs (1) corn rootworm adults (2) cutworms (3) European corn borer (5) flea beetle adults (1) southern corn leaf beetle webworms (4) western bean cutworm	1 - 2
brown marmorated stink bug corn earworm southwestern corn borer (6)	1.5 - 2
billbugs (1) common stalk borer (9) corn rootworm larvae (7), (8) lesser cornstalk borer	2

Numbers in parentheses (-) refer to Pest-Specific Use Directions.

Pest-Specific Use Directions:
1. **Billbug, chinch bug**, or **flea beetle:** For best control, ground apply in a minimum spray volume of 20 to 40 gpa at 40 psi. If corn is less than 6 inches tall, apply in a 9- to 12-inch wide band over the row. For corn more than 6 inches tall, apply using drop nozzles directed to the base of the plant. Do not reduce the application rate for banded or directed applications. Concentrate the full labeled dosage rate in the treated zone. When chinch bugs continue to immigrate to corn over a prolonged period or under extreme pest pressure, a second application may be needed.
2. **Corn rootworm adults:** The specified dosage will control silk clipping.
3. **Cutworms:** It is preferable to apply Lorsban Advanced when soil is moist and worms are active on or near the soil surface. If ground is dry, cloddy, or crusted at time of treatment, worms may be protected from the spray and effectiveness will be reduced. Shallow incorporation using a rotary hoe or other suitable equipment immediately before or soon after treatment may improve control. A second application may be required if damage or density levels exceed economic thresholds established for your area.
4. **Webworm:** For control, shallow incorporation using a rotary hoe or other suitable equipment immediately before or soon after treatment is necessary.
5. **European corn borer:** For control, use 1.5 to 2 pints per acre when application is made with power-operated ground or aerial equipment, or 1 to 2 pints per acre when application is made through a sprinkler irrigation system. University research indicates that achieving greater than 50% control of first-generation European borer with a single liquid insecticide treatment is highly dependent upon timing, insecticide placement, and weather conditions.
6. **Southwestern corn borer:** A second application may be applied 21 days later if needed due to reinfestation.
7. **Corn rootworm larvae:** For postemergence control, apply at cultivation. Direct the spray to both sides of the row at the base of the plants just ahead of the cultivator shovels. Cover the insecticide with soil around the brace roots. A cultivation application of Lorsban Advanced may be made in addition to an at-planting application of Lorsban 15G.
8. Lorsban Advanced may also be applied through sprinkler irrigation systems at the rate of 2 pints per acre to control **corn rootworm larvae**. Time application to coincide with the appearance of the second instar larvae. Apply with enough water to wet the root zone to the depth control needed. If soils are wet, allow enough soil drying to occur such that an application using a minimum amount of water will not produce surface runoff. See Chemigation Application section for application instructions.
9. Do not use Lorsban Advanced in combination with a burndown herbicide for control of common stalk borer. For **common stalk borer** control, treat approximately 11 days after application of glyphosate or after burndown with paraquat herbicide is complete (3 to 5 days).

Specific Use Restrictions:
- **Preharvest Interval:** Do not apply within 21 days before harvest of grain, ears, forage or fodder.
- Do not make more than three applications of Lorsban Advanced or any product containing chlorpyrifos per season, including the maximum allowed of two granular applications, at the 1 lb ai chlorpyrifos rate.
- Maximum single application rate is 1 lb ai chlorpyrifos (2.13 pints of Lorsban Advanced) per acre.
- Do not apply more than 3 lb ai chlorpyrifos (6.38 pints of Lorsban Advanced) per acre per season.
- Do not make a second application of Lorsban Advanced or other product containing chlorpyrifos within 10 days of the first application.
- If more than 1 lb ai granular chlorpyrifos per acre is applied at-plant (for a maximum of 1.3 lb ai per acre per season), only one additional application of a liquid product containing chlorpyrifos at 1 lb ai per acre is allowed per season, for a total of 2.3 lb ai chlorpyrifos per acre per season.
- Do not apply in tank mixes with Steadfast or Lightning herbicides.
- Do not aerially apply this product in Mississippi.

Cotton
(Not for use in Mississippi)

Worker Restricted Entry Interval: Do not enter or allow worker entry into treated areas during the restricted entry interval (REI) of 24 hours unless PPE required for early entry is worn.

Apply as a broadcast foliar spray using aircraft or ground spray equipment (see separate rate table for Arizona and California). Use a higher rate in the rate range when there is increased pest pressure. Use sufficient spray volume to ensure thorough coverage of treated plants, but no less than 10 gpa for ground spray equipment or 2 gpa for aircraft equipment. Increase spray volume when foliage is dense and/or pest population is high and/or under high temperature and wind conditions. Treat when field counts indicate damaging insect populations are developing or present.

Chemigation: Lorsban Advanced may be applied through sprinkler irrigation systems at specified broadcast application rates to control listed foliar pests. See Chemigation Application section.

Proper application methods are necessary to ensure thorough spray coverage and correct rate, and minimize off-target drift. Follow Application Directions for ground and aerial application and Spray Drift Management recommendations in Product Information section of this label.

All States Except Arizona and California

Target Pests	Lorsban Advanced (pint/acre)
cotton fleahopper (1) plant bugs (1) (*Lygus, Mirids*)	0.37 - 1
grasshoppers thrips	0.5 - 1
cotton aphid fall armyworm yellowstriped armyworm	0.5 - 2
spider mites (2)	1
beet armyworm cotton bollworm (3) cutworms pink bollworm salt marsh caterpillar tobacco budworm (3)	1.5 - 2

Numbers in parentheses (-) refer to Pest-Specific Use Directions.

Pest-Specific Use Directions:
1. The 0.37 pint per acre rate will not provide a high degree of control but, compared to the 1 pint per acre rate, will minimize the damage from **plant bugs** and **cotton fleahoppers** and allow increased survival and build-up of beneficial insects to aid in the control of **bollworms** infesting cotton.
2. **Spider mites:** When large numbers of eggs are present, scout the treated area in 3 to 5 days. If newly hatched nymphs are present, make a follow-up application of a non-chlorpyrifos product that is effective against mites.
3. **Bollworms** and **budworms:** For best results, scout fields twice per week and apply when worms are 1/4 inch or less in length.

Arizona and California

Target Pests	Lorsban Advanced (pint/acre)
armyworms cotton aphid cotton fleahopper *Lygus* salt marsh caterpillar silverleaf whitefly (1) thrips	1 - 2
boll weevil cotton bollworm (2) cotton leaf perforator (suppression) cutworms pink bollworm spider mites (suppression) tobacco budworm (2)	2

Numbers in parentheses (-) refer to Pest-Specific Use Directions.

Pest-Specific Use Directions:
1. **Silverleaf whitefly:** Apply in tank mix combination with the specified rate of a pyrethroid insecticide labeled for control or suppression.
2. **Bollworms** and **budworms:** For best results, scout fields twice per week and apply when worms are 1/4 inch or less in length.

Specific Use Restrictions:
- **Preharvest Interval:** Do not apply within 14 days before harvest.
- Do not make more than three applications of Lorsban Advanced or other product containing chlorpyrifos per crop season.
- Maximum single application rate is 0.94 lb ai chlorpyrifos (2 pints of Lorsban Advanced) per acre.
- Do not apply more than 2.82 lb ai chlorpyrifos (6 pints of Lorsban Advanced) per acre per season.
- Do not make a second application of Lorsban Advanced or other product containing chlorpyrifos within 10 days of the first application.
- Do not allow meat or dairy animals to graze in treated areas.
- Do not feed gin trash or treated forage to meat or dairy animals.

Cranberry
(Not for use in Mississippi)

Worker Restricted Entry Interval: Do not enter or allow worker entry into treated areas during the restricted entry interval (REI) of 24 hours unless PPE required for early entry is worn.

Apply as a broadcast foliar spray. Use sufficient spray volume to ensure thorough coverage, but no less than 15 gpa. Except for control of cranberry weevil, treat when field counts indicate damaging insect populations are developing or present.

Chemigation: Lorsban Advanced may be applied through sprinkler irrigation systems to control listed pests. Apply at specified broadcast application rates. See Chemigation Application section.

Target Pests	Lorsban Advanced (pint/acre)
brown spanworm cranberry fruitworm cranberry weevil (1) cutworms fireworms sparganothis fruitworms	3

Numbers in parentheses (-) refer to Pest-Specific Use Directions.

Pest-Specific Use Directions:
1. **Cranberry weevil:** For control, apply once at flower bud development (late May, early June) and, if cranberry weevils are present, once after 100% bloom (early to mid-July).

Specific Use Precautions:
Apply only after the winter flood water has been removed. To avoid pesticide contamination of flood waters, do not apply when bogs are flooded.

Specific Use Restrictions:
- **Preharvest Interval:** Do not apply within 60 days before harvest.
- Do not make more than two applications of Lorsban Advanced or other product containing chlorpyrifos per season.
- Maximum single application rate is 1.41 lb ai chlorpyrifos (3 pints of Lorsban Advanced) per acre.
- Do not make a second application of Lorsban Advanced or other product containing chlorpyrifos within 10 days of the first application.

Fig
(For use only in California)

Worker Restricted Entry Interval: Do not enter or allow worker entry into treated areas during the restricted entry interval (REI) of 4 days unless PPE required for early entry is worn.

Apply Lorsban Advanced as a dormant application in late winter prior to beetle emergence and prior to leaf formation. Use a spray volume of 10 gpa or more and apply as a broadcast spray to the soil surface using power-operated ground spray equipment. On the day of treatment, incorporate Lorsban Advanced into the top 3 inches of soil using suitable equipment.

Target Pest	Lorsban Advanced (quart/acre)
brown marmorated stink bug dried fruit beetle	2

Specific Use Restrictions:
- **Preharvest Interval:** Do not apply within 217 days (7 months) before harvest.
- Make only one application per year of Lorsban Advanced or other product containing chlorpyrifos.
- Maximum single application rate is 1.88 lb ai chlorpyrifos (2 quarts of Lorsban Advanced) per acre.

Grape
(Not for use in Mississippi)

Worker Restricted Entry Interval: Do not enter or allow worker entry into treated areas during the restricted entry interval (REI) of 24 hours unless PPE required for early entry is worn.

Soil Surface Application
(For use in areas east of the Continental Divide only)
Apply Lorsban Advanced just before the pest emerges from the soil. Apply 2 quarts of the diluted spray mixture to the soil surface on a 15-square foot area (4.4 foot circle) around the base of each vine.

Target Pest	Lorsban Advanced (pint/100 gal)
grape borer	4.5

Specific Use Restrictions for Soil Surface Application:
- Do not allow spray to contact fruit or foliage.
- Maximum single application rate for soil surface application is 2.12 lb ai chlorpyrifos (4.5 pints of Lorsban Advanced) per acre.

Prebloom Application
(For use in areas east of the Continental Divide only)
Apply as a spray drench ground application using a minimum spray volume of 25 gpa.

Target Pest	Lorsban Advanced (quart/acre)
brown marmorated stink bug climbing cutworm[1] grape mealybugs[2] grape scale	1

Numbers in parentheses (-) refer to Pest-Specific Use Directions.

Pest-Specific Use Directions:
1. **Cutworm:** For control, apply 1 quart of Lorsban Advanced per acre as a broadcast spray in a minimum spray volume of at least 50 gallons of water using power-operated ground spray equipment. Treat when cutworms first become active and when field counts indicate damaging insect populations are developing or present. Do not apply after bloom stage of growth. Consult your state agricultural experiment station or

extension service specialist concerning cutworm control practices in your area.

2. **Grape mealybug:** For control, apply 1 quart of Lorsban Advanced per acre in a minimum spray volume of at least 50 gallons of water per acre using power-operated ground spray equipment only prior to late budbreak. Applications after budbreak may result in transient leaf yellowing (Concords).

Specific Use Restrictions for Prebloom Application:
- Do not use in conjunction with soil surface application for grape borer control.
- Maximum single application rate for prebloom application to minimize phytotoxicity is 0.94 lb ai chlorpyrifos (1 quart of Lorsban Advanced) per acre.

Specific Use Restrictions for Soil Surface Application and Prebloom Application:
- **Preharvest Interval:** Do not apply within 35 days before harvest.
- Do not make more than one application of Lorsban Advanced or other product containing chlorpyrifos per season.
- Based upon available residue data, the use of Lorsban Advanced in grapes is restricted to areas east of the Continental Divide only. Do not use in the state of Mississippi.

Legume Vegetables (Succulent or Dried) (Except Soybean)[1]
(Not for use in Mississippi)

Worker Restricted Entry Interval: Do not enter or allow worker entry into treated areas during the restricted entry interval (REI) of 24 hours unless PPE required for early entry is worn.

[1]Legume vegetables including adzuki bean, asparagus bean, bean, blackeyed pea, broad bean (dry and succulent), catjang, chickpea, Chinese longbean, cowpea, crowder pea, dwarf pea, edible pod pea, English pea, fava bean, field bean, field pea, garbanzo bean, garden pea, grain lupin, green pea, guar, hyacinth bean, jackbean, kidney bean, lablab bean, lentil, lima bean, moth bean, mung bean, navy bean, pea, pigeon pea, pinto bean, rice bean, runner bean, snap bean, snow pea, southern pea, sugar snap pea, sweet lupin, sword bean, tepary bean, urd bean, wax bean, white lupin, white sweet lupin, yardlong bean

Preplant Broadcast Application
Apply Lorsban Advanced at a rate of 2 pints per acre to control seed maggots. Make a preplant broadcast application in a minimum of 10 gpa of spray to the soil surface using suitable ground equipment. To improve the activity against seed maggots, incorporate Lorsban Advanced into the top 1 to 3 inches of soil using suitable tillage equipment.

At-Plant T-Band Application
Apply 1.8 fl oz of Lorsban Advanced per 1000 feet of row at 30-inch row spacing. Apply the spray in a 3- to 5-inch wide band over the row behind the planter shoe and in front of the press wheel to achieve shallow incorporation. Mix the specified dosage in a minimum of 10 gpa of spray and apply to the soil surface using suitable ground spray equipment. Equivalent rates of insecticide spray required per 100 feet of row for listed row spacings are given in the accompanying table. To improve the activity of Lorsban Advanced against seed maggots, incorporate Lorsban Advanced into the top 1/2 to 1-inch of soil using tines or chains or other suitable equipment.

Spray Volume Per Acre (Gallons)	fl oz of Spray Volume per 100 Feet of Row			
	30-inch	28-inch	24-inch	22-inch
10	7.3	6.9	5.9	5.4
15	11	10.3	8.8	8.1
20	14.7	13.7	11.8	10.8

Specific Use Precautions: Insecticides, including Lorsban Advanced, may contribute to the stress of plants under certain environmental conditions. This stress may reduce plant stand or interfere with normal plant development. Herbicides used preplant incorporated may interact with insecticides and enhance this stress.

Specific Use Restrictions:
- Do not make more than one application of Lorsban Advanced per year.
- Do not apply more than 0.94 lb ai chlorpyrifos (2 pints of Lorsban Advanced) per acre.
- Do not apply Lorsban Advanced at-plant if the field was treated with a preplant incorporated treatment of Lorsban Advanced.

Onion (Dry Bulb)

Worker Restricted Entry Interval: Do not enter or allow worker entry into treated areas during the restricted entry interval (REI) of 24 hours unless PPE required for early entry is worn.

At-Plant Soil Drench Application
For direct seeded onions to control onion maggot, apply 32 fl oz of Lorsban Advanced per acre in a water-based spray as a 2- to 4-inch wide band over the row at planting time in a minimum of 40 gpa. Equivalent rates of insecticide spray required per 1000 feet of row for listed row spacings are given in the table below. Shallow incorporation is necessary. Place behind the planter shoe and in front of the presswheel. Phytotoxicity may occur if Lorsban Advanced is sprayed directly onto onion seeds. Do not mix Lorsban Advanced with other pesticide products. **Note**: The user should exercise reasonable judgment and caution with this product. Until familiar with results under user planting and growing conditions, limit application of this product to a small area to determine plant tolerance and extent of injury if such occurs prior to initiating large scale applications.

Lorsban Advanced (32 fl oz/acre)	Row Spacing			
	6-inch	10-inch	12-inch	18-inch
fl oz/1000 ft of row	0.37	0.61	0.74	1.1

Specific Use Restrictions:
- Do not make more than one application per year.
- Maximum single application rate is 0.032 lb ai chlorpyrifos per 1000 feet of row.
- Do not aerially apply this product in Mississipppi.

Postplant Soil Drench Application
Apply as an early season directed spray to the base of onion seedlings or transplants during peak egg laying. Use a minimum of 100 gpa for thorough wetting.

Target Pest	Lorsban Advanced (quart/acre)
onion maggot seedcorn maggot	1

Specific Use Restrictions:
- **Preharvest Interval:** Do not apply within 60 days before harvest.
- Do not make more than two applications (at-plant plus postplant) per year.
- Maximum single application rate is 0.94 lb ai chlorpyrifos (1 quart of Lorsban Advanced) per acre.
- Do not aerially apply this product in Mississippi.

Peanut

Worker Restricted Entry Interval: Do not enter or allow worker entry into treated areas during the restricted entry interval (REI) of 24 hours unless PPE required for early entry is worn.

Apply to the soil surface as a preplant broadcast spray followed by immediate soil incorporation to a depth of 3 to 4 inches using a disc, field cultivator, or equivalent equipment. Use a minimum of 10 gpa total spray.

Target Pests	Lorsban Advanced (pint/acre)
wireworms (suppression)	4

Specific Use Restrictions:
- **Preharvest Interval:** Do not apply within 21 days before harvest.
- Do not make more than one preplant application of Lorsban Advanced per season.
- Maximum single application rate is 1.88 lb ai chlorpyrifos (4 pints of Lorsban Advanced) per acre.
- The combined total of preplant and postplant applications of Lorsban Advanced, Lorsban 15G, or other product containing chlorpyrifos, must not exceed 4 lb ai chlorpyrifos per acre per season.
- Do not feed treated peanut forage or hay to meat or dairy animals.
- Do not aerially apply this product in Mississippi.

Pear
(For use only in California, Oregon and Washington)

Worker Restricted Entry Interval: Do not enter or allow worker entry into treated areas during the restricted entry interval (REI) of 24 hours unless PPE required for early entry is worn.

Postharvest Application
Mix the specified dosage in 100 to 400 gpa of spray and apply using an airblast speed sprayer or other suitable ground equipment.

Target Pest	Lorsban Advanced (pint/acre)
brown marmorated stink bug codling moth	4

Specific Use Restrictions:
- Do not make more than one postharvest application (prior to dormancy) per year.
- Maximum single application rate is 1.88 lb ai chlorpyrifos (4 pints of Lorsban Advanced) per acre.
- Do not harvest or use treated fruit for food or feed.
- Do not allow meat or dairy animals to graze in treated orchards.
- If unauthorized entry into a treated orchard cannot be prevented, then the orchard must be posted with appropriate signs according to the Worker Protection Standard while treated, unharvested fruit remains on the tree.

Peppermint and Spearmint
(Not for use in Mississippi)

Worker Restricted Entry Interval: Do not enter or allow worker entry into treated areas during the restricted entry interval (REI) of 24 hours unless PPE required for early entry is worn.

Apply as a broadcast spray using a total spray volume of 10 gpa or more using ground equipment.

Chemigation: Lorsban Advanced may be applied through sprinkler irrigation systems at specified broadcast application rates to control listed foliar pests. See Chemigation Application section.

Target Pests	Lorsban Advanced (pint/acre)
cutworm (1)	2 – 4
garden symphylans(2) mint root borer (3)	4

Numbers in parentheses (-) refer to Pest-Specific Use Directions.

Pest-Specific Use Directions:
1. **Cutworms:** Apply during May and June when field counts indicate damaging insect populations are developing or present. When larvae are less than 3/4 inch in length, use the 2 pint rate; otherwise, use a higher rate in the rate range.
2. **Garden symphylans:** Apply preplant to the soil surface. On the same day of treatment, incorporate the insecticide into the top 2 to 4 inches of soil using a disc, field cultivator, or equivalent equipment.
3. **Mint borer:** Apply postharvest when field counts indicate damaging insect populations are developing or present. If ground applied, follow with approximately 1 acre inch of sprinkler irrigation immediately after application to incorporate the insecticide into the soil or apply by chemigation.

Specific Use Restrictions:
- **Preharvest Interval:** Do not apply within 90 days before harvest.
- Make only one application of Lorsban Advanced or other product containing chlorpyrifos during the growing season.
- Do not make more than one preplant incorporated application in the spring.
- Make only one postharvest application of Lorsban Advanced or other product containing chlorpyrifos per season.
- Maximum single application rate is 1.88 lb ai chlorpyrifos (4 pints of Lorsban Advanced) per acre.
- Do not use in conjunction with a broadcast foliar application of Lorsban Advanced for cutworm control.

Sorghum - Grain Sorghum (Milo)

Worker Restricted Entry Interval: Do not enter or allow worker entry into treated areas during the restricted entry interval (REI) of 24 hours unless PPE required for early entry is worn.

Apply as a postemergence broadcast spray using sufficient spray volume to ensure thorough coverage of treated plants, but no less than 15 gpa for ground spray equipment or 2 to 5 gpa for aircraft equipment. Control may be reduced at low spray volumes under high temperature and wind conditions.

Chemigation: Lorsban Advanced may be applied through sprinkler irrigation systems at specified broadcast application rates to control listed foliar pests. See Chemigation Application section.

Target Pests	Lorsban Advanced (pint/acre)
sorghum midge (1)	0.5
grasshoppers yellow sugar cane aphid and other aphids	0.5 – 1
greenbug (2)	0.5 – 2
armyworms chinch bugs (3) cutworms lesser cornstalk borer (3)	1 – 2
webworms	1
European and southwestern corn borer	1.5 – 2
corn earworm	2

Numbers in parentheses (-) refer to Pest-Specific Use Directions.

Pest-Specific Use Directions:
1. **Sorghum midge:** Apply when 30% to 50% of the seed heads are in bloom.
2. **Greenbug:** Use a higher rate in the rate range when pest populations are high.
3. **Chinch bugs** and **lesser cornstalk borer:** Apply as a directed spray toward the base of the plant using power-operated ground spray equipment with sufficient water to ensure coverage of an 8- to 12-inch band centered in the row. For plants less than 6 inches high, apply an 8- to 12-inch band centered over the row. Do not reduce the dosage for banded or directed applications. Concentrate the full labeled dosage rate in the treated zone.

Specific Use Precautions:
- To minimize the potential for chemical injury, do not apply Lorsban Advanced to drought stressed grain sorghum within three days following irrigation or rain except where the product is applied in irrigation water.
- Be aware that sorghum lines used in seed production fields may be more susceptible to chemical injury. Susceptible inbred lines or hybrids are likely to be at greater risk of yield-reducing chemical injury when treated at the higher application rates. Users should not apply more than 1 pint of Lorsban Advanced per acre to seed sorghum if the additional risk of crop injury is unacceptable.

Specific Use Restrictions:
- **Preharvest Interval:** Do not harvest for grain, forage, fodder, hay, or silage within 30 days after application of 1 pint of Lorsban Advanced per acre or within 60 days after application of rates above 1 pint per acre.
- Do not make more than three applications of Lorsban Advanced or other product containing chlorpyrifos per use season.
- Maximum single application rate is 0.94 lb ai chlorpyrifos (2 pints of Lorsban Advanced) per acre.
- Do not apply more than 1.41 lb ai chlorpyrifos (3 pints of Lorsban Advanced) per acre per season.
- Do not make a second application of Lorsban Advanced or other product containing chlorpyrifos within 10 days of the first application.
- Do not treat sweet varieties of sorghum.
- Do not aerially apply this product in Mississippi.

Soybean
(Not for use in Mississippi)

Worker Restricted Entry Interval: Do not enter or allow worker entry into treated areas during the restricted entry interval (REI) of 24 hours unless PPE required for early entry is worn.

Soil Application
Apply as a broadcast treatment to soil surface in a minimum spray volume of 10 gpa using suitable ground spray equipment or as a band application. Use a higher rate in the rate range when there is increased pest pressure. For band application, equivalent rates of insecticide spray required per 100 feet of row for listed row spacing are given in the table below. For at-plant treatments, apply in a 4- to 6-inch band centered over the row. Position the spray nozzle in front of the planter shoe or press wheel or after the press wheel followed by a drag chain for light incorporation. **Do not apply as an in-furrow treatment.** For a postemergence rescue treatment, apply as a directed spray in a 9- to 12-inch band at the base of the plant. For plants less than 6 inches tall, apply over-the-top in a 6- to 12-inch band.

Target Pests	At-Plant Treatment (Broadcast, T-band or Band) (pint/acre)	Postemergence Rescue Treatment (Band Only) (pint/acre)
cutworms lesser cornstalk borer	1 – 2	1 – 2

Fluid Ounces of Spray Required Per 100 Feet of Row for Listed Row Spacings and Spray Volumes				
Volume of Spray Per Acre (gal)	36"	32"	28"	24"
10	8.8	7.9	6.9	5.9
15	13.2	11.8	10.3	8.8
20	17.6	15.7	13.7	11.8

Foliar Application
Apply as a postemergence broadcast spray using sufficient spray volume to ensure thorough coverage of treated plants, but no less than 15 gpa for ground spray equipment or 2 to 5 gpa for aircraft equipment. Apply when field counts indicate damaging pest populations are developing or present. Lorsban Advanced may be tank mixed with glyphosate products, such as Duramax or Durango DMA, when application is to be made to glyphosate-tolerant soybeans. Use a higher rate in the rate range when there is increased pest pressure.

Chemigation: Lorsban Advanced may be applied through sprinkler irrigation systems at specified broadcast application rates to control listed foliar pests. See Chemigation Application section.

Target Pests	Lorsban Advanced (pint/acre)
grasshoppers green cloverworm spider mites (1) velvetbean caterpillar	0.5 – 1
armyworms bean leaf beetle corn earworm cutworms Mexican bean beetle potato leafhopper saltmarsh caterpillar and other woolly bears soybean aphid thistle caterpillar (painted lady butterfly)	1 - 2
brown marmorated stink bug European corn borer southern green stink bug	2

Numbers in parentheses (-) refer to Pest-Specific Use Directions.

Pest-Specific Use Directions:
1. **Spider mites:** When large numbers of eggs are present, scout the treated area in 3 to 5 days. If newly hatched nymphs are present, make a follow-up application of a non-chlorpyrifos product that is effective against mites.

Specific Use Precaution:
- On determinate soybeans, do not make more than one application after pod set.

Specific Use Restrictions:
- **Preharvest Interval:** Do not apply within 28 days before harvest.
- Do not make more than three applications of Lorsban Advanced or other product containing chlorpyrifos per year.
- Maximum single application rate is 0.94 lb ai chlorpyrifos (2 pints of Lorsban Advanced) per acre.
- Do not apply more than a total of 2.82 lb ai chlorpyrifos (6 pints of Lorsban Advanced) per acre per season.
- Do not make a second application of Lorsban Advanced or other product containing chlorpyrifos within 14 days of the first application.
- Do not allow meat or dairy animals to graze in treated areas or otherwise feed treated soybean forage, hay, and straw to meat or dairy animals.

Strawberry
(Not for use in Mississippi)

Worker Restricted Entry Interval: Do not enter or allow worker entry into treated areas during the restricted entry interval (REI) of 24 hours unless PPE required for early entry is worn.

Preplant Incorporation Application
Apply Lorsban Advanced in sufficient water to ensure uniform soil coverage and incorporate into the soil in the spring for protection of strawberries during the following year.

Target Pest	Lorsban Advanced (quart/acre)
garden symphylans grub	2

Foliar Application
Apply as a broadcast foliar spray when buds first appear and repeat application 10 to 14 days later. Use a minimum spray volume of 40 gpa.

Target Pest	Lorsban Advanced (quart/acre)
strawberry bud weevil	1

Postharvest Application
Apply as a directed spray to crown of strawberry plants immediately after harvest and after plants are topped. Repeat application, if required, 14 to 18 days later. Use a minimum spray volume of 100 gpa.

Target Pest	Lorsban Advanced (quart/acre)
strawberry crown moth	1

Specific Use Precautions:
- Do not tank mix Lorsban Advanced with pesticides, surfactants, or fertilizer formulations unless prior use has shown the combination non-injurious under your current conditions of use.
- Phytotoxicity may occur when Lorsban Advanced is applied to strawberries under conditions of high temperature and drought stress.

Specific Use Restrictions:
- **Preharvest Interval:** Do not apply within 21 days before harvest.
- **Preplant Application:** Do not make more than one application of Lorsban Advanced or other product containing chlorpyrifos per year.
- **Foliar and Postharvest Applications:** Do not make more than two applications of Lorsban Advanced or other product containing chlorpyrifos per year.
- **Postharvest Application:** Do not sprinkle irrigate for one week following application.
- Maximum single application rate is 1.88 lb ai chlorpyrifos (2 quarts of Lorsban Advanced) per acre for preplant incorporation and 0.94 lb ai chlorpyrifos (1 quart of Lorsban Advanced) per acre for foliar and postharvest application.
- Do not make a second application of Lorsban Advanced or other product containing chlorpyrifos within 10 days of the first foliar application and within 14 days of postharvest application.
- **For prebloom use only.** Do not apply after berries start to form or when berries are present.

Sugarbeet
(Not for use in Mississippi)

Worker Restricted Entry Interval: Do not enter or allow worker entry into treated areas during the restricted entry interval (REI) of 24 hours unless PPE required for early entry is worn.

Soil Application (At-Planting or Preplant Incorporated)
To reduce feeding damage from early season insects such as cutworms, apply at-planting or as a preplant treatment and incorporate to a depth of 1 to 2 inches. Do not apply as an in-furrow treatment. Apply 1 pint of Lorsban Advanced per planted acre to a 10-inch wide band centered over the row for furrows 30 inches apart. (For rows 30 inches apart, this is equivalent to 9.2 fl oz of Lorsban Advanced per 10,000 feet of row). For other row widths, adjust the spray volume per planted acre in proportion to the length of row actually treated.

Postemergence Application
Apply specified rate as a broadcast or banded foliar spray. Treat when field counts indicate that damaging insect populations are developing or present.

Broadcast Application: Apply the specified dosage in water using 2 to 5 gpa of finished spray when using aerial spray equipment or 10 to 30 gpa when using ground spray equipment. **Chemigation:** Lorsban Advanced may be applied through sprinkler irrigation systems at specified broadcast application rates to control listed foliar pests. See Chemigation Application section for application instructions.

Banded Foliar Spray: Apply the specified rate within the band using a minimum of 7 gallons of spray volume in a 5- to 7-inch wide band centered over the row. Do not reduce the rate for band applications. Concentrate the full labeled dosage rate (see band rates in table below) in the treated zone. For best results, lightly incorporate band-applied treatments, either mechanically or with irrigation.

Target Pests	Lorsban Advanced	
	Broadcast (pint/acre)	Band (pint/acre)
grasshoppers (1)	0.5 - 1	-
leafminers spider mites	1	0.67
tarnished plant bug (*Lygus*)	1	-
aphids fall armyworm yellowstriped armyworm webworms	1 - 2	0.67 – 1.33
beet armyworm	1.5 - 2	1 – 1.33
cutworms flea beetle adults	2	1.33
sugarbeet root maggot adults (2), (5)	0.5 - 1	-
sugarbeet root maggot larvae (3), (5)	-	1.33 - 2
sugarbeet root maggot larvae (4), (5)	2	1.33 - 2

Numbers in parentheses (-) refer to “Pest-Specific Use Directions".

Pest-Specific Use Directions:

1. **Grasshoppers:** The low rate will control small nymphs (1st through 3rd instar).
2. **Sugarbeet root maggot adults:** Apply anytime from 7 days before until 3 days after peak adult emergence in order to target adults present at time of application based upon local field trap monitoring.
3. **Sugarbeet root maggot larvae:** Use as primary treatment to control root maggot larvae. Base application timing on local field trap monitoring. Apply anytime from 7 days before until 3 days after peak adult emergence.
4. **Sugarbeet root maggot larvae:** Use as a supplemental postemergence treatment following an at-plant insecticide application for control of root maggot larvae. Base application timing upon local field trap monitoring. Apply anytime from 7 days before until 3 days after peak adult emergence.
5. **Sugarbeet root maggot:** To prevent the potential development of insecticide resistance, producers are encouraged to take the following steps: (1) avoid making more than two applications of Lorsban Advanced per season when adults are active; (2) if an organophosphate insecticide was applied at planting, make no more than one postemergence application of Lorsban Advanced when adults are active.

Specific Use Restrictions:

- **Preharvest Interval:** Do not apply within 30 days before harvest of beet roots and tops.
- Do not make more than three applications of Lorsban Advanced or other product containing chlorpyrifos per season.
- Maximum single application rate is 0.94 lb ai chlorpyrifos (2 pints of Lorsban Advanced) per acre.
- Do not apply more than a total of 2.82 lb ai chlorpyrifos (6 pints of Lorsban Advanced) per acre per season.
- Do not make a second application of Lorsban Advanced or other product containing chlorpyrifos within 10 days of the first application.
- Do not allow meat or dairy animals to graze in treated areas or harvest treated beet tops as feed for meat or dairy animals within 30 days of last treatment.
- To avoid unacceptable crop injury, do not tank mix Lorsban Advanced with Quadris or Headline or with any EC formulation or any tank mix containing an oil adjuvant.

Sunflower

(Not for use in Mississippi)

Worker Restricted Entry Interval: Do not enter or allow worker entry into treated areas during the restricted entry interval (REI) of 24 hours unless PPE required for early entry is worn.

Preplant Incorporation Application

Broadcast apply to soil surface in a minimum spray volume of 10 gpa using suitable ground spray equipment. On the same day of treatment, incorporate the insecticide into the top 2 to 4 inches of soil using a disc, field cultivator, or equivalent equipment. Use a higher rate in the rate range when there is increased pest pressure.

Target Pests	Lorsban Advanced (pint/acre)
cutworms	2 - 4

Postemergence Broadcast Application

Apply as a postemergence broadcast spray using sufficient spray volume to ensure thorough coverage of treated plants, but no less than 15 gpa for ground spray equipment or 2 to 5 gpa for aircraft equipment. Use a higher rate in the rate range when there is increased pest pressure.

Target Pests	Lorsban Advanced (pint/acre)
grasshoppers	1
banded sunflower moth seed weevil (4) stem weevil (2) sunflower beetle larvae and adults (1) sunflower moth (3) woolly bears	1 – 1.5
cutworms	2
tarnished plant bug (*Lygus*) (5)	1 - 2

Numbers in parentheses (-) refer to Pest-Specific Use Directions.

Pest-Specific Use Directions:

1. **Sunflower beetle:** For control of larvae or adults, treat when field counts indicate 10 larvae or 1 to 2 adults per seedling.
2. **Stem weevil:** Optimal treatment time is within 5 to 7 days after adult weevils begin to appear.
3. **Sunflower moth:** To control, make first application during early 1% to 5% bloom stage.
4. **Seed weevil:** To control, apply when field counts indicate 10 to 12 adults per plant for oil crop varieties and 1 to 3 adults per plant on confectionery crop varieties.
5. **Tarnished plant bug (*Lygus*):** Use a higher rate in the rate range where populations are heavy. Apply at the onset of pollen spread or approximately 10% bloom (R-5 growth stage). For best protection, make a second application 10 days later. Use sufficient water to ensure thorough coverage of treated plants.

Specific Use Restrictions:

- **Preharvest Interval:** Do not apply within 42 days before harvest.
- Do not make more than three applications of Lorsban Advanced or other product containing chlorpyrifos per season.
- Maximum single application rate is 1.88 lb ai chlorpyrifos (4 pints of Lorsban Advanced) per acre for preplant incorporation and 0.94 lb ai chlorpyrifos (2 pints of Lorsban Advanced) per acre for postemergence broadcast treatment.
- Do not apply more than a total of 2.82 lb ai chlorpyrifos (6 pints of Lorsban Advanced) per acre per season.
- Do not make a second application of Lorsban Advanced or other product containing chlorpyrifos within 10 days of the first application.
- Do not allow meat or dairy animals to graze in treated areas.

Sweet Potato

Worker Restricted Entry Interval: Do not enter or allow worker entry into treated areas during the restricted entry interval (REI) of 24 hours unless PPE required for early entry is worn.

Apply to the soil surface as a preplant broadcast spray to reduce the feeding damage caused by listed pests. Use a spray volume of 10 gpa or more. Incorporate immediately after application to a depth of 4 to 6 inches using a rotary hoe, disc cultivator, or other suitable incorporation equipment. Plant sweet potatoes in the usual manner no more than 14 days after treatment. Delaying planting more than 14 days after application will reduce the time interval of protection against feeding damage.

Target Pests	Lorsban Advanced (pint/acre)
Conoderus (wireworm) sweet potato flea beetle *Systena* (flea beetle)	4

Specific Use Precaution:
- Lorsban Advanced will not control false wireworms, white fringe beetle or other grubs that attack sweet potatoes.

Specific Use Restrictions:
- **Preharvest Interval:** Do not apply within 125 days before harvest.
- Do not make more than one application of Lorsban Advanced or other product containing chlorpyrifos per season.
- Maximum single application rate is 1.88 lb ai chlorpyrifos (4 pints of Lorsban Advanced) per acre.
- Do not aerially apply this product in Mississippi.

Tobacco

Worker Restricted Entry Interval: Do not enter or allow worker entry into treated areas during the restricted entry interval (REI) of 24 hours unless PPE required for early entry is worn.

Apply as a preplant broadcast spray to reduce the feeding damage caused by listed pests. Apply 24 to 48 hours before bedding and transplanting using a spray volume of 10 gpa or more. Incorporate immediately after application to a depth of 2 to 4 inches using suitable incorporation equipment.

Before broadcast application of Lorsban Advanced onto existing beds, knock down beds to final shape for transplanting. Use PTO-driven implements that will incorporate Lorsban Advanced to a depth of 4 inches.

Target Pests	Lorsban Advanced (pint/acre)
cutworms flea beetles mole crickets root maggots wireworms	2

To control the above listed pests and suppress populations of rootknot nematodes in all tobacco growing regions, use Lorsban Advanced in a tank mix with Nemacur 3 at the rate of 2 pints of Lorsban Advanced plus 4 quarts of Nemacur 3 per acre. Read and carefully follow all applicable directions, restrictions, and precautions on labeling for Nemacur 3 used in combination with Lorsban Advanced. Apply the specified rate(s) to the soil surface in a spray volume of 10 gpa or more 24 to 48 hours before bedding and transplanting. Immediately following application, incorporate into the soil to a depth of at least 4 inches using suitable equipment. Where the nematode species *Meloidogyne arenaria* or *M. javanica* are present, or there are high populations of *M. incognita*, apply Telone® II soil fumigant at the specified label rate.

Specific Use Restrictions:
- Do not make more than one application of Lorsban Advanced or other product containing chlorpyrifos per season.
- Maximum single application rate is 1 lb ai chlorpyrifos (2 pints of Lorsban Advanced) per acre.
- Do not aerially apply this product in Mississippi.

Tree Fruits,[1] Almond, and Walnut (Dormant/Delayed Dormant Sprays)
(Not for use in Mississippi)

Worker Restricted Entry Interval: Do not enter or allow worker entry into treated areas during the restricted entry interval (REI) of 4 days for tree fruits and 24 hours for almond and walnut unless PPE required for early entry is worn.

[1]Apple, cherry, nectarine, peach, pear, plum, prune

Apply as a dormant or delayed dormant spray. While Lorsban Advanced may be used without oil, for best results, use oil to control additional pests, such as European red mite. See precautions for use of oil below. Apply as a concentrate or dilute spray using conventional, power-operated spray equipment. For dilute sprays (greater than 200 gpa), use sufficient spray volume to completely wet tree foliage, but not to point of runoff. For concentrate sprays (less than 200 gpa), uniformly apply an equivalent amount of Lorsban Advanced per acre.

Use a higher rate in the rate range when there is increased pest pressure.

Use Precautions for Tree Fruits, Almond and Walnut:
- Cold or dry conditions may cause Lorsban Advanced plus oil sprays to infuse into trees, resulting in bud damage or bud drop. Do not apply until winter rains or irrigation has replenished soil moisture such that bark and twigs are not desiccated.
- To avoid contamination of irrigation tail waters, do not flood irrigate within 24 hours of application of Lorsban Advanced.

Use Restrictions for Tree Fruits, Almond and Walnut:
- Make only-one application of chlorpyrifos during the dormant season.
- For apple, do not make more than one application of Lorsban Advanced to the apple tree trunk per year as either a prebloom or post-bloom application.
- Do not use more than a total of 1.88 lb ai chlorpyrifos (4 pints of Lorsban Advanced) per acre per season as a dormant/delayed dormant application.
- Do not allow meat or dairy animals to graze in treated orchards.

Almond, Cherry, Nectarine, Peach, Pear, Plum, Prune

Target Pests	Lorsban Advanced (pint/acre)
American plum borer brown almond mite climbing cutworms European red mite greater peach tree borer lesser peach tree borer mealy plum aphid peach twig borer pear psylla adults San Jose scale	1.5 - 4

Specific Use Precautions for Almond, Cherry, Nectarine, Peach, Pear, Plum, Prune:
- Avoid contact with foliage in sweet cherries as premature leaf drop may result.

Specific Use Restrictions for Almond, Cherry, Nectarine, Peach, Pear, Plum, Prune:
- Do not make a soil or foliar application of Lorsban Advanced or other product containing chlorpyrifos within 10 days of a dormant/delayed dormant application of chlorpyrifos to the orchard.

Additional Restrictions Specific to California for Almond, Cherry, Nectarine, Peach, Pear, Plum, Prune:
- Do not use more than 1% dormant oil and/or penetrating surfactants in almond orchards less than 4 years old.
- Use a minimum of 100 gpa of total spray volume.
- Use up to 2% supreme oil with no more than 4 gpa on almonds.
- Use up to 2% supreme oil with no more than 6 gpa on peaches and nectarines.
- Refer to the University of California pest management guide for pears, plums, and prunes.
- In orchards with high overwintering populations of European red mite or brown almond mite, use higher spray volumes that allow for the use of higher per acre rates of oil.
- Do not use any adjuvants or surfactants in addition to, or as a substitute for, a petroleum spray oil in a tank mix with Lorsban Advanced.
- Do not apply on almonds in the following counties in California: Butte, Colusa, Glenn, Solano, Sutter, Tehama, Yolo, and Yuba.

Apple

Target Pests	Lorsban Advanced (pint/acre)
climbing cutworms *Lygus* obliquebanded leafroller pandemis leafroller rosy apple aphid San Jose scale	1.5 - 4

Specific Use Restrictions for Apple:
- Only one application of any chlorpyrifos containing product can be made per year. The application can be either a prebloom dormant/delayed dormant spray to the canopy or the trunk, or a post-bloom application to the lower 4 feet of the trunk (for post-bloom application instructions and restrictions on apple, refer to Apple Tree Trunk section of the label).

Additional Restrictions Specific to California for Apple:
- Use a minimum of 100 gpa of total spray volume.
- Refer to the University of California pest management guide for apples.

- In orchards with high overwintering populations of European red mite or brown almond mite, use higher spray volumes that allow for the use of higher per acre rates of oil.
- Do not use any adjuvants or surfactants in addition to, or as a substitute for, a petroleum spray oil in a tank mix with Lorsban Advanced.

Tree Fruits[1] and Almond (Trunk Spray or Preplant Dip)
(Not for use in Mississippi)

Worker Restricted Entry Interval: Do not enter or allow worker entry into treated areas during the restricted entry interval (REI) of 4 days for tree fruits and 24 hours for almond unless PPE required for early entry is worn.

[1]Cherry, nectarine, peach, plum

Apply Lorsban Advanced to tree trunks and lower branches using a coarse, low-pressure spray to control pests listed in the following table. Use a higher rate in the rate range when there is increased pest pressure. Unless otherwise specified, a second application may be made after two weeks and a third application may be made after harvest. Avoid spray contact with foliage in sweet cherries as premature leaf drop may result. Consult your state agricultural experiment station or extension service specialist for proper application timing for your area.

Crops	Target Pests	Lorsban Advanced (quart/100 gal)
cherry	American plum borer greater peach tree borer lesser peach tree borer	1.5 – 3
almond nectarine peach plum	peach tree borers (1) (2)	3

Numbers in parentheses (-) refer to Pest-Specific Use Directions.

Pest-Specific Use Directions:
1. **Preplant Dip Application (Peaches and Nectarines Only).** For preplant control of **peachtree borer**, use Lorsban Advanced at the equivalent application rate of 3 quarts per 100 gallons of water. Dip trees several inches above the grafting bud scar and plant immediately or allow them to dry before returning to storage. Do not allow peach trees to remain in contact with the dip solution.
2. P**each tree borer:** For control in established trees, apply before newly hatched borers enter the tree. Use as a coarse, low-pressure trunk spray and thoroughly wet all bark areas from ground level to scaffold limbs. Do not allow spray to contact fruit. Consult written recommendations provided by your State agricultural experiment station or extension service specialist for proper time to treat in your area.

Specific Use Restrictions:
- **Preharvest Interval:** Do not apply within 14 days before harvest of almonds, nectarines, peaches and plums or within 21 days before harvest of cherries.
- Do not make more than one chlorpyrifos application per year in nectarines peaches, and no more than three chlorpyrifos applications per year in cherries.
- Do not allow meat or dairy animals to graze in treated orchards.

Tree Nuts[1] (Foliar Sprays)

Worker Restricted Entry Interval: Do not enter or allow worker entry into treated areas during the restricted entry interval (REI) of 24 hours unless PPE required for early entry is worn.

[1]Almond, filbert, pecan, walnut

Apply Lorsban Advanced as a foliar spray at the dosages indicated to control pests listed in the following table. Mix the required dosage in sufficient water to ensure thorough and complete coverage of the foliage and crop and apply as a concentrate or dilute spray using conventional, power-operated spray equipment. For dilute sprays applied to tree nut crops, mix the required dosage in sufficient water to allow for spray to runoff. For concentrate sprays, apply an equivalent amount of Lorsban Advanced per acre. Treat when pests appear or in accordance with local conditions. Aerial application may result in less effective insect control because of reduced coverage. Consult your State agricultural experiment station, certified pest control advisor, or extension service specialist for specific use information in your area.

Crops	Target Pests		Lorsban Advanced (pint/acre)
almond	leaf footed plant bug navel orangeworm	peach twig borer San Jose scale	4
filbert	brown marmorated stink bug eye-spotted bud moth filbert aphid filbert leafroller	filbert worm obliquebanded leafroller omnivorous leaftier winter moth	3 – 4
pecan	blackmargined aphid (1) spittlebugs (2)	yellow pecan aphid (1)	1 – 4
	fall webworm	pecan nut casebearer	1.5 – 4
	black pecan aphid brown marmorated stink bug hickory shuckworm (3)	*Phylloxera* spp.(4) pecan leaf scorch mite (suppression) (5)	2 – 4
walnut	codling moth walnut husk fly	walnut scale	4

Numbers in parentheses (-) refer to Pest-Specific Use Directions.

Pest-Specific Use Directions:
1. **Yellow pecan aphid** and **blackmargined aphid:** For control, apply in tank mix combination with the specified rate of a pyrethroid insecticide labeled for control or suppression of these aphids.
2. **Spittlebug:** For control, use a dosage of 2 to 4 pint per acre for concentrate sprays.
3. **Hickory shuckworm**, For best results, make two applications, 10 to 14 days apart.
4. ***Phylloxera* spp.:** For best control, make two applications at a 10-day interval using a minimum of 1 pint of Lorsban Advanced per acre starting at bud swell.
5. **Pecan leaf scorch mite:** For suppression, use a preventative program.

Specific Use Precautions:
- Lorsban Advanced is highly toxic to bees exposed to direct treatment and should not be applied when bees are foraging in the treated area.
- To avoid contamination of irrigation tail waters, do not flood irrigate within 24 hours of application of Lorsban Advanced.

Specific Use Restrictions:
- **Preharvest Interval:** Do not apply within 14 days before harvest of almonds, filberts and walnuts, or 28 days before harvest of pecans.
- Do not make more than three total applications of Lorsban Advanced or other product containing chlorpyrifos per season to almonds, pecans and filberts and no more than two applications per season on walnuts.
- Do not apply more than a total of 3.76 lb ai chlorpyrifos (8 pints of Lorsban Advanced) per acre per season as a foliar spray.
- Do not make a second application of Lorsban Advanced or other product containing chlorpyrifos within 10 days of the first application.
- Do not allow meat or dairy animals to graze in treated orchards.
- Do not use on almond, filbert or walnut in Mississippi.
- Do not aerially apply this product in Mississippi.

Tree Nut[1] Orchard Floors
(Not for use in Mississippi)

Worker Restricted Entry Interval: Do not enter or allow worker entry into treated areas during the restricted entry interval (REI) of 24 hours unless PPE required for early entry is worn.

[1]Almond, pecan, walnut

Apply as a ground broadcast spray directed to the orchard floor using ground application equipment that will apply the spray uniformly. Do not allow spray to contact foliage or fruit. Treat when ant activity (excluding fire, harvester, carpenter, and pharaoh ants) becomes evident in the orchard. Since worker ants (excluding fire, harvester, carpenter, and pharaoh ants) cease most of their foraging activity at temperatures above 90°F, best results will be achieved if applied at a time of day when temperatures are below 90°F.

Chemigation: Lorsban Advanced may be applied to almond, pecan and walnut orchard floors through sprinkler irrigation systems only if the system uniformly covers the soil surface at the base of the tree. Use specified broadcast application rates to control listed pests. See Chemigation Application section.

Orchard Floor	Target Pests	Lorsban Advanced (pint/acre)
pecan	ants (1)	4
almond walnut		4 – 8

Numbers in parentheses (-) refer to Pest Specific Use Directions.

Pest Specific Use Directions:
1. Excludes fire, harvester, carpenter, and pharaoh ants.

Eliminate weed growth that would prevent uniform coverage of the orchard floor by mowing or herbicide treatment. Foliar applications of Lorsban Advanced may be made in addition to the orchard floor treatment.

Specific Use Precaution:
- To avoid contamination of irrigation tail waters, do not flood irrigate within 24 hours of application of Lorsban Advanced.

Specific Use Restrictions:
- **Preharvest Interval:** Do not apply within 14 days before harvest.
- Do not make more than two applications of Lorsban Advanced or other product containing chlorpyrifos per season to the orchard floor. If the 8 pint per acre rate is used, a second application is not allowed.
- Do not apply more than 3.76 lb ai chlorpyrifos (8 pints of Lorsban Advanced) per acre per season to the orchard floor.
- Do not make a second application of Lorsban Advanced or other product containing chlorpyrifos within 10 days of the first application.
- Do not allow meat or dairy animals to graze in treated orchards.

Turfgrass
(Not for use in Mississippi)

Worker Restricted Entry Interval: Do not enter or allow worker entry into treated areas during the restricted entry interval (REI) of 24 hours unless PPE required for early entry is worn.

Dilute Lorsban Advanced in water and apply to turfgrass grown for sod using suitable application equipment. For best results, turfgrass should be moist at time of treatment.

Pests	Lorsban Advanced fl oz/ 1000 sq ft	Lorsban Advanced quart/ acre
ants (1) armyworms beet fall yellowstriped centipedes chiggers chinch bugs crickets cutworms deer ticks earwigs European crane fly larvae fiery skipper fleas gnats grasshoppers greenbug aphids green June beetle grubs leafhoppers Lucerne moth millipedes mites Bermudagrass stunt clover winter grain mosquitoes pillbugs springtails sod webworms (lawn moths) (2) sowbugs ticks	0.75	1
billbug adults (3) bluegrass Denver hunting	0.75 - 1 1/2	1 - 2
annual bluegrass weevil (*Hyperodes*) (4) black turfgrass ataenius adults (5) mole crickets (6)	1.5	2
white grubs (7) black turfgrass ataenius European chafer Japanese beetle larvae northern and southern masked chafers)	1.5 - 3	2 - 4

Numbers in parentheses (-) refer to Pest-Specific Use Directions below.

Pest-Specific Use Directions:
1. Excludes fire, harvester, carpenter, and pharaoh ants.
2. **Sod webworms:** Delay watering or mowing of the treated area for 12 to 24 hours after treatment.
3. B**illbugs:** Spray early in the season just prior to or coinciding with first appearance of adults as recommended by your local Agricultural Extension Service Specialist.
4. **Annual bluegrass weevil:** To control, spray suspected problem areas in mid-April and again in mid-May, or as recommended by your local Agricultural Extension Service Specialist.
5. **Black turfgrass ataenius adults**: Spray early in the season as recommended by your local Agricultural Extension Service Specialist. A repeat application may be needed 1 to 2 weeks later.
6. **Mole crickets:** To control in turfgrass, apply Lorsban Advanced through high-pressure injection or other suitable subsurface placement application equipment. Depending upon the application equipment used, follow the manufacturer's directions for calibration and the volume of spray per acre needed to provide control or as recommended by your local Agricultural Extension Service Specialist. For best results, apply when young nymphs are active.
7. **White grubs:** Spray when grubs are young and actively feeding near the soil surface, usually during late July and August, or as recommended by your local Agricultural Extension Service Specialist. For best results, soil should be moist prior to treatment. For best results, immediately after spraying, irrigate the treated area with 1/2 to 1 inch of water to wash the insecticide into the thatch and underlying soil.

Wheat
(For use only in Arizona, California, Colorado, Idaho, Kansas, Minnesota, Montana, Nebraska, New Mexico, Nevada, North Dakota, Oklahoma, Oregon, South Dakota, Texas, Utah, Washington and Wyoming)

Worker Restricted Entry Interval: Do not enter or allow worker entry into treated areas during the restricted entry interval (REI) of 24 hours unless PPE required for early entry is worn.

Foliar Application
Apply using aerial (fixed wing or helicopter) or power-operated ground spray equipment. Mix the required dosage with water and apply in a minimum of 2 to 5 gpa finished spray volume for aerial equipment or 15 gpa for ground spray equipment. Apply when field counts indicate damaging pest populations are developing or present.

Chemigation: Lorsban Advanced may be applied through sprinkler irrigation systems at specified broadcast application rates to control listed foliar pests. See Chemigation Application section.

Target Pests	Lorsban Advanced (pint/acre)
aphids (1) English grain aphid greenbug Russian wheat aphid brown wheat mite grasshoppers	0.5 - 1
army cutworms (2) armyworms (3) cereal leaf beetle (4) cutworms (suppression) (2) wheat midge (5)	1

Numbers in parentheses (-) refer to Pest-Specific Use Directions.

Pest-Specific Use Directions:
1. Consult university extension bulletins for local treatment recommendations.
2. Control may be reduced under high temperature conditions (greater than 80°F), under dry soil conditions, or if larvae are more than 1/2 inch long.
3. Expect suppression under conditions of heavy pest populations or large worms.
4. Target application when eggs are near hatching and larvae is emerging as monitored by plant inspection.
5. **Wheat midge:** For control, treat when 75% of the wheat heads have emerged from the boot and when midge adults are found in the crop (1 midge per 4 to 5 heads). If possible, apply in the late afternoon or early evening when temperatures exceed 50°F and wind speed is less than 7 mph.

Specific Use Restrictions:

- **Preharvest Interval:** Do not apply within 14 days before harvest for forage and hay and within 28 days before harvest for grain and straw.
- Do not make more than two applications of Lorsban Advanced or other product containing chlorpyrifos per season.
- Maximum single application rate is 0.47 lb ai chlorpyrifos (1 pint of Lorsban Advanced) per acre.
- Do not allow meat or dairy animals to graze or otherwise feed on treated forage within 14 days of application.
- Do not feed straw from treated wheat within 28 days of application.

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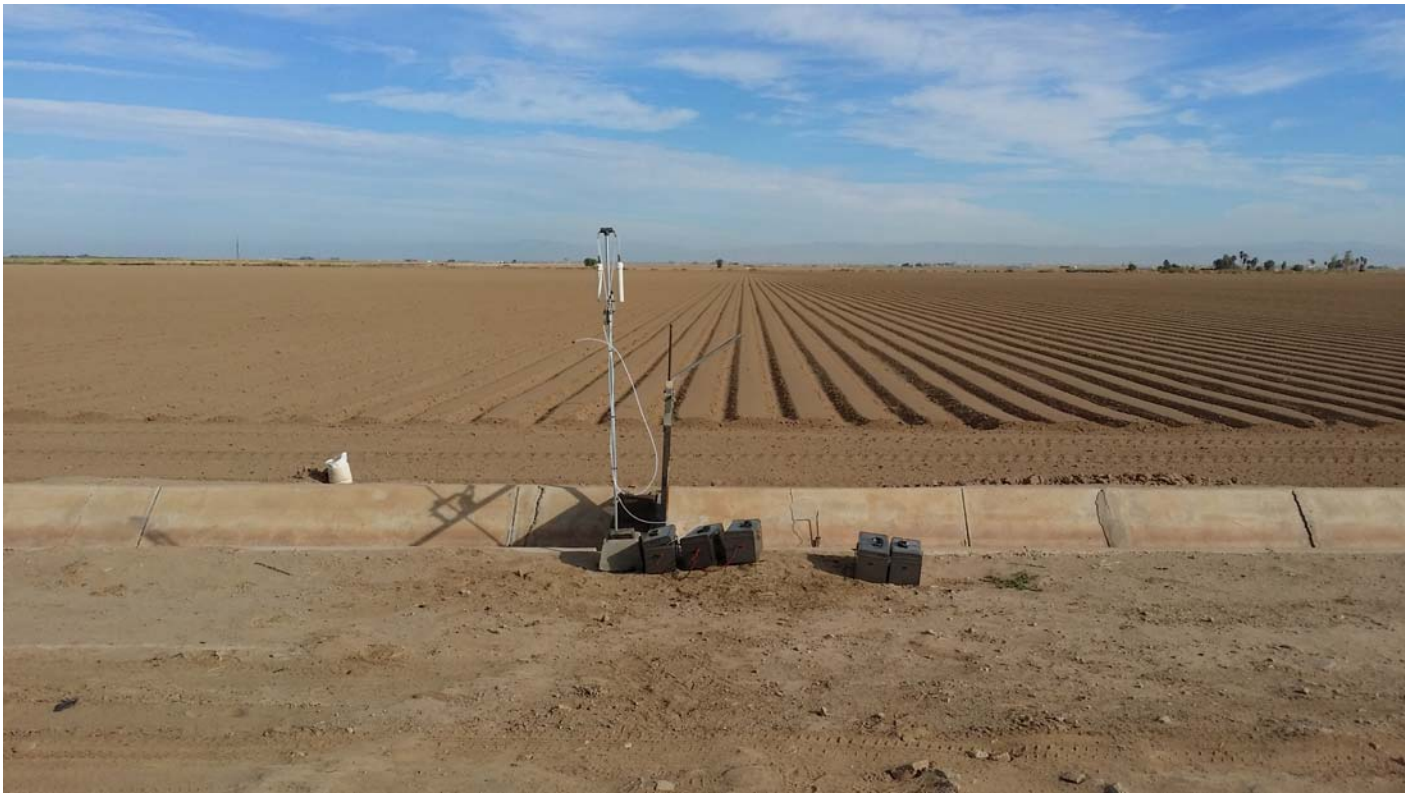
EPA accepted 12/21/12

Revisions:

1. Added buffer zone language based upon application rate and nozzle droplet size.
2. Under Brassica (Cole) Leafy Vegetables[1] and Radish, Rutabaga, and Turnip within the Specific Use Restrictions for Preplant Incorporation and At-Plant or Post Plant Soil Applications section removed 'cauliflower' from the third bullet.
3. Updated trademarking



North Site – Facing North

North Site – Facing East

North Site – Facing South

North Site – Facing West

North East Site – Facing North

North East Site – Facing East

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North East Site – Facing West

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