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CALIFORNIA AIR RESOURCES BOARD

Final Report on Seasonal Ambient Pesticide Air Monitoring For The Organophosphate Pesticide Active Ingredients Chlorpyrifos, Diazinon, and Malathion In Imperial County, January through March 2018

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Monitoring Report Approval

Report Title: Final Report on Seasonal Ambient Pesticide Air Monitoring For The Organophosphate Pesticide Active Ingredients Chlorpyrifos, Diazinon, and Malathion In Imperial County, January to March 2018

Approval: The following monitoring report has been reviewed and approved by the Monitoring and Laboratory Division.

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Executive Summary

At the request of the California Department of Pesticide Regulation (DPR), (memorandum dated October 2016, “Use Information and Air Monitoring Recommendation for the Organophosphate Pesticide Active Ingredients Chlorpyrifos, Diazinon, and Malathion: Seasonal Ambient Air Monitoring Studies in Kern County, Fresno and Tulare Counties, and Imperial County.”), the California Air Resources Board (CARB) conducted an ambient air monitoring project for the organophosphate (OP) pesticide active ingredients chlorpyrifos, diazinon, and malathion, during the high-use months of January through March 2018 in Imperial County. The monitoring was conducted in communities near historical high-use areas. There were five sampling locations throughout the County including three at public schools and two at Imperial County Air Pollution Control District air monitoring stations. In a partnership with the community health group Comite Civico Del Valle (CCV), a sixth monitoring site was added during the third week of the study.

Two hundred and eighty four (284) field samples including three (3) trip spikes, eight (8) field spikes, ten (10) field blanks, and fourteen (14) collocated samples were collected over the ten week study period. Six primary samplers were set up around Imperial County, in the cities of Seeley, Westmorland, Brawley, Imperial, and Heber. An additional sampler for QC samples was set up in Seeley due to it being the expected high-use site (based on historical high-use data).

During the third week of sampling, CARB partnered with the community group Comite Civico Del Valle (CCV) to collect pesticide data in an area of concern to the community. An additional sampler was set up at the Brawley campus of San Diego State University (SDSU) by CARB, and staff from CCV were trained to operate and collect samples at that site.

Samples were collected on sorbent tubes with an air sampling flow rate of one standard liter per minute (SLPM). The sorbent tube air samples were analyzed with the “Standard Operating Procedure for the Determination of Selected Organophosphate Pesticides Collected on XAD-2 Resin by Gas Chromatography-Triple Quadrupole Mass Spectrometry” by CARB’s Northern Laboratory Branch (NLB) in Sacramento.

Sorbent Tube Results

Many of the organophosphate (OP) samples collected were below the method detection limit or were present only at trace levels. Therefore, the OP concentrations of most samples could not be calculated with certainty. Of 2,333 total valid analyses, 26 had quantifiable OP concentrations, 38 had trace levels, and 2,269 had non-detectable levels.

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1.0 Introduction

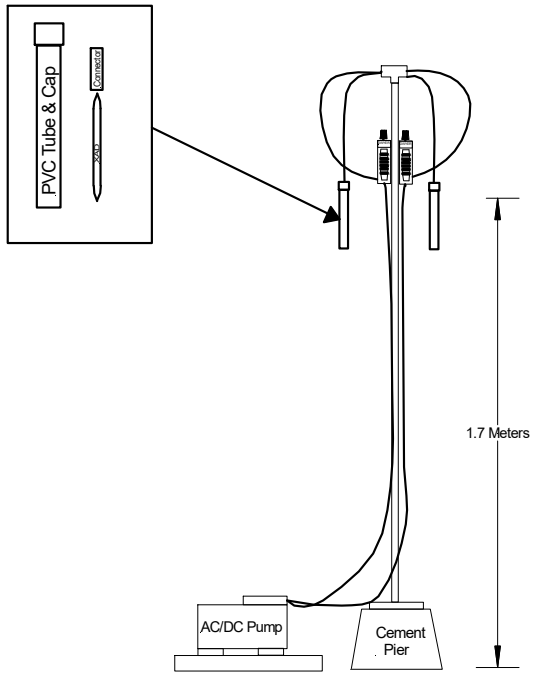
At the request of the Department of Pesticide Regulation (DPR) and as part of the proposed monitoring requests included in the 2016 Budget Act, the California Air Resources Board (CARB) conducted air monitoring for the organophosphate (OP) pesticide active ingredients chlorpyriphos, diazinon, and malathion, all of which are included in the organophosphate chemical class. Organophosphate pesticides work through the inhibition of the enzyme acetylcholinesterase. This inhibition results in the accumulation of the neurotransmitter acetylcholine at post-synaptic receptors in the peripheral, neuromuscular, and central nervous systems. Data presented by DPR in 2016 showed that Imperial County had the fourth highest annual reported OP usage for years 2012 – 2014. The report showed that during those years, the total reported use in Imperial County was over 458,000 pounds of active ingredients. Past reports indicates that the usage in Imperial County peaks during the months of January to March (Appendix I).

A total of 284 samples, which included 249 primary samples and 35 quality control samples (14 collocated samples, 8 field spikes, 3 trip spike, and 10 field blanks), were collected from January 15, 2017 through March 22, 2017. Monitoring occurred continuously for four 24-hour periods for each week of the study. Weekly sampling commenced upon arrival of the field staff and continued until the fourth/final sample was collected approximately 96 hours later. The “Sampling Protocol for Organophosphate Study” is located in Appendix II.

2.0 Methods

The sampling process was designed to collect OP's on an XAD sorbent tube. Samples were collected by passing a measured volume of ambient air through the sorbent tubes mounted on sampling trees. The inlet portion of each sampling tree was approximately 1.7 meters above the sampling platform. A sampler leak check and flow check was performed prior to each sampling period. After the sample sorbent tube was installed, the flow rate was set to 1 SLPM ± 10% (standard cubic centimeters per minute) using the inline rotameter with a flow range of 0-2 LPM. The flow rate was measured using an Alicat Whisper digital mass flow meter with a range of 0-2 LPM. The flow rate was re-checked at the end of each sampling period just prior to removal of the sorbent tube. For the samples to be acceptable, the average flow rate must have been within 20% of 1 SLPM (between 0.8 SLPM and 1.2 SLPM). Samples out of the specified flow range were flagged as invalid. The certification document for the mass flow meter can be seen in Appendix III.

Figure 1 – XAD Sampling Tube Setup



The ten week study began on January 15, 2018 and ended March 22, 2018. Of the 284 samples collected in total, 249 were primary samples and 35 were quality control (QC) samples (14 collocated samples, 8 field spikes, 3 trip spikes, and 10 field blanks). The QC samples were collected at the Seeley Elementary School location on a

secondary sampler. The spiked sorbent tubes were prepared prior to weekly sampling and stored in the laboratory freezer then shipped with blue ice by laboratory staff to field personnel. Upon retrieval of the spike they were immediately put into a dry ice cooler with dry ice for transport to the sampling location. Monitoring occurred continuously for four 24-hour periods each week.

At the end of each sampling period, the sampled sorbent tubes were placed in individual capped culture tubes with an identification label affixed to each sample. The operating interval and flow rate of each sample were recorded on the log sheet. Each culture tube was then placed in a dry ice cooler with dry ice and stored for the remainder of the week. At the end of the week, the collected samples were shipped with blue ice back to CARB MLD's Northern Laboratory Branch (NLB).

The OP field log, which presents the sample start and end times, start and end flow rates, and elapsed time meter readings for each sample, can be found in Appendix IV. Site nomenclature for this study was based upon the location of each sampler and the daily sample number. Additional abbreviations were added to identify the type of QC sample collected (collocated, blank, or spike), if applicable.

Sampler Locations:

SE – Seeley Elementary School

BW – Brawley Courthouse

FW – Frank Wright Middle School, Imperial

WM –Westmorland

MH – Brawley SDSU

HE – Heber Elementary School

Quality Control:

FB – Field Blank

CO – Collocated

FS – Field Spike

TS – Trip Spike

Examples:

HE – 1 = Heber, sample day 1

SE– 8 - CO = Seeley Elementary School, sample day 8, Collocated Sample

NLB extracted and analyzed all of the samples from this pesticide study. The collected sorbent tube samples were analyzed following the laboratory standard operating procedure titled "SOP MLD 077 (Appendix V), Standard Operating Procedure for the

Determination of Selected Organophosphate Pesticides Collected on XAD-2 Resin by Gas Chromatography-Triple Quadrupole Mass Spectrometry." Following this procedure, each tube was extracted with four milliliters (mL) of ethyl acetate and desorbed in an ultrasonic bath for 60 minutes. Sample extracts were filtered and then analyzed using a gas chromatograph coupled with a triple quadrupole mass spectrometer detector (GC/MS/MS). The full laboratory results are included in Appendix VI.

3.0 Sampling Sites

The locations for air monitoring were determined by working with local school districts and the local Air Pollution Control District in the desired monitoring area. Upon securing access to the sampling sites, DPR approved the site locations.

Six samplers were set up in the following locations:

- Seeley – Seeley Elementary School
- Westmorland – Imperial County Air Pollution Control District air monitoring network site
- Brawley – Imperial County Air Pollution Control District air monitoring network site
- Imperial – Frank Wright Middle School
- Heber – Heber Elementary School
- Brawley SDSU – San Diego State University Imperial County campus

With Seeley being the historically high-use city in the County, a second sampler for quality control samples was set up at Seeley Elementary School.

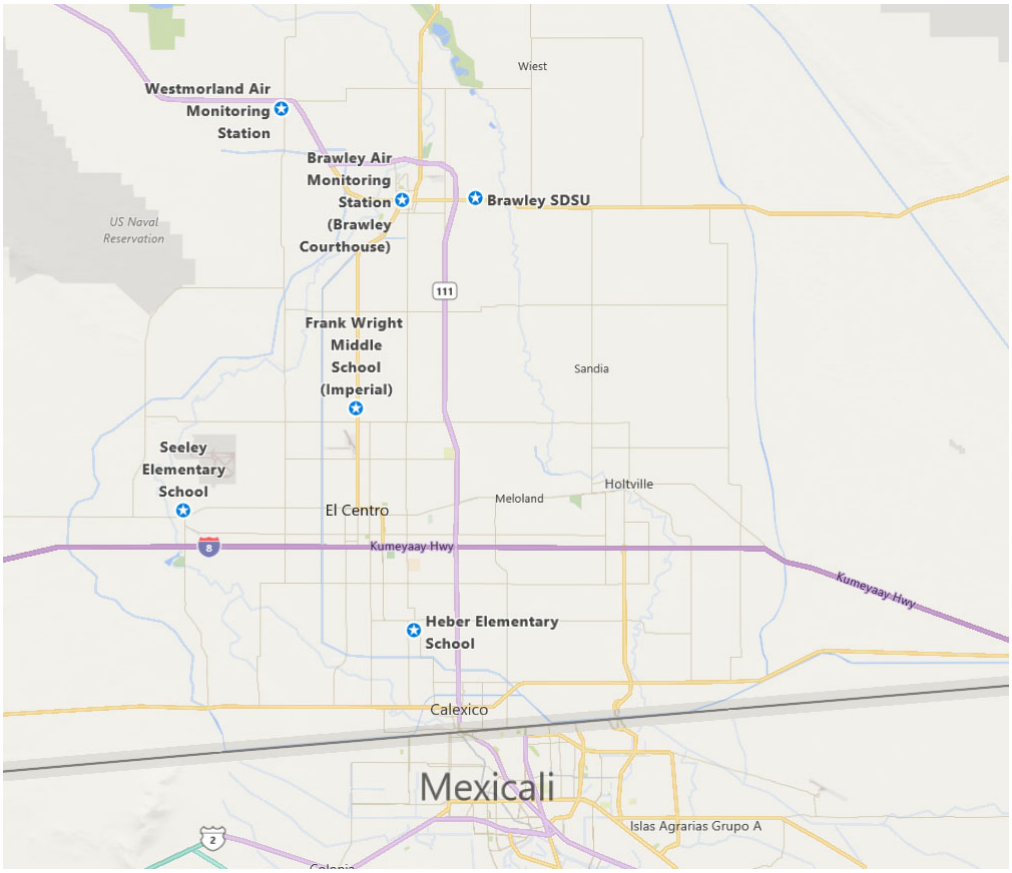
The global positioning satellite coordinates of each sampler are included in Table 1. Also included in Table 1 are the sampler probe heights from the ground. The samplers were placed on top of buildings and shipping containers, or on ground level at the sampling locations.

Figure 2 shows an aerial view of the monitored area with the sampler locations marked. Photos of all of the samplers at each location can be seen in Appendix VII.

Table 1: Sampler Waypoints

City	Location	Coordinates	Probe Height From Ground (m)
Seeley	Seeley Elementary School	32°47'43.5"N 115°41'29.9"W	4.4
Westmorland	Imperial County APCD Air Monitoring Site (Cargo Container)	33°01'56.7"N 115°37'25.3"W	3.6
Brawley	Imperial County APCD Air Monitoring Site (Brawley Courthouse)	32°58'42.4"N 115°32'20.8"W	8.5
Imperial	Frank Wright Middle School	32°51'19.08"N 115°34'17.8248" W	7.8
Heber	Heber Elementary School	32°43'35.7312"N 115°31'41.826" W	4.4
Brawley	San Diego State University-Imperial County campus	32°58'47.532"N 115°29'16.5516" W	1.7

Figure 2: Aerial Overview of Monitored Area



4.0 Deviations from Protocol

After the sampling had begun at the initial five sites, CARB worked with Comite Civico Del Valle (CCV), a community group in Brawley, to address concerns that the site at the Brawley courthouse does not adequately address exposure to the community. In partnership with CCV, a sixth sampling site was located and secured by CCV at the San Diego State University (SDSU) Imperial Valley Brawley Campus. Note that this site at the SDSU campus ended up to be the selected site by CCV instead of the site at the Miguel Hidelgo Elementary School as initially noted in the study protocol. Pesticide sampling equipment, sample media, flow standards, training, shipping containers and set-up were provided by CARB. CCV staff were trained to operate the pesticide sampler at the Brawley SDSU site and were responsible for operating the sampler, changing sample media, and shipping samples to the laboratory. Sampling at SDSU began on 2/5/18 and was completed on 3/22/18.

In addition to analyzing the three organophosphate compounds listed in the sampling protocol, MLD's Organics Laboratory provided analyses for eight additional compounds that were not included in the sampling protocol. The complete list of compounds analyzed, their method detection limit (MDL), and estimated quantitation limit (EQL) are listed in Table 2.

Table 2

Analyzed Compounds with MDLs and EQLs

Compound	**Method Detection Limit** (µg/ml)	**Estimated Quantitation Limit** (µg/ml)
Chlorpyrifos	0.0011	0.0055
Diazinon	0.00080	0.0040
Malathion	0.00090	0.0045
Chlorpyrifos Oxygen Analog (OA)	0.0015	0.0075
Diazinon OA	0.0011	0.0055
Malathion OA	0.0024	0.012
DEF	0.0017	0.0085
Dimethoate	0.0020	0.010
Dimethoate OA	0.0013	0.0065
Dichlorvos	0.0010	0.0050
Phosmet	0.00090	0.0045

The sampling protocol states that field samples are considered valid if the sample run times were between 23 to 25 hours. In this study, samples where the Estimated Time Meter (ETM) indicates a run time of 22.9 were rounded to 23 hours and considered valid. If the laboratory analysis indicated a trace or quantifiable amount of a compound and the

sample run time was 22.9 hours, the result was flagged so that the reader could note the difference. Of six flagged samples, two samples had trace amounts and no samples had measureable amounts of OPs.

The monitoring recommendation for the study was 12 weeks. However, CARB and DPR collectively agreed that the study could be shortened to ten weeks.

Pump failures or power failures occurred on 1/16/18 and 1/17/18 and resulted in invalid samples. The final flow rates of each invalidated sample could not be confirmed; therefore, an average flow rate could not be calculated.

On 1/26/18 through 1/29/18, the sample at Frank Wright Middle school ran for 72 hours because the school grounds were locked and inaccessible over the weekend which resulted in an invalid sample.

The DPR protocol required that at least 10% of the total number of collected samples be QC samples (i.e., collocated, blank and spike), however, an agreement between DPR and CARB allowed for one QC sample per week. In this study, ten passive samples were collected at the collocated Seeley site. A passive sample is a sample tube which is loaded into the sampler without air being drawn through the sample media. The sample media is typically loaded after the last sampling day of each week (Thursday or Friday) and removed prior to the beginning of the next sampling week. During the study, only eight field spikes and three trip spikes were sampled. One field spike was received with the temperature strip indicating that the temperature exceeded 4 degree Celsius and another was due to a missed shipment. The number of trip spikes was reduced due to a shortage of sample media.

Typically, sorbent tubes used for sampling should only be opened just prior to utilization and then collected right after sampling stops. This ensures no passive contamination and/or degradation of the sorbent materials in the tubes due to humidity or temperature fluctuations. During the study, the first sample tube of each week was opened and the pump programmed to begin to run between 3 to 5 days later, depending on the sampling schedule for the week.

Moreover, typically, dry ice is utilized to transport samples from the field to the laboratory by vehicle. However, for this study, the samples were shipped overnight by flight from Imperial County to Sacramento County. Due to restrictions of having dry ice on airplanes, blue ice was used in lieu of dry ice to transport the samples collected in the study.

Besides the deviations noted above, no other significant deviations from the “Sampling Protocol for Organophosphate Monitoring in Imperial County” occurred.

5.0 Results

A brief summary of the data results are provided below. Detailed information regarding sample flow rate, sampling date and time, sample volume, and pesticide concentrations at each of the monitoring sites are located in Appendix VIII of this report.

The majority of the samples were under the method detection limit or were present only at trace levels (between the MDL and EQL). Due to this, the OP concentrations of most samples could not be calculated with certainty. Of 213 total valid primary samples, there were 26 quantifiable concentrations, in total, of which 3 were chlorpyrifos, 4 were diazinon, and 5 were malathion. The chlorpyrifos sample with the highest concentrations was from the Westmorland site on 1/16/18 (0.039 µg/m^3). The diazinon sample with the highest concentration was from Westmorland on 1/16/18 (0.032 µg/m^3), and the highest malathion sample was also from Westmorland on 2/25/18 (0.212 µg/m^3).

Note that samples (i.e., MH-17 through MH-32) from the Brawley SDSU site between 2/24/18 and 3/17/18 were invalidated because there were no chain of custody forms submitted with the samples for validation. While these samples were invalidated, all samples collected and received by the lab were analyzed therefore the results are provided in Appendix VIII. Attempts were made to obtained COC sample forms for the Brawley SDSU site from CCV but were unsuccessful.

Table 3 summarizes the results of the three primary OP compounds chlorpyrifos, diazinon, and malathion broken down by site, and by the number of samples with non-detectable levels, trace levels, and quantifiable levels. Table 4 provides a summary of the eight additional OP compounds that were analyzed by the lab. Figure 3 summarizes the results of all eleven OP compounds.

Tables 5 through 8 present the QC sampling results at the Seeley site.

Table 3 – Sampling Results Summary:

Chlorpyrifos, Diazinon, and Malathion

	Chlorpyrifos				Diazinon				Malathion			
Site	**Non-Detect**	**Trace**	**Quantifiable**	**Invalid**	**Non-Detect**	**Trace**	**Quantifiable**	**Invalid**	**Non-Detect**	**Trace**	**Quantifiable**	**Invalid**
Seeley	39	1	0	3	40	0	0	3	37	3	0	3
Westmorland	38	0	3	2	38	0	3	2	33	3	5	2
Brawley Court House	43	0	0	0	43	0	0	0	41	2	0	0
Brawley SDSU*	11	0	0	1	11	0	0	1	11	0	0	1
Imperial**	38	0	0	3	37	0	1	3	32	6	0	3
Heber	40	0	0	3	40	0	0	3	36	4	0	3
Total	209	1	3	12	209	0	4	12	190	18	5	12

*A total of thirty-four samples were collected from this site. Of the 34 samples, 11 samples were valid. There were no quantifiable or traceable chlorpyrifos, diazinon, or malathion concentrations from the 11 valid samples. One sample (MH-24) was invalidated because of a field setup error. Fourteen samples were submitted without a Chain of Custody (COC) form or with missing sample information. These 14 samples without COCs were invalidated, however, all collected and received samples were analyzed, therefore, the results are provided in Appendix VIII. Eight samples were not received by the lab for analyses.

**A total of forty-one samples were collected from this site. Three samples were invalidated. There was one quantifiable diazinon concentration and six trace concentrations of malathion but neither quantifiable nor traceable chlorpyrifos concentration were measured at this site. Two samples (FW-11 and FW-12) were not received by the lab for analyses.

Table 4 – Sampling Results Summary:

Chlorpyrifos OA, Diazinon OA, Malathion OA, Dimethoate,

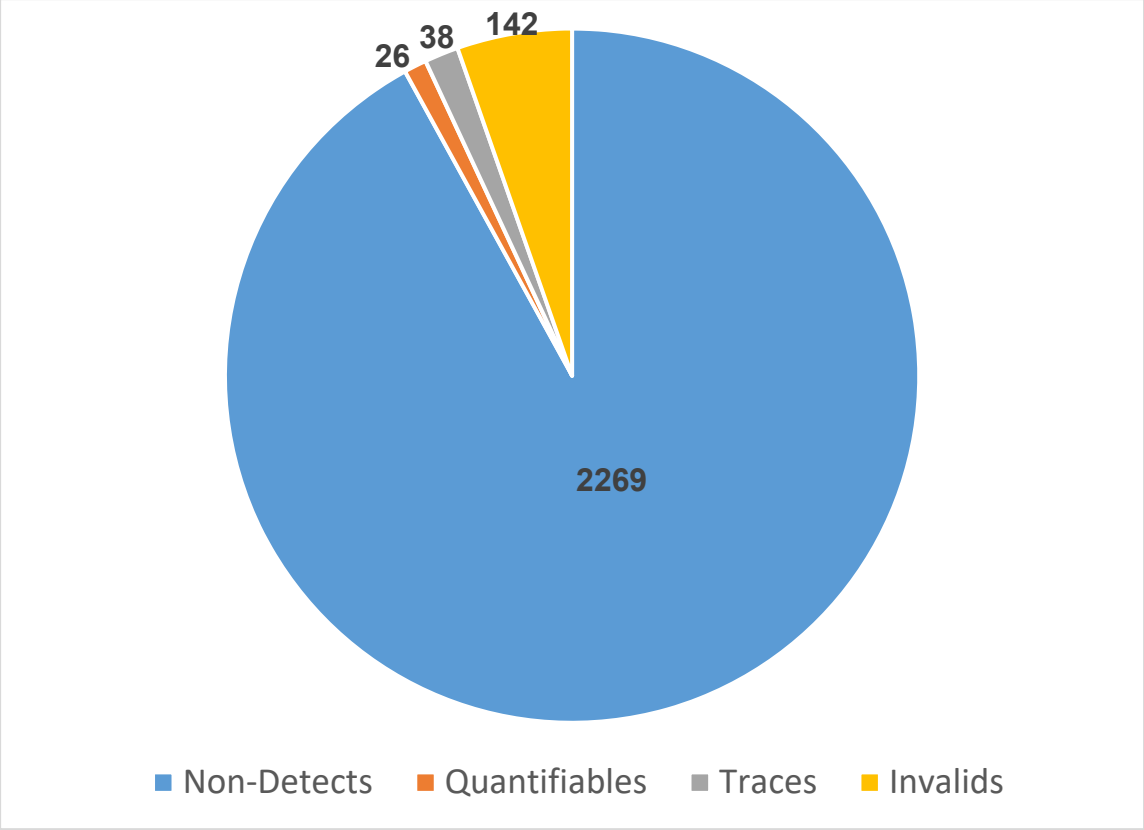
Dimethoate OA, DEF, Dichlorvos, Phosmet

		Chlorpyrifos OA	Diazinon OA	Malathion OA	Dimethoate	Dimethoate OA	DEF	Dichlorvos	Phosmet	Total
Seeley	Non Detect	40	40	40	40	35	40	38	40	313
	Trace	0	0	0	0	0	0	2	0	2
	Quantifiable	0	0	0	0	1	0	0	0	1
	Invalid	3	3	3	3	7	3	3	3	28
Westmorland	Non Detect	40	38	38	37	33	39	41	37	303
	Trace	0	1	1	3	1	1	0	2	9
	Quantifiable	1	2	2	1	2	1	0	2	11
	Invalid	2	2	2	2	7	2	2	2	21
Brawley Court	Non Detect	42	43	43	43	39	43	42	43	338
	Trace	0	0	0	0	0	0	1	0	1
	Quantifiable	0	0	0	0	0	0	0	0	0
	Invalid	1	0	0	0	4	0	0	0	5
Brawley SDSU*	Non Detect	11	11	11	11	11	11	8	11	85
	Trace	0	0	0	0	0	0	3	0	3
	Quantifiable	0	0	0	0	0	0	0	0	0
	Invalid	1	1	1	1	1	1	1	1	8
Imperial**	Non Detect	38	38	36	38	35	38	38	38	299
	Trace	0	0	2	0	0	0	0	0	2
	Quantifiable	0	0	0	0	1	0	0	0	1
	Invalid	3	3	3	3	5	3	3	3	26
Heber	Non Detect	40	40	37	40	35	40	39	40	311
	Trace	0	0	1	0	0	0	1	0	2
	Quantifiable	0	0	0	0	1	0	0	0	1
	Invalid	3	3	3	3	7	3	3	3	28
Total	Non Detect	211	210	205	209	188	211	206	209	1649
	Trace	0	1	4	3	1	1	7	2	19
	Quantifiable	1	2	2	1	5	1	0	2	14
	Invalid	13	12	12	12	21	12	12	12	106

*A total of thirty-four samples were collected from this site. Of the 34 samples, 11 samples were valid. One sample (MH-24) was invalidated because of a field setup error. Fourteen samples were submitted without a Chain of Custody (COC) form or with missing sample information. These 14 samples without COCs were invalidated, however, all collected and received samples were analyzed, therefore, the results are provided in Appendix VIII. Eight samples were not received by the lab for analyses.

**A total of forty-one samples were collected from this site. Three samples were invalidated. Two samples (FW-11 and FW-12) were not received by the lab for analyses.

Figure 3 – Summary of All Eleven OP Compounds Analyzed



6.0 Quality Control Results

Field QC samples consisted of 14 collocated samples, 8 field spikes, 3 trip spikes, and 10 field blanks. The formula for calculating the Relative Percent Difference (RPD) is as follows:

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

The RPD of the collocated samples for all samples could not be calculated because all primary and collocated samples were below the EQL. The results of the collocated samples are listed in Table 5.

Table 5 – Collocated Relative Percent Difference

Barcode	Sample Name	Volume (m3)	Chlorpyrifos (µg/sample)	Chlorpyrifos (µg/m3)	Diazinon (µg/sample)*	Diazinon (µg/m3)	Malathion (µg/sample)	Malathion (µg/m3)
DPR2014	SE-3	1.46	ND		ND		ND	
DPR2015	SE-3- CO	1.35	ND		ND		ND	
DPR2035	SE-6	1.43	ND		ND		ND	
DPR2036	SE-6-CO	1.43	ND		ND		ND	
DPR2042	SE-7	1.44	ND		ND		ND	
DPR2043	SE-7-CO	1.38	ND		ND		ND	
DPR2056	SE-9	1.51	ND		ND		ND	
DPR2057	SE-9-CO	1.44	ND		ND		ND	
DPR2063	SE-10	1.55	ND		ND		ND	
DPR2064	SE-10-CO	1.38	ND		ND		ND	
DPR2105	SE-16	1.41	ND		ND		ND	
DPR2106	SE-16-CO	1.44	ND		ND		ND	
DPR2112	SE-17	1.44	ND		ND		ND	
DPR2113	SE-17-CO	1.39	ND		ND		ND	
DPR2126	SE-19	1.50	ND		ND		ND	
DPR2127	SE-19-CO	1.39	ND		ND		ND	
DPR2140	SE-21	1.45	ND		ND		ND	
DPR2141	SE-21-CO	1.37	ND		ND		ND	
DPR2168	SE-25	1.40	ND		ND		ND	
DPR2169	SE-25-CO	1.39	ND		ND		ND	
DPR2196	SE-29	1.39	ND		ND		TRACE	
DPR2197	SE-29-CO	1.42	ND		ND		TRACE	
DPR2238	SE-35	1.52	ND		ND		ND	
DPR2239	SE-35-CO	1.53	ND		ND		ND	
DPR2252	SE-37	1.41	ND		ND		TRACE	
DPR2253	SE-37-CO	1.36	ND		ND		TRACE	
DPR2280	SE-41	1.49	ND		ND		ND	
DPR2281	SE-41-CO	1.45	ND		ND		ND	

Field spike recoveries are calculated using the following equations:

$$Field\ Spike\ Conc\left(\frac{ug}{m3}\right) = \frac{Field\ Recovery\ (\frac{ug}{sample})}{Sample\ Volume\ (\frac{m3}{sample})}$$

$$Net\ Spike\ Conc\left(\frac{ug}{m3}\right) = Field\ Spike\ Conc\left(\frac{ug}{m3}\right) - Primary\ \ Sample\ \ Conc\left(\frac{ug}{m3}\right)$$

$$Net\ Spike\left(\frac{ug}{sample}\right) = NetSpike\ \ \left(\frac{ug}{m3}\right)\ x\ Total\ Volume\left(\frac{m3}{sample}\right)$$

$$Spike\ Percent\ Recovery\ (\%) = \frac{\text{Net Spike}\ \ (\frac{ug}{sample})}{\text{Lab Spike}\ \ (\frac{ug}{sample})}\ \text{x 100}$$

Since there were no quantifiable concentrations from the primary sample, the field spike recovery cannot be calculated. The laboratory recovery of the spiked amounts of each OP compound is provided in Table 6.

The OP trip spike recovery ranged from a minimum of 100% to a maximum of 117.5%. The results of the three trip spikes are provided in Table 7.

The formula for calculating the Trip Spike Percent Recovery is as follows:

Recovery % = (Measured µg/sample) ÷ (Expected µg/sample) x 100

Each week, passive samples were loaded in the sampler on the last day of sampling each week and retrieved prior to beginning sampling the following week. They are typically loaded on a Thursday or Friday and removed on a Monday or Tuesday. No air is drawn through the sample media, and the passive samples are used to determine if passive sampling is occurring. The results are shown in Table 8 Passive Sample Results. One occurrence of passive sampling was detected on SE-28-FB, which was on the sampler from 2/23/18 and removed on 2/26/18. Quantifiable amounts of chlorpyrifos and trace amounts of malathion were detected on the sample days prior to and following SE-28-FB.

Table 6 – Laboratory Field Spike Percent Recovery

			Chlorpyrifos			Diazinon			Malathion		
Barcode	Sample Name	Analysis Date	µg/sample	Spike Amount (µg /sample)	Spike Percent Recovery	µg/sample	Spike Amount (µg/sample)	Spike Percent Recovery	µg/sample	Spike Amount (µg/sample)	Spike Percent Recovery
DPR2008	SE-2-FS	1/29/18	1.44	1.60	90	1.48	1.60	92.5	1.64	1.60	102.5
DPR2050	SE-8-FS	2/7/18	1.56	1.60	97.5	1.68	1.60	105	1.84	1.60	115
DPR2071	SE-11-FS	2/8/18	1.36	1.60	85	1.44	1.60	90	1.56	1.60	97.5
DPR2120	SE-18-FS	2/15/18	1.64	1.60	102.5	1.68	1.60	105	1.68	1.60	105
DPR2148	SE-22-FS	3/1/18	1.68	1.60	105	1.64	1.60	102.5	1.60	1.60	100
DPR2232	SE-34-FS	3/22/18	1.60	1.60	100	1.52	1.60	95	1.44	1.60	90
DPR2267	SE-39-FS	3/24/18	1.76	1.60	110	1.76	1.60	110	1.76	1.60	110
DPR2295	SE-43-FS	3/27/18	1.88	1.60	117.5	1.88	1.60	117.5	1.80	1.60	112.5

Table 7 – Trip Percent Recovery

			Chlorpyrifos			Diazinon			Malathion		
Barcode	Date Trip Spike Initiated	Analysis Date	µg/sample	Spike Amount (µg/sample)	Spike Percent Recovery	µg/sample	Spike Amount (µg/sample)	Spike Percent Recovery	µg/sample	Spike Amount (µg/sample)	Spike Percent Recovery
DPR2020	1/19/18	1/30/18	1.60	1.60	100	1.72	1.60	107.5	1.84	1.60	115
DPR2181	2/22/18	3/9/18	1.92	1.60	120	1.92	1.60	120	1.84	1.60	115
DPR2188	2/23/18	3/9/18	1.88	1.60	117.5	1.88	1.60	117.5	1.84	1.60	115

Table 8 –Passive Sample Results

Barcode	Sample Name	Sample Start Date	Chlorpyrifos µg/sample	Diazinon µg/sample	Malathion µg/sample
DPR2001	SE-1-FB	1/16/18	ND	ND	ND
DPR2029	SE-5-FB	1/20/18	ND	ND	ND
DPR2079	SE-12-FB	1/28/18	ND	ND	ND
DPR2099	SE-15-FB	1/31/18	ND	ND	ND
DPR2134	SE-20-FB	2/9/18	ND	ND	ND
DPR2162	SE-24-FB	2/16/18	ND	ND	ND
DPR2190	SE-28-FB	2/23/18	0.025	ND	TRACE
DPR2218	SE-32-FB	3/1/18	ND	ND	ND
DPR2246	SE-36-FB	3/8/18	ND	ND	ND
DPR2274	SE-40-FB	3/15/18	ND	ND	ND

7.0 Summary

During the ten-week study, a total of 284 samples, which included 249 primary samples and 35 quality control samples were collected from the six pesticide monitoring sites. From those samples, the MLD Northern Laboratory Branch performed over 2,200 analyses on 11 different OP compounds.

Many of the samples were under the method detection limits or were present at only trace levels. There were no noticeable trends in any OP concentrations because the study did not yield enough quantifiable data points.

The highest measured concentration of each OP compound, the location, and sampling date were as follows:

Chlorpyrifos:	0.039 µg/m^3 at Westmorland on 1/16/18
Chlorpyrifos OA:	0.034 µg/m^3 at Westmorland on 1/16/18
Diazinon:	0.032 µg/m^3 at Westmorland on 1/16/18
Diazinon OA:	0.034 µg/m^3 at Westmorland on 1/16/18
Malathion:	0.212 µg/m^3 at Westmorland on 2/25/18
Malathion OA:	0.062 µg/m^3 at Westmorland on 2/25/18
Dimethoate:	0.046 µg/m^3 at Westmorland on 1/16/18
Dimethoate OA:	0.110 µg/m^3 at Seeley on 1/18/18
DEF:	0.038 µg/m^3 at Westmorland on 1/16/18
Dichlorvos:	No Detections
Phosmet:	0.051 µg/m^3 at Westmorland on 1/16/18