DEPARTMENT OF PESTICIDE REGULATION

AMBIENT MONITORING REPORT

Date: February 15, 2017

1. Study highlights:

- Study Number: 304
- Title: Surface Water Monitoring for Pesticides in Agricultural Areas of California, 2016
- Author Xin Deng

- Study area:
  - County: Monterey, San Luis Obispo, Santa Barbara, Imperial
  - Waterbody/ Watershed: Salinas River, Tembladero Slough, Santa Maria River, New River, Alamo River

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- Land Use Type: ☒ Ag ☐ Urban ☐ Forested ☐ Mixed ☐ Other

- Water body type: ☐ Storm drain outfall ☒ Creek ☒ River ☐ Pond ☐ Lake ☒ Drainage ditch ☐ Other: Click here to enter describe other

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- Objectives: 1. Determine pesticide presence and their concentrations in surface water runoff from agricultural areas of high pesticide uses; 2. Compare pesticide concentrations to the lowest US EPA aquatic life benchmarks; 3. Determine the toxicity of a subset samples to surrogate aquatic species in 96-hour or 10-day water column testing.

- Sampling period: March, 2016 – October, 2016

- Pesticides monitored:

Chlorpyrifos, Diazinon, Dimethoate, Malathion, Methidathion, Methomyl, Methoxyfenozide, Tebufenozide, Imidacloprid, Bifenthrin, λ-cyhalothrin, Cyfluthrin, Cypermethrin, Fenpropathrin, (Es)fenvalerate, Permethrin, Atrazine and degradates, Prometryn, Bensulide, Benfluralin, Ethalfluralin, Oryzalin, Pendimethalin, Prodiamine, Trifluralin, Oxyfluorfen, Azoxystrobin, Kresoxim-methyl, Pyraclostrobin, Trifloxystrobin

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- Major findings:

INSECTICIDES. Imidacloprid, methomyl, methoxyfenozide and bifenthrin were the four insecticides with high detection frequencies (DF) (56-89%). Four organophosphates including chlorpyrifos, diazinon, dimethoate and malathion were detected at 1-32% DF. DFs for pyrethroids varied from 0-56%. Bifenthrin was the most frequently detected pyrethroid (56% DF), followed by permethrin (32% DF), λ-cyhalothrin (29% DF), cypermethrin (7% DF) and (es)fenvalerate (2% DF). No detections were reported for methidathion, tebufenozide, fenpropathrin and cyfluthrin. As for the aquatic life benchmark (BM) exceedances, bifenthrin had the highest frequency (46%) exceeding its lowest BM, followed by permethrin (32%) and λ-cyhalothrin (29%). Chlorpyrifos, imidacloprid, dimethoate, malathion and methomyl had the exceedance frequencies of 6-31%.

HERBICIDES AND FUNGICIDES. The herbicides and fungicides with the highest DF were bensulide (67%) and prometryn (50%), followed by oxyfluorfen (41%), atrazine (29%), azoxystrobin (27%), pendimethalin (19%), pyraclostrobin (14%), trifluralin (11%), trifloxystrobin (5%) and benfluralin (3%). No detections were reported for the rest of the herbicides and fungicides. Atrazine, prometryn and oxyfluorfen were the three herbicides that had BM exceedances at 8, 10 and 29%, respectively.

TOXICITY. Two water samples collected at SM_Orcutt on May 17 and September 13, 2016 were tested for toxicity by UC Davis Granite Canyon Marine Pollution Laboratory.

The sample collected on May 17 was tested for 96-hour toxicity with the amphipod *Hyalella azteca* and for 10-day toxicity with the midge *Chironomus dilutus*. No effects on survival were observed in the *H. azteca* test but 92% mortality and significant reduction of growth were observed in the *C. dilutus* test. Four pesticides (imidacloprid, azoxystrobin, oxyfluorfen and prometryn) were detected in the sample and imidacloprid was the only insecticide that was found with a concentration (1.01 µg/L) close to its lowest aquatic life benchmark (1.05 µg/L). Based on the analytical and toxicological results, imidacloprid likely contributed most to toxicity.

The sample collected on September 13 was tested for 96-hour toxicity with *H. azteca*, *C. dilutus* and *Ceriodaphnia dubia*. No effects on survival were observed in the *H. azteca* test but 100% and 28% mortalities were observed in the *C. dilutus* and *C. dubia* tests, respectively. Five pesticides (imidacloprid, malathion, azoxystrobin, oxyfluorfen and prometryn) were detected in the sample. Imidacloprid and malathion were the two insecticides detected with concentrations exceeding or approaching their lowest aquatic life benchmarks. Based on the analytical and toxicological results, imidacloprid and malathion likely contributed most to toxicity.

2. Pesticide detection frequency

Table 1. Pesticides detected in water. Complete data set in Appendix.

Pesticide	Number of samples	Number of detections	Reporting Limit (µg/L)	Detection frequency (%)	Lowest USEPA benchmark (BM) (µg/L)*		Number of BM exceedances	BM exceedance frequency (%)
Chlorpyrifos	54	7	0.01	13	0.04	IC	3	6
Diazinon	18	2	0.01	11	0.105	IA	0	0
Dimethoate	54	17	0.04	32	0.5	IC	5	9
Malathion	54	11	0.02	20	0.035	IC	8	15
Methidathion	54	0	0.05	0	0.66	IC	0	0
Methomyl	26	17	0.05	65	0.7	IC	8	31
Methoxyfenozide	16	12	0.05	75	6.3	IC	0	0
Tebufenozide	16	0	0.05	0	4.3	IC	0	0
Imidacloprid	54	48	0.05	89	1.05	IC	4	7
Bifenthrin	41	23	0.001	56	0.0013	IC	19	46
λ-cyhalothrin	41	12	0.002	29	0.002	IC	12	29
Cyfluthrin	41	0	0.002	0	0.0074	IC	0	0
Cypermethrin	41	3	0.005	7	0.069	IC	0	0
(Es)fenvalerate	41	1	0.005	2	0.017	IC	0	0
Fenpropathrin	37	0	0.005	0	0.064	IC	0	0
Permethrin	41	13	0.002	32	0.0014	IC	13	32
Atrazine	14	4	0.05	29	0.001	VA	4	29
ACET	14	0	0.05	0	na		na	na
DACT	14	0	0.05	0	na		na	na
DEA	14	0	0.05	0	na		na	na
Prometryn	10	5	0.05	50	1.04	NVA	1	10
Bensulide	54	36	0.04	67	290	IA	0	0
Benfluralin	37	1	0.05	3	1.9	FA	0	0
Ethalfluralin	37	0	0.05	0	0.4	FC	0	0
Oryzalin	33	0	0.05	0	15.4	VA	0	0
Pendimethalin	37	7	0.05	19	5.2	NVA	0	0
Prodiamine	37	0	0.05	0	1.5	IC	0	0
Trifluralin	37	4	0.05	11	1.14	FC	0	0
Oxyfluorfen	37	15	0.05	41	0.29	NVA	3	8
Azoxystrobin	22	6	0.05	27	44	IC	0	0
Kresoxim-methyl	22	0	0.05	0	55	IC	0	0
Pyraclostrobin	22	3	0.05	14	1.5	NVA	0	0
Trifloxystrobin	22	1	0.05	5	2.76	IC	0	0

*FA, fish acute; FC, fish chronic; IA, invertebrate acute; IC, invertebrate chronic; NVA, non-vascular acute; VA, vascular acute; na, value not available.

3. Laboratory QC summary

QC Type	Water Samples		Sediment Samples	
	Total Number	**Number of QC out of contro1**	**Total Number**	**Number of QC out of control**
Lab Blanks	210	0	NA	NA
Matrix Spikes/Duplicates	210	0	NA	NA
Laboratory Control Spikes/Duplicates	0	0	NA	NA
Blind Spikes	28	2	NA	NA
Surrogate Spikes	4	0	NA	NA
Explain out of control QC and interpretation of data:	One blind spike for oryzalin and one for fenpropathrin resulted in zero recoveries. Eight results associated with the blind spikes were excluded from the report.			

4. Supporting Information

Index of Supporting Information

Appendix I. Study protocol

Appendix II. Sampling site information and pictures

Appendix III. Water quality data

Appendix IV. Water monitoring data

Appendix V. Aquatic toxicity data

Appendix VI. Analytical methods