DEPARTMENT OF PESTICIDE REGULATION

AMBIENT MONITORING REPORT

Date: April 30, 2015

1. Study highlights:

- Study Number: 269
- Title: Surface Water and Sediment Monitoring in 2012-2013
- Author: Mike Ensminger

- Study area:
  - County: Placer, Sacramento
  - Waterbody/ Watershed: Pleasant Grove Creek (Sacramento), Upper American River (Folsom)

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

- Water body type: ☒ Storm drain outfall ☒ Creek ☐ River ☐ Pond ☐ Lake ☐ Drainage ditch ☐ Other:

- Objectives: 1. Determine the pesticides and their concentrations in runoff from different urban neighborhoods and creeks in the Sacramento and Roseville area; 2. Compare pesticide concentrations to US EPA benchmarks at monitoring sites in northern California; 3. Determine the toxicity to a subset of the of the samples to Hyalella azteca in 96 hour water column testing; 4. Determine potential pyrethroid toxicity of sediments.

- Sampling period: July 1, 2012 – June 30, 2013

- Pesticides monitored: 2,4-D, bifenthrin, carbaryl, chlorothalonil, chlorpyrifos, cyfluthrin, cypermethrin, deltamethrin/tralomethrin (sediments only), diazinon, dicamba, fenpropathrin (sediments only), fenvalerate/esfenvalerate, fipronil, fipronil amide, fipronil desulfinyl, fipronil desulfinyl amide, fipronil sulfide, fipronil sulfone, imidacloprid, lambda-cyhalothrin, malathion, MCPA, pendimethalin, permethrin, triclopyr

- Major findings:

In water samples, of insecticides, bifenthrin was most frequently detected (97% detection frequency [DF], highest in the study). Four other pyrethroids were also detected, but at much lower detection frequencies: permethrin (33% DF), cyfluthrin (23% DF), lambda-cyhalothrin (13% DF) and cypermethrin (7% DF). Of the detected pyrethroids, bifenthrin was almost always detected at concentrations above its minimum US EPA benchmark (BM) and permethrin and lambda-cyhalothrin were always detected at concentrations above their BM. BM's for bifenthrin and lambda-cyhalothrin are about equal to their reporting limits but permethrin's BM is lower than the RL; trace detections of this pyrethroid could also be above the minimum BM.

Fipronil and some of its degradates were also frequently detected. Fipronil was detected in about half of the samples (47% DF), with the two most commonly detected degradates detected in about one-third of the samples (sulfone, 39% DF; desulfinyl, 31% DF). Other degradates were infrequently detected (amide, 3% DF) or not detected (desulfinyl amide, sulfide). Fipronil was always detected, and fipronil sulfone was frequently detected, at concentrations above their BM. Fipronil's reporting limit is higher than the BM, such that trace detections may also be above the BM. In this study, there were 14 (39%) trace detections of fipronil.

Imidacloprid was also frequently detected (60% DF). However, it was not detected at concentrations above its BM. Imidacloprid has a relatively high BM (1.05 µg/L) although some aquatic organisms are known to be sensitive to imidacloprid at concentrations lower than its BM. Three other insecticides were detected infrequently: diazinon (8% DF), carbaryl (7% DF), and malathion (4% DF). All malathion detections were above its minimum BM.

Of herbicides, 2,4-D was the most frequently detected herbicide (87% DF). Three other herbicides with the same mode of action, (dicamba, triclopyr, and MCPA) were also detected (40% DF, 27% DF, and 13% DF, respectively). The only other herbicide monitored was pendimethalin, at only the first rain monitoring event, at three sites; it was not detected. None of the herbicides were detected above their respective BMs.

The fungicide chlorothalonil was monitored for six times, with no detections.

96 hour water column toxicity was conducted with the organism *Hyalella azteca* at two sites in Folsom. During the first flush rain event in October, no *H. azteca* survived in the testing (0% survivability). During two nonstorm (dry) monitoring, survival of *H. azteca* ranged from 2 – 100%; three of the four samples taken (two sites, at two sampling dates) had significantly less survival than the controls.

Sediments sampling was increased in FY2012-13, with sediments collected at seven monitoring sites and analyzed for eight pyrethroids (bifenthrin, cyfluthrin, cypermethrin, deltamethrin/tralomethrin, fenpropathrin, fenvalerate/esfenvalerate, lambda-cyhalothrin, permethrin). Except for fenvalerate/esfenvalerate and fenpropathrin, all pyrethroids were detected in all sediments. Bifenthrin accounted for the largest percentage (62%) of toxicity units (TUs; an indicator of potential toxicity), cypermethrin accounted for 19% of the TUs, and lambda-cyhalothrin accounted for 7%, and deltamethrin/tralomethrin accounted for 6% of the TUs. All other pyrethroids contributed little to potential toxicity.

2. Pesticide detection frequency

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

Pesticide	Number of samples	Number of detections	Reporting Limit (µg/L)	Detection frequency (%)	Lowest USEPA OPP benchmark (BM) (µg/L)*		Number of BM exceed-ances	BM exceed-ance frequency (%)
2,4-D	15	13	0.05	86.7	13.1	VA	0	0
Bifenthrin	30	29	0.001	96.7	0.0013	IC	27	90
Carbaryl	15	1	0.05	6.7	0.5	IC	0	0
Chlorothalonil	6	0	0.05	0	0.6	IC	0	0.
Chlorpyrifos	24	0	0.01	0	0.04	IC	0	0
Cyfluthrin	30	7	0.002	23.3	0.007	IC	1	3.3
Cypermethrin	30	2	0.005	6.7	0.069	IC	0	0
Diazinon	24	2	0.01	8.3	0.11	IA	0	0
Dicamba	15	6	0.05	40	61	NA	0	0
Fenvalerate/ esfenvalerate	30	0	0.005	0	0.017	IC	0	0
Fipronil	36	17	0.02	47.2	0.011	IC	17	47.2
Fipronil amide	36	1	0.03	2.8	None		N/A	N/A
Fipronil desulfinyl	36	11	0.02	30.6	0.59	FC	0	0
Fipronil desulfinyl amide	36	0	0.03	0	None		N/A	N/A
Fipronil sulfide	36	0	0.02	0	0.11	IC	0	0
Fipronil sulfone	36	14	0.03	38.9	0.037	IC	9	25
Imidacloprid	30	18	0.05	60	1.05	IC	0	0
Lambda-cyhalothrin	30	4	0.002	13.3	0.002	IC	4	13.3
Malathion	24	1	0.05	4.2	0.035	IC	1	4.2
MCPA	15	2	0.05	13.3	170	VA	0	0
Pendimethalin	3	0	0.05	0	5.2	NA	0	0
Permethrin	30	10	0.002	33.3	0.0014	IC	10	33.3
Triclopyr	15	4	0.05	26.7	100	NA	0	0

*FA, fish acute; FC, fish chronic; IA, invertebrate acute; IC, invertebrate chronic; NA, non-vascular acute; VA, vascular acute

Table 2. Pesticides detected in sediment. Complete data set in Appendix IV.

Pesticide	Number of samples	Number of detections	Detection frequency (%)	LC_{50} (µg/g OC)*	Detection frequency (%) of sediments ≥ 1 TU	Median TUs*
Bifenthrin	17	17	100	0.52	100	6.4
Cyfluthrin	17	15	88.2	1.08	29.4	0.5
Cypermethrin	17	12	70.6	0.38	41.2	0.58
Deltamethrin/Tralomethrin	17	11	64.7	0.79	11.8	0.1
Fenpropathrin	17	1	5.9	(None)	NA	NA
Fenvalerate/Esfenvalerate	17	11	64.7	1.54	0	0.04
Lambda-cyhalothrin	17	13	76.5	0.45	29.4	0.5
Permethrin	17	13	76.5	10.83	0	0.03

*Sediment Toxicity Units (TUs) are calculated using the formula, use TU = C/LC_{50} * % TOC * 10, where C = concentration (µg/kg dry weight), LC_{50} is derived from accepted published values (from Amweg et al. 2005, Toxicol. Chem. 24:966-972; Amweg and D.P. Weston 2007, Environ. Toxicol. Chem. 26:2389-2396; Maund et al. 2002, Environ. Toxicol. Chem., 21:9-15), % TOC is stated in the sediment results Appendix III, and 10 is a conversion factor. One TU is equal to the LC_{50}. If using other LC_{50} values, list value and reference.

3. Laboratory QC summary

QC Type	Water Samples: Total Number	Water Samples: Number of QC out of contro1	Sediment Samples: Total Number	Sediment Samples: Number of QC out of control
Lab Blanks	242	0	36	0
Matrix Spikes/Duplicates	230	0	16	0
Laboratory Control Spikes/Duplicates	22	0	72	4
Blind Spikes	14	0	0	na
Surrogate Spikes	0	na	64	0
Other QC: Laboratory Duplicates	0	na	9	0
Other QC:				
Explain out of control QC and interpretation of data:	All water QC was within control limits. With sediment QC, two lab control spike/duplicate sets were low for deltamethrin (both sets were extracted and analyzed on the same date). Deltamethrin was detected in all associated sediment samples, but amounts could have been greater than reported. In northern California monitoring, deltamethrin only contributes 4% of the total sediment TUs (toxicity units), so this is not an issue for overall TU calculation. All other sediment QC was acceptable, and the data was deemed acceptable.			

The following Supporting Information is available for this report:

Appendix I. Study protocol
Appendix II. Sampling site information and site pictures
Appendix III. Water quality data
Appendix IV. Water or sediment monitoring data
Appendix V. Aquatic toxicity data
Appendix VI. Analytical methods