DEPARTMENT OF PESTICIDE REGULATION

AMBIENT MONITORING REPORT

Date: April 30, 2015

1. Study highlights:

- Study Number: 269
- Title: Further Characterization Of Sacramento, California Area Urban Neighborhoods. Addendum for Fiscal Year 2011-2012
- Author Michael 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 Sacramento and Roseville area; 2. Compare pesticide concentrations to US EPA benchmarks; 3. Determine the toxicity of a subset of the samples to Hyalella azteca in 96 hour water column testing; 4. Determine potential pyrethroid toxicity of sediments.

- Sampling period: July 1, 2011 – June 30, 2012

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

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- Major findings:

In water samples, of insecticides, bifenthrin was most frequently detected (91% detection frequency [DF]). Three other pyrethroids were also commonly detected, albeit less frequently: cyfluthrin (32% DF), cypermethrin (29% DF), and permethrin (29% DF). Lambda-cyhalothrin was infrequently detected (3% DF). All of these pyrethroids, except for cypermethrin, were almost always detected above their lowest US EPA benchmark (BM).

Fipronil and some of its degradates were also frequently detected. Fipronil was detected in about half of the samples (56% DF), with the two most commonly detected degradates detected in about one-third of the samples (sulfone, 38% DF; desulfinyl, 29% DF). Other degradates were infrequently detected (amide, 3% DF) or not detected (desulfinyl amide, sulfide). Fipronil was always detected above its lowest BM. The reporting limit for fipronil is higher than the lowest BM, thus trace detections may also be above the minimum BM. In this study, there were 15 (44% DF) trace detections of fipronil. The sulfone degradate was also frequently detected at concentrations above its BM.

Two other insecticides were detected: imidacloprid (23% DF) and malathion (13% DF). FY2011-12 is the first year imidacloprid was sampled in northern California urban monitoring and its detection frequency indicates that it will be a common pesticide detected in urban runoff. Malathion was always detected above its minimum BM; imidacloprid has a relatively high BM (1.05 µg/L) and was only detected once above its BM. However, some aquatic organisms are known to be sensitive to imidacloprid at concentrations lower than the BM.

Chlorpyrifos, diazinon, deltamethrin/tralomethrin, fenpropathrin, fenvalerate/esfenvalerate, and resmethrin were not detected in the study.

Of herbicides, 2,4-D was the most frequently detected pesticide in the study (97% DF). Two other herbicides with the same mode of action, dicamba and triclopyr, were also frequently detected (68% DF and 62% DF, respectively). Only one other herbicide was monitored for in FY2011-12, MCPA; it was detected in 9% of the samples. None of the herbicides were detected above their minimum BMs.

Chlorothalonil, a fungicide was monitored for in FY2011-12, the first time it has been monitored for in Northern California urban monitoring. It was detected once in 25 samples (4% DF).

96 hour water column toxicity was conducted with the organism *Hyalella azteca* at five sites. During rain events, *H. azteca* survival was less than or equal to 2% of the control levels at all sites. During nonstorm (dry) monitoring, survival of *H. azteca* ranged from 0 – 98%; all but one site had significantly less survival than the controls.

Sediments were collected at two monitoring sites in FY2011-12 (in Folsom) and analyzed for seven pyrethroids (bifenthrin, cyfluthrin, cypermethrin, deltamethrin/tralomethrin, fenvalerate/esfenvalerate, lambda-cyhalothrin, permethrin). All pyrethroids were detected in all sediments. Bifenthrin accounted for the largest percentage (57%) of toxicity units (TUs; an indicator of potential toxicity), cypermethrin accounted for 24% of the TUs, and lambda-cyhalothrin accounted for 12%.

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 benchmark (BM) (µg/L)*		Number of BM exceed-ances	BM exceedance frequency (%)
2,4-D	34	33	0.05	97	13.1	VA	0	0
bifenthrin	34	31	0.001	91	0.0013	IC	31	91
chlorothalonil	25	1	0.05	4	0.6	IC	0	0
chlorpyrifos	24	0	0.01	0	0.04	IC	0	0
cyfluthrin	34	11	0.002	32	0.007	IC	8	24
cypermethrin	34	10	0.005	29	0.069	IC	0	0
deltamethrin/ tralomethrin	10	0	0.005	0	0.0041	IC	0	0
diazinon	24	0	0.01	0	0.11	IA	0	0
dicamba	34	23	0.05	68	61	NA	0	0
fenpropathrin	10	0	0.005	0	0.064	IC	0	0
fenvalerate/ esfenvalerate	34	0	0.005	0	0.017	IC	0	0
fipronil	34	19	0.02	56	0.011	IC	19	56
fipronil amide	34	1	0.03	3	none	--	--	--
fipronil desulfinyl	34	10	0.02	29	0.59	FC	0	0
fipronil desulfinyl amide	34	0	0.03	0	none	--	--	--
fipronil sulfide	34	0	0.02	0	0.11	FC	0	0
fipronil sulfone	34	13	0.03	38	0.037	IC	8	24
imidacloprid	40	9	0.05	23	1.05	IC	1	3
lambda-cyhalothrin	34	1	0.002	3	0.002	IC	1	3
malathion	24	3	0.05	13	0.035	IC	3	13
MCPA	34	3	0.05	9	170	VA	0	0
permethrin	34	10	0.005	29	0.0014	IC	10	29
resmethrin	10	0	0.01	0	0.14	FA	0	0
triclopyr	34	21	0.05	62	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	6	6	100	0.52	100	7
cyfluthrin	6	6	100	1.08	17	0.4
cypermethrin	6	6	100	0.38	50	0.9
deltamethrin/tralomethrin	6	6	100	0.79	0	0.16
fenvalerate/ esfenvalerate	4	4	100	1.5	0	0.05
lambda-cyhalothrin	6	6	100	0.45	33	0.8
permethrin	6	6	100	10.8	0	0.05

*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		Sediment Samples	
	Total Number	**Number of QC out of contro1**	**Total Number**	**Number of QC out of control**
Lab Blanks	138	0	39	0
Matrix Spikes/Duplicates	125	0	30	0
Laboratory Control Spikes/Duplicates	0	0	18	1
Blind Spikes	8	0	0	0
Surrogate Spikes	0	0	15	0
Other QC: Laboratory Duplicate			9	6
Other QC: (none)				

Explain out of control QC and interpretation of data:

All water QC was within control limits. With sediment QC, one laboratory control spike was low for recovery of deltamethrin. The corresponding spike duplicate was within control limits. Deltamethrin was detected in all associate sediment samples, but amounts may have been actually higher than detected. In northern California monitoring, across all years, deltamethrin in sediment only accounts for about 4% of the total toxicity units (TUs). One low detection of deltamethrin was not considered a detriment to the overall sediment sampling and QC. One set of laboratory duplicates were out of control, the relative percent differences were higher in the original sample than in the duplicate sample. This may have accounted for higher calculated TUs in the original sample, and for two other sediment samples were analyzed in the same batch for Study 269. TUs may have been actually lower adjusting for the QC; however, TUs would have still been quite high, 17 and 8 TUs, respectively, for the two samples. All other QC was within control for these samples. QC was deemed acceptable.

4. 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