DEPARTMENT OF PESTICIDE REGULATION (DPR) Date: January 1, 2026

SURFACE WATER AMBIENT MONITORING REPORT

1. Study Highlights

- DPR Study Number 321
- SURF (Surface Water Database) Study Number 91
- Study Title Surface Water Monitoring for Pesticides in Agricultural Areas in the Central Coast and Southern California, 2024
- Project Lead Pedro Lima
- Email pedro.lima@cdpr.ca.gov
- Protocol Source (*protocol available online for five years, thereafter, request a copy from the SWPP list of archived files)* Environmental Monitoring Protocol Page

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- Study Area

  County: Imperial, Monterey, Santa Barbara, San Luis Obispo

  Waterbody/Watershed: Alamo River, New River, Oso Flaco Creek, Salinas River, Santa Maria River, Tembladero Slough

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

- Water Body Type

  ☒ Creek ☒ River ☐ Pond ☐ Lake

  ☒ Drainage Ditch ☐ Storm drain outfall ☐ Other Enter other type

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- Objectives

  1. Determine occurrences (% detections) and measured chemical concentrations of pesticides in surface water and sediment collected from agricultural areas; 2. Compare environmental concentrations to the lowest US EPA (United States Environmental Protection Agency) aquatic life benchmarks; 3. Determine the toxicity of a subset of collected water samples to surrogate aquatic species in 96-hour (acute) or 10-day (chronic) water column testing.

- Sampling Period January 2024 to December 2024

- Major Findings

INSECTICIDES IN WATER:

Insecticides with detection frequencies (DF) > 50% were as follows: imidacloprid (92%), methoxyfenozide (88%), chlorantraniliprole (86%), clothianidin (80%), thiamethoxam (65%), and methomyl (53%). Insecticides with DFs < 50% include: acetamiprid (43%), lambda cyhalothrin (37%), permethrin (34%), bifenthrin (32%), malathion (31%), dimethoate (20%), cypermethrin (18%), dinotefuran (18%), and indoxacarb (14%). Abamectin, esfenvalerate, diflubenzuron, cyfluthrin, carbaryl, chlorpyrifos, and sulfoxaflor were detected infrequently with DFs ranging between 2 and 6%. Other insecticides were not detected in any samples collected during 2024. Concentrations of eight insecticides surpassed their lowest associated US EPA aquatic life benchmarks (BMs) in more than 10% of the total samples collected. Active ingredients that exceeded their BMs were imidacloprid (92%), clothianidin (67%), lambda cyhalothrin (37%), permethrin (32%), bifenthrin (32%), malathion (20%), cypermethrin (18%), and thiamethoxam (10%). The BM exceedance frequencies for other insecticides were less than 10%.

HERBICIDES AND FUNGICIDES IN WATER:

Herbicides or their degradates with DFs ≥ 10% were triclopyr (100%), glyphosate (97%), AMPA (91%), bensulide (84%), 2,4-D (83%), dicamba (58%), prometryn (57%), glufosinate (34%), oxyfluorfen (26%), pendimethalin (24%), diuron (18%), trifluralin (16%), and s-metolachlor (14%). Other herbicides were detected infrequently with DFs <5%. Fungicides with DFs ≥ 10% were azoxystrobin (73%), boscalid (71%), mefenoxam (63%), propiconazole (63%), pyraclostrobin (31%), fenamidone (24%), cyprodinil (22%), tebuconazole (20%), fludioxonil (20%), and trifloxystrobin (12%). Other fungicides were detected infrequently with DFs < 3%. There were six herbicides and one fungicide with concentrations exceeding their lowest US EPA BMs: prometryn (22%), oxyfluorfen (16%), pendimethalin (16%), glyphosate (3%), glufosinate (3%), bensulide (2%), and pyraclostrobin (2%).

PYRETHROIDS IN SEDIMENT:

Sediment was collected from 16 monitoring sites in the Central Coast and Imperial Valley. All samples were analyzed for the presence of eight pyrethroids. However, no sample records for lambda-cyhalothrin, cyfluthrin, and esfenvalerate were available from the Imperial Valley due to matrix spike recovery limitations. This significantly impacted 2024 results—lambda-cyhalothrin detection frequency dropped to 30% (from 80% in 2023), while esfenvalerate and cyfluthrin were not detected at all (previously 33% and 7%, respectively). Detection frequencies were as follows: permethrin (31%), lambda cyhalothrin (30%), bifenthrin (25%), cypermethrin (25%), and fenpropathrin (6%). Cyfluthrin, deltamethrin, and esfenvalerate were not detected. No pyrethroids that were detected in sediment exceeded their sediment LC_{50} (normalized to OC) concentration.

TOXICITY:

Toxicity tests (96-hr *Hyalella azteca* and 10-d *Chironomus dilutus*) were conducted on 39 water samples collected from 17 monitoring locations. Samples were collected during the irrigation season and a storm event. Toxicity endpoint testing included organism survival for both *Hyalella* and *Chironomus* species. Compared to laboratory controls, *Hyalella* survival was significantly reduced in 48% of tested surface water samples. Meanwhile, *Chironomus* survival was assessed only in the Imperial Valley, where no significant reductions were observed in any of the tested water samples.

- Recommendations for pesticides that need a California Department of Food and Agriculture (CDFA) analytical method; recommendations based on the Surface Water Monitoring Prioritization model (SWMP):

  Ametoctradin, linuron, 4-(2,4-DB), dimethylamine salt, PCNB (pentachloronitrobenzene), spinetoram, paraquat dichloride, and propyzamide

2. Pesticide detection frequency

Data available in SURF upon yearly update. Contact Project Lead for data not yet uploaded. In SURF, use "SURF Study Number" (Section 1) to obtain the data.

Table 1. Pesticide detections in water

Pesticide	Sample Number	Detection Number	Detection Frequency (%)	Minimum Reporting Limit (µg/L)	Lowest US EPA Benchmark (BM) (µg/L)[1]	BM[2]	Number of BM Exceed-ances	BM Exceedance Frequency (%)
2,4-D	12	10	83.3	0.05	299.2	VPA	0	0.0
Abamectin	49	3	6.1	0.02	0.17	FIA	0	0.0
Acetamiprid	49	21	42.9	0.02	2.1	FIC	0	0.0
AMPA	32	29	90.6	0.2	249500	FVA	0	0.0
Atrazine	49	2	4.1	0.02	1	NVA	0	0.0
Azoxystrobin	49	36	73.5	0.02	20*	NVC	0	0.0
Benfluralin	38	0	0.0	0.05	1.9	FVC	0	0.0
Bensulide	44	37	84.1	0.02	11	FIC	1	2.3
Bifenthrin	38	12	31.6	0.001	0.00005	FIC	12	31.6
Boscalid	49	35	71.4	0.02	116	FVC	0	0.0
Bromacil	49	0	0.0	0.02	1.1*	NVC	0	0.0
Carbaryl	44	1	2.3	0.02	0.5	FIC	0	0.0
Chlorantraniliprole	49	42	85.7	0.02	3.02	FIC	0	0.0
Chlorfenapyr	38	0	0.0	0.1	2.915	FIA	0	0.0
Chlorpyrifos	44	1	2.3	0.02	0.04*	FIC	1	2.3
Clothianidin	49	39	79.6	0.02	0.05	FIC	33	67.3
Cyfluthrin	38	1	2.6	0.002	0.00012	FIC	1	2.6
Cypermethrin	38	7	18.4	0.005	0.00005	FIC	7	18.4
Cyprodinil	49	11	22.4	0.02	8.2	FIC	0	0.0
Deltamethrin	32	0	0.0	0.004	0.000026	FIC	0	0.0
Desulfinyl Fipronil	49	0	0.0	0.01	0.53	FVC	0	0.0
Desulfinyl Fipronil Amide	49	0	0.0	0.01		(no BM)	0	0.0
Diazinon	49	0	0.0	0.02	0.105	FIA	0	0.0
Dicamba	12	7	58.3	0.05	5*	NVC	0	0.0
Diflubenzuron	49	2	4.1	0.02	0.00025	FIC	2	4.1
Dimethoate	49	10	20.4	0.02	0.5	FIC	2	4.1
Dinotefuran	49	9	18.4	0.02	6360	FVC	0	0.0

Pesticide	Sample Number	Detection Number	Detection Frequency (%)	Minimum Reporting Limit (µg/L)	Lowest US EPA Benchmark (BM) (µg/L)[1]	BM[2]	Number of BM Exceed-ances	BM Exceedance Frequency (%)
Diuron	49	9	18.4	0.02	0.83*	FIC	0	0.0
Esfenvalerate	38	2	5.3	0.005	0.0000309	FIC	2	5.3
Ethalfluralin	38	0	0.0	0.05	0.4	FVC	0	0.0
Ethoprop	49	0	0.0	0.02	0.8	FIC	0	0.0
Etofenprox	44	0	0.0	0.02	0.17	FIC	0	0.0
Fenamidone	49	12	24.5	0.02	4.7	FVC	0	0.0
Fenhexamid	38	0	0.0	0.02	101	FVC	0	0.0
Fenpropathrin	38	0	0.0	0.005	0.0015	FIC	0	0.0
Fipronil	44	0	0.0	0.01	0.011	FIC	0	0.0
Fipronil Amide	49	0	0.0	0.01		(no BM)	0	0.0
Fipronil Sulfide	44	0	0.0	0.01	0.83*	FVC	0	0.0
Fipronil Sulfone	44	0	0.0	0.01	0.22	FIC	0	0.0
Fludioxonil	49	10	20.4	0.02	4.66*	NVC	0	0.0
Glufosinate	32	11	34.4	0.07	41*	NVC	1	3.1
Glyphosate	32	31	96.9	0.07	1300*	VPC	1	3.1
Hexazinone	49	0	0.0	0.02	4*	NVC	0	0.0
Imidacloprid	49	45	91.8	0.01	0.01	FIC	45	91.8
Indoxacarb	44	6	13.6	0.02	75	FIC	0	0.0
Isoxaben	49	1	2.0	0.02	6*	VPC	0	0.0
Kresoxim-methyl	49	0	0.0	0.02	12*	NVC	0	0.0
Lambda Cyhalothrin	38	14	36.8	0.002	0.00004	FIA	14	36.8
Malathion	49	15	30.6	0.02	0.049	FIA	10	20.4
MCPA	12	0	0.0	0.05	170	VPA	0	0.0
Mefenoxam	49	31	63.3	0.02	1200	FIC	0	0.0
Methidathion	49	0	0.0	0.02	0.66	FIC	0	0.0
Methomyl	49	26	53.1	0.02	0.7	FIC	4	8.2
Methoxyfenozide	49	43	87.8	0.02	3.1	FIC	1	2.0
Metribuzin	49	0	0.0	0.02	2.3*	NVC	0	0.0
Norflurazon	49	0	0.0	0.02	5.33*	NVC	0	0.0
Oryzalin	49	0	0.0	0.02	13	VPA	0	0.0
Oxadiazon	49	0	0.0	0.02	0.88	FVC	0	0.0
Oxyfluorfen	38	10	26.3	0.05	0.33	VPA	6	15.8
Pendimethalin	38	9	23.7	0.05	0.7*	NVC	6	15.8
Permethrin	38	13	34.2	0.001	0.0033	FIA	12	31.6
Prodiamine	38	0	0.0	0.05	1.5	FIC	0	0.0
Prometon	49	1	2.0	0.02	32	NVC	0	0.0
Prometryn	49	28	57.1	0.02	0.288*	NVC	11	22.4
Propanil	49	0	0.0	0.02	2.4	FVC	0	0.0
Propargite	44	0	0.0	0.02	1.27*	NVC	0	0.0
Propiconazole	49	31	63.3	0.02	15	FVC	0	0.0
Pyraclostrobin	49	15	30.6	0.02	1.18*	NVC	1	2.0

Pesticide	Sample Number	Detection Number	Detection Frequency (%)	Minimum Reporting Limit (µg/L)	Lowest US EPA Benchmark (BM) (µg/L)[1]	BM[2]	Number of BM Exceed-ances	BM Exceedance Frequency (%)
Pyriproxyfen	49	0	0.0	0.015	0.015	FIC	0	0.0
Quinoxyfen	49	1	2.0	0.02	13	FVC	0	0.0
Simazine	49	0	0.0	0.02	6	NVA	0	0.0
S-Metolachlor	49	7	14.3	0.02	8	NVA	0	0.0
Sulfoxaflor	47	1	2.1	0.02	660	FVC	0	0.0
Tebuconazole	49	10	20.4	0.02	11	FVC	0	0.0
Tebufenozide	49	0	0.0	0.02	29	FIC	0	0.0
Tebuthiuron	49	0	0.0	0.02	13*	NVC	0	0.0
Thiabendazole	43	1	2.3	0.02	42	FIC	0	0.0
Thiacloprid	49	0	0.0	0.02	0.97	FIC	0	0.0
Thiamethoxam	49	32	65.3	0.02	0.74	FIC	5	10.2
Thiobencarb	49	0	0.0	0.02	1	FIC	0	0.0
Triclopyr	12	12	100.0	0.05	1400*	NVC	0	0.0
Trifloxystrobin	49	6	12.2	0.02	2.76	FIC	0	0.0
Trifluralin	38	6	15.8	0.05	1.9	FVC	0	0.0

[1] Benchmarks from freshwater organisms are used as a screening tool for relative toxicity

[2] FVA, fish acute; FVC, fish chronic; FIA, invertebrate acute; FIC, invertebrate chronic; NVA, non-vascular acute; NVC, non-vascular chronic; VPA, vascular acute; VPC, vascular chronic

* Lowest US EPA BM values have changed since the 2024 monitoring report due to the inclusion of nonvascular and vascular plant chronic endpoints

Table 2. Pesticide detections in sediment

Pesticide	Sample Number	Detection Number	Detection Frequency (%)	LC_{50} (µg/kg OC)*	Detection Frequency > LC_{50} (%)
Bifenthrin	16	4	25.0	520	0.0
Cyfluthrin	10	0	0.0	1080	0.0
Cypermethrin	16	4	25.0	380	0.0
Deltamethrin	16	0	0.0	790	0.0
Esfenvalerate	10	0	0.0	1540	0.0
Fenpropathrin	16	1	6.3	(no BM)	0.0
Lambda Cyhalothrin	10	3	30.0	450	0.0
Permethrin	16	5	31.3	10830	0.0

*LC_{50} is derived from 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)

3. Tracking Exceedances of Aquatic Benchmarks or Sediment LC50 values

For further data analysis: pesticides that have ≥ 10% aquatic benchmark exceedance rate or exceed their OC normalized sediment LC_{50} for three consecutive years are recommended for further detailed data analysis if no analysis has been complete in the past five years (Ambient Urban Monitoring Methodology SOP METH014).

Table 3. Pesticides with three consecutive years of either 1) > 10% of their detections exceeding their lowest US EPA aquatic life water benchmark or 2) percentage of sediment detections exceeding their sediment LC50 (normalized to OC)

Pesticide	Matrix	Current Year (2024)	2023	2022	Last Written Evaluation (Reference)	Further Data Analysis (Y/N)
Bifenthrin	Water	32	50	58	Deng et al. 2019	Y
Clothianidin	Water	67	68	76	Deng et al. 2019	Y
Cyfluthrin	Water	0	15	10	Deng et al. 2019	N
Cypermethrin	Water	18	15	12	Deng et al. 2019	Y
Fenpropathrin	Water	0	15	15	Deng et al. 2019	N
Imidacloprid	Water	92	92	96	Deng et al. 2019	Y
Lambda Cyhalothrin	Water	37	45	35	Deng et al. 2019	Y
Malathion	Water	20	21	23	Deng et al. 2019	Y
Methomyl	Water	0	23	25	Deng et al. 2019	N
Oxyfluorfen	Water	16	22	10	Deng et al. 2019	Y
Pendimethalin	Water	16	12	18	Deng et al. 2019	Y
Permethrin	Water	32	35	37	Deng et al. 2019	Y
Prometryn	Water	22	12	16	Deng et al. 2019	Y
Thiamethoxam	Water	10	11	12	None	Y
Bifenthrin	Sediment	6	40	38	None	N
Lambda Cyhalothrin	Sediment	20	13	13	None	Y

4. Quality Control

Table 4. Laboratory Quality Control (QC) data flag summary*

Lab QC	Matrix	Total Samples	H	L	E	O	R
Lab Blank	Water	499	-	-	-	-	-
Matrix Spike	Water	538	-	-	88	40	12
Surrogate Spike	Water	156	-	-	18	5	3
Lab Blank	Sediment	20	-	-	-	-	-
Matrix Spike	Sediment	23	-	-	6	-	3

*Note: “H” = Analysis performed beyond holding times; “L” = Trace level contamination detected in LabBlank; “E” = Matrix spike is out of established control limits; “O” = Matrix spike is out of ongoing control limits; “R” = Matrix spike out of 50-150% recovery, data not acceptable for SURF upload (Table 5)

Twelve water matrix spikes for bensulide, carbaryl, chlorpyrifos, etofenprox, fenhexamid, fipronil and its degradates (fipronil sulfide and sulfone), indoxacarb, propargite, sulfoxaflor, and thiabendazole had recoveries outside their QC limits (50 – 150%). As a result, five sample records of bensulide, carbaryl, chlorpyrifos, etofenprox, fipronil, fipronil sulfide, fipronil sulfone, indoxacarb, and propargite, 11 sample records of fenhexamid, two sample records of sulfoxaflor, and six water sample records of thiabendazole, were excluded from the monitoring results in 2024. Similarly, three sediment matrix spikes for cyfluthrin, esfenvalerate, and lambda cyhalothrin had recoveries outside their QC limits (50 – 150%). As a result, six sediment sample records of cyfluthrin, esfenvalerate, and lambda cyhalothrin, were also excluded from the monitoring results in 2024. Matrix spikes for other analytes in water and sediment samples were within the QC limits.

Table 5. “R” flagged data. Associated R flag data will not be uploaded into SURF.

Pesticide	Matrix	Number R Flags
Bensulide	Water	1
Carbaryl	Water	1
Chlorpyrifos	Water	1
Etofenprox	Water	1
Fenhexamid	Water	1
Fipronil	Water	1
Fipronil Sulfide	Water	1
Fipronil Sulfone	Water	1
Indoxacarb	Water	1
Propargite	Water	1
Sulfoxaflor	Water	1
Thiabendazole	Water	1
Cyfluthrin	Sediment	1
Esfenvalerate	Sediment	1
Lambda Cyhalothrin	Sediment	1

5. Data: water quality, aquatic toxicity, and analytical chemistry results

Water quality data, aquatic toxicity data, and monitoring results are available upon request. Please contact the Project Lead or SURF database administrator for the data.