



Department of Pesticide Regulation



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MEMORANDUM

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DATE: May 29, 2009

SUBJECT: PROCEDURE FOR IDENTIFYING PESTICIDES WITH A HIGH POTENTIAL
TO CONTAMINATE SURFACE WATER

This memorandum explains how the pesticides that may be regulated to prevent surface water contamination were identified.

Environmental Monitoring staff are developing regulations to protect surface water from pesticides. The regulations will list pesticides that have a high potential to contaminate surface water and then specify mitigation measures designed to protect beneficial uses of waters of the state from those pesticides.

We identified pesticides that have a high potential to contaminated surface water by first listing all pesticides detected in surface water or sediment from the Department of Pesticide Regulation's (DPR's) Surface Water Database at <http://www.cdpr.ca.gov/docs/emon/surfwtr/surfcont.htm>. The database contains sampling results from 1991 to the present. To that list we added fipronil and pyrethrins, which are draft detections pending completion of the monitoring reports (Table 1). For screening purposes, we also added all active ingredient isomers of pesticides detected, and the associated salts, esters, and/or amines of 2,4-D, dicamba, glyphosate, and MCPA (Table 2).

The following five pesticides were removed from the list because they had single detections (number of samples analyzed in parentheses): bromoxynil octanoate (193), fenamiphos (635), hydramethylnon (203), paraquat dichloride (312), and tetrachlorvinphos (1243). Five additional pesticides were removed from the list for the stated reasons: endosulfan because it is already subject to California-only label requirements to protect surface water; molinate because its use will no longer be allowed after August 2009; pyrethrins because they have very short half-lives; terbuthylazine because all of its uses would qualify for the provision that would exempt all intentional applications to water in accordance with all regulatory requirements; and thiobencarb because it is being addressed by the rice industry and the Central Valley Regional Water Quality Control Board in a different forum to protect surface water.



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Finally, the list was screened to exclude pesticides that are detected in surface water at levels that are relatively low compared to the levels that cause aquatic toxicity or that are protective of human health in drinking water. This screening process was not used to remove any pesticides remaining on the list that were detected exclusively in sediment. The U.S. Environmental Protection Agency (EPA) Aquatic Life Benchmark Table, as of November 2008, http://www.epa.gov/oppefed1/ecorisk_ders/aquatic_life_benchmark.htm was used to obtain the lowest aquatic life benchmark for pesticides on the DPR draft list. It should be noted that EPA is in the process of revising the aquatic life benchmarks so values in Table 2, as of November 2008, may be different from those in the current EPA Aquatic Life Benchmark Table. For pesticides with no aquatic life benchmark, the U.S. EPA Office of Pesticide Programs Pesticide Ecotoxicity Database <<http://www.ipmcenters.org/Ecotox/index.cfm>>, as of November 2008, was used to obtain the lowest acute LC50 or EC50, or the lowest chronic no observable effect level (NOEL) for the standard test species that U.S. EPA uses to assess pesticide aquatic toxicity. For acute toxicity to freshwater fish, the standard test species is usually rainbow trout or bluegill sunfish; for chronic toxicity to freshwater fish, rainbow trout or fathead minnow; for acute and chronic toxicity to freshwater invertebrates, midge, scud (amphipods), or daphnids; for acute toxicity to freshwater nonvascular plants, green algae or diatoms; and for acute toxicity to freshwater vascular plants, duckweed. To be consistent with the methodology used to establish aquatic life benchmarks, the lowest toxicity values were multiplied by the appropriate levels of concern (LOC) factors (LOC=1 for chronic fish and invertebrate values, and for acute vascular and nonvascular plant values; LOC=0.5 for acute fish and invertebrate values).

In addition, the Department of Fish and Game has completed hazard assessments for 17 of the 71 pesticides detected in surface water and reviewed by DPR for their potential to contaminate surface water. The lowest values to protect human health or aquatic organisms used in the DPR screening in Table 2 were compared with the lowest values to protect aquatic organisms developed in the DFG hazard assessments. Only toxicity values measured on the active ingredient were used unless there were only data for formulated products. We computed the ratio of the lowest DFG value to the lowest DPR value. Ratios of less than one indicate that DPR values were less protective of aquatic organisms than the DFG values. The ratios ranged from 0.03 for cypermethrin to 173,000 for 2,4-D. The median ratio was 6.2. Although the DFG values were lower for carbofuran, chlorpyrifos, cypermethrin, S-cypermethrin, diazinon, methidathion, methomyl, and methyl parathion, they did not result in any change in the list of pesticides identified as having a high potential to contaminate surface water.

For drinking water health protective levels, the California Central Valley Regional Water Quality Control Board's Compilation of Water Quality Goals at <http://www.swrcb.ca.gov/rwqcb5/water_issues/water_quality_standards_limits/water_quality_goals/wq_goals_2008.pdf>, as of November 2008, were used to identify, for each pesticide, either a California Department of Public Health (CDPH) or U.S. EPA maximum contaminant level (MCL), or, if an MCL is not established, the lowest drinking water concentration level for

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protection of human health of one of the following levels: a U.S. EPA Integrated Risk Information System reference dose as a drinking water level, a drinking water health advisory (HA) or suggested no-adverse-response level for toxicity other than cancer risk, or various measures of one-in-a-million incremental cancer risk estimates for drinking water, as footnoted in the table below.

If the lowest of the aquatic life benchmark or acute or chronic aquatic toxicity value, or human health protection level, was 50 parts per billion (ppb) or above (five times or greater than the ten ppb 95th percentile of detected water concentrations in the DPR's Surface Water Database), the pesticide was excluded from the draft DPR list. The following pesticides were excluded because their aquatic toxicity or level to protect human health is 50 ppb or higher: 2,4-D and related pesticides, butylate, chlorthal dimethyl, cycloate, EPTC, glyphosate and related compounds, metalaxyl, napropamide, oxamyl, prometon, propiconazole, tebuthiuron, triclopyr butoxy ethyl ester, and triclopyr triethylamine salt.

A summary of these data for the pesticides screened for determining potential to contaminate surface water is shown in Table 2.

Table 1. Pesticides detected in surface water or sediment

chemical	DPR chem code	
2,4-D	636	
alachlor	678	
aldicarb	575	
atrazine	45	
azinphos-methyl	314	
benefin	53	
bentazon, sodium salt	1944	
bifenthrin	2300	
bromacil	83	
bromoxynil octanoate	834	
butylate	565	
carbaryl	105	
carbofuran	106	
chlorpyrifos	253	
chlorthal-dimethyl	179	synonym: dacthal and DCPA
cycloate	516	
cyfluthrin	2223	
cypermethrin	2171	
DDVP	187	synonym: dichlorvos
deltamethrin	3010	
diazinon	198	
dicamba	200	
dicofol	346	
dimethoate	216	
disulfoton	230	
diuron	231	
endosulfan	259	
EPTC	264	synonym: eptam
esfenvalerate	2321	
ethalfluralin	2166	
ethoprop	404	
fenamiphos	1857	
fenoxycarb	2283	

chemical	DPR chem code
fenpropathrin	Initially omitted
fipronil	3995
glyphosate	2997
hexazinone	1871
hydramethylnon	2203
imidacloprid	3849
lambda cyhalothrin	2297
linuron	361
malathion	367
MCPA	2326
MCPA, dimethylamine salt	786
metalaxyl	2132
methidathion	1689
methiocarb	375
methomyl	383
methyl isothiocyanate	392
methyl parathion	394
metolachlor	1996
metribuzin	1692
molinate	449
napropamide	1728
norflurazon	2019
oryzalin	1868
oxadiazon	2017
oxamyl	1910
oxyfluorfen	1973
paraquat dichloride	1601
pendimethalin	1929
permethrin	2008
phorate	478
phosmet	335
prodiamine	2236
prometon	499
prometryn	502
propanil	503
propargite	445
propiconazole	2276
propoxur	62

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chemical	DPR chem code	
propyzamide	694	
pyrethrins	510	
pyriproxyfen	4019	
S.S.S-tributyl phosphorotrithioate	190	synonym: tribufos
siduron	603	
simazine	531	
tebuthiuron	1810	
terbuthylazine	3004	
tetrachlorvinphos	305	
thiobencarb	1933	
triallate	49	
triclopyr	2131	
trifluralin	597	

Table 2. Pesticides detected in surface water (and related chemicals) screened for possible regulation to protect surface water

Common name	MCL or Lowest Drinking Water Concentration for Protection of Human Health (ppb)	Lowest U.S. EPA Aquatic Acute or Chronic Benchmark (A), or Lowest OPP Database Value (B) Multiplied by Level of Concern ² (LOC) Factor (ppb)	Test type (A) or Species/test type (B)	Lowest Aquatic Toxicity Value or Human Health Protective Level for Drinking Water	Reason for exclusion from draft list for surface water regulation
2,4-D and related pesticides	70 ^a	1.124B x 0.5 = 0.56	Daphnia magna Acute invertebrates	0.56	
Alachlor	2 ^a	1.64A	Acute nonvascular plants	1.64	
Aldicarb	3 ^b	0.46A	Chronic fish	0.46	
Atrazine	1 ^c	1A	Acute nonvascular plants	1	
Azinphosmethyl	87.5 ^d	.036A	Chronic invertebrates	.036	
Benefin (benfluralin)	700 ^d	1.9A	Chronic fish	1.9	

Common name	MCL or Lowest Drinking Water Concentration for Protection of Human Health (ppb)	Lowest U.S. EPA Aquatic Acute or Chronic Benchmark (A), or Lowest OPP Database Value (B) Multiplied by Level of Concern ² (LOC) Factor (ppb)	Test type (A) or Species/test type (B)	Lowest Aquatic Toxicity Value or Human Health Protective Level for Drinking Water	Reason for exclusion from draft list for surface water regulation
Bentazon, sodium salt	18 ^e	4500A	Acute nonvascular plants	18	
beta-Cyfluthrin	NA	.007B (Cyfluthrin NOEL) x 1 = .007	Daphnia magna/ Chronic invertebrates	0.007	
Bifenthrin	110 ^e	0.0013B (NOEL) x 1 = .0013	Daphnia magna/ Chronic invertebrates	0.0013	
Bromacil	70 ^f	6.8A	Selenastrum capricornutum/ Acute nonvascular plants Acute nonvascular plants	6.8	
Bromoxynil octanoate ¹	140 ^e	2.5A (bromoxynil)	Chronic invertebrates	2.5	Single detection
Butylate	350 ^e	105A	Acute fish	105	Lowest value 50 ppb or more

Common name	MCL or Lowest Drinking Water Concentration for Protection of Human Health (ppb)	Lowest U.S. EPA Aquatic Acute or Chronic Benchmark (A), or Lowest OPP Database Value (B) Multiplied by Level of Concern ² (LOC) Factor (ppb)	Test type (A) or Species/test type (B)	Lowest Aquatic Toxicity Value or Human Health Protective Level for Drinking Water	Reason for exclusion from draft list for surface water regulation
Carbaryl	40 ^g	0.5A	Chronic invertebrate	0.5	
Carbofuran	18 ^c	0.75A	Chronic invertebrate	0.75	
Chlorpyrifos	2 ^f	.04A	Chronic invertebrate	0.04	
Chlorthal dimethyl	70 ^e	11000A	Acute vascular and nonvascular plants	70	Lowest value 50 ppb or more
Cycloate	NA	1300A	Acute invertebrates	1300	Lowest value 50 ppb or more
Cyfluthrin	NA	0.004B (NOEL) x 1 = .004	Daphnia magna/ Chronic invertebrates	0.004	

Common name	MCL or Lowest Drinking Water Concentration for Protection of Human Health (ppb)	Lowest U.S. EPA Aquatic Acute or Chronic Benchmark (A), or Lowest OPP Database Value (B) Multiplied by Level of Concern ² (LOC) Factor (ppb)	Test type (A) or Species/test type (B)	Lowest Aquatic Toxicity Value or Human Health Protective Level for Drinking Water	Reason for exclusion from draft list for surface water regulation
Cypermethrin, cis-cypermethrin	70 ^e	.069A	Chronic invertebrates	.069	
S-cypermethrin	70 ^{fe}	Assume same as cypermethrin	Assume same as cypermethrin	0.69	
DDVP (Assume breakdown product of naled listed below)					
Deltamethrin	NA	.003B (EC50) x 0.5 = .0015	Daphnia magna/ Acute invertebrates	0.0015	
Diazinon	1 ^{gf}	0.105A	Acute invertebrates	0.105	
Dicamba, dimethylamine salt	8.75 ^d	61A (Based on lowest toxicity values of dicamba)	Acute nonvascular plants	8.75	

Common name	MCL or Lowest Drinking Water Concentration for Protection of Human Health (ppb)	Lowest U.S. EPA Aquatic Acute or Chronic Benchmark (A), or Lowest OPP Database Value (B) Multiplied by Level of Concern ² (LOC) Factor (ppb)	Test type (A) or Species/test type (B)	Lowest Aquatic Toxicity Value or Human Health Protective Level for Drinking Water	Reason for exclusion from draft list for surface water regulation
Dicamba, sodium salt	8.75 ^d	61A (Based on lowest toxicity values of dicamba)	Acute nonvascular plants	8.75	
Dicofol	NA	80B (EC50) x 0.5 = 40	Daphnia magna/Acute invertebrate	40	
Dimethoate	1.4 ^{fe}	0.5A	Chronic invertebrates	0.5	
Disulfoton	.3 ^e	.01A	Chronic invertebrates	.01	
Diuron	2 ^g	2.4A	Acute nonvascular plants	2	

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Endosulfan	42°	.07A	Chronic invertebrates	.07	Already subject to California only label requirements to protect surface water
EPTC	NA	810A	Chronic invertebrates	810	Lowest value 50 ppb or more
Esfenvalerate	NA	.017A	Chronic invertebrates	.017	
Ethalfluralin	NA	0.4A	Chronic fish	0.4	
Ethoprop	NA	22A	Acute invertebrates	22	

Common name	MCL or Lowest Drinking Water Concentration for Protection of Human Health (ppb)	Lowest U.S. EPA Aquatic Acute or Chronic Benchmark (A), or Lowest OPP Database Value (B) Multiplied by Level of Concern ² (LOC) Factor (ppb)	Test type (A) or Species/test type (B)	Lowest Aquatic Toxicity Value or Human Health Protective Level for Drinking Water	Reason for exclusion from draft list for surface water regulation
Fenamiphos ¹	.7 ^f	.12B (NOEL) x 1 = .12	Daphnia magna/ Chronic invertebrates	0.12	Single detection
Fenoxycarb	NA	.0016B (NOEL) x 1 = .0016	Daphnia magna/ Chronic invertebrates	0.0016	
Fenpropathrin	NA	.013B (NOEL) x 1 = .013	Pimephales promelas/ Chronic fish	0.013	
Fipronil	NA	6.6B (NOEL) x 1 = 6.6	Oncorhynchus mykiss/ Chronic fish	6.6	
gamma-Cyhalothrin	35 ^e	0.00042B (LC50) x .5 = .00021	Gammarus pseudolimnaeus/ Acute invertebrates	0.00021	
Glyphosate	700 ^a	1800A	Chronic fish	700	Lowest value 50 ppb or more

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Common name	MCL or Lowest Drinking Water Concentration for Protection of Human Health (ppb)	Lowest U.S. EPA Aquatic Acute or Chronic Benchmark (A), or Lowest OPP Database Value (B) Multiplied by Level of Concern ² (LOC) Factor (ppb)	Test type (A) or Species/test type (B)	Lowest Aquatic Toxicity Value or Human Health Protective Level for Drinking Water	Reason for exclusion from draft list for surface water regulation
Glyphosate, diammonium salt	Assume same as glyphosate	Assume same as glyphosate	Assume same as glyphosate	Assume same as glyphosate	Lowest value 50 ppb or more
Glyphosate, isopropylamine salt	Assume same as glyphosate	42450A	Acute fish	Assume same as glyphosate	Lowest value 50 ppb or more
Glyphosate, monoammonium salt	Assume same as glyphosate	Assume same as glyphosate	Assume same as glyphosate	Assume same as glyphosate	Lowest value 50 ppb or more
Glyphosate, potassium salt	Assume same as glyphosate	Assume same as glyphosate	Assume same as glyphosate	Assume same as glyphosate	Lowest value 50 ppb or more
Hexazinone	230 ^e	7A	Acute nonvascular plants	7	
Hydramethylnon ¹	NA	5B (EC50) x 1 = 5	Chlorella sp./ Acute nonvascular plants	5	Single detection

Common name	MCL or Lowest Drinking Water Concentration for Protection of Human Health (ppb)	Lowest U.S. EPA Aquatic Acute or Chronic Benchmark (A), or Lowest OPP Database Value (B) Multiplied by Level of Concern ² (LOC) Factor (ppb)	Test type (A) or Species/test type (B)	Lowest Aquatic Toxicity Value or Human Health Protective Level for Drinking Water	Reason for exclusion from draft list for surface water regulation
Imidacloprid	NA	1.05A	Chronic invertebrates	1.05	
lambda-Cyhalothrin	35 ^e	.0019B (NOEL) x 1 = .0019	Daphnia magna/ Chronic invertebrates	0.0019	
Linuron	1.4 ^e	0.09A	Chronic invertebrates	0.09	
Malathion	100 ^f	.000026A	Chronic invertebrates	.000026	
MCPA	3.5 ^e	170A	Acute vascular plants	3.5	
MCPA, dimethylamine salt		130A	Acute vascular plants	Assume same as MCPA	

Common name	MCL or Lowest Drinking Water Concentration for Protection of Human Health (ppb)	Lowest U.S. EPA Aquatic Acute or Chronic Benchmark (A), or Lowest OPP Database Value (B) Multiplied by Level of Concern ² (LOC) Factor (ppb)	Test type (A) or Species/test type (B)	Lowest Aquatic Toxicity Value or Human Health Protective Level for Drinking Water	Reason for exclusion from draft list for surface water regulation
MCPA, 2-ethyl hexyl ester	Assume same as MCPA	20A	Acute vascular plants	Assume same as MCPA	
MCPA, isooctyl ester	Assume same as MCPA	20A (Assume same as MCPA, 2-ethyl hexyl ester)	Assume same as MCPA, 2-ethyl hexyl ester	Assume same as MCPA	
Metalaxyl	420 ^e	1200B (NOEL) x 1 = 1200	Daphnia magna/ Chronic invertebrates	420	Lowest value 50 ppb or more
Methidathion	0.7 ^e	0.66A	Chronic invertebrates	0.66	
Methiocarb	NA	0.1A	Chronic invertebrates	0.1	
Methomyl	175 ^d	0.7A	Chronic invertebrates	0.7	

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Methyl isothiocyanate (Assume source is dazomet, metam potassium or metam sodium)	50 ^h	25.6A (metam sodium)	Acute fish	25.6	Single detection
Methyl parathion	1 ^f	0.25A	Chronic invertebrates	0.25	
Metolachlor	70 ^f	1A	Chronic invertebrates	1	
S-metolachlor	70 ^f (metolachlor)	1A (metolachlor)	Chronic fish	1	
Metribuzin	70 ^f	1.29A	Chronic invertebrates	1.29	

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Molinate	20 ^e	105A	Acute Fish	20	The use of molinate will be terminated as of 8/31/2009
Naled (assume source of detected DDVP)	14 ^e	0.0058A	Chronic invertebrates	0.0058	
Napropamide	700 ^e	1100A	Chronic fish and chronic invertebrates	700	Lowest value 50 ppb or more
Norflurazon	280 ^e	9.7A	Acute nonvascular plants	9.7	
Oryzalin	35 ^e	42A	Acute nonvascular plants	35	
Oxadiazon	35 ^e	0.88B (NOEL) x 1 = .88	Oncorhynchus mykiss/ Chronic fish	0.88	

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Oxamyl	50 ^e	90A	Acute invertebrates	50	Lowest value 50 ppb or more
Oxyfluorfen	20 ^e	0.29A	Acute nonvascular plants	0.29	
Paraquat dichloride ¹	3.2 ^e	.55B (EC50) x 1 = .55	Navicula pelliculosa/ Acute nonvascular plant	0.55	Single detection
Pendimethalin	280 ^e	5.4A	Acute nonvascular plants	5.4	
Permethrin	350 ^e	0.0014A	Chronic invertebrates	0.0014	
Phorate	.7 ^d	0.21A	Chronic invertebrates	0.21	

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Common name	MCL or Lowest Drinking Water Concentration for Protection of Human Health (ppb)	Lowest U.S. EPA Aquatic Acute or Chronic Benchmark (A), or Lowest OPP Database Value (B) Multiplied by Level of Concern ² (LOC) Factor (ppb)	Test type (A) or Species/test type (B)	Lowest Aquatic Toxicity Value or Human Health Protective Level for Drinking Water	Reason for exclusion from draft list for surface water regulation
Phosmet	140 ^e	0.8A	Chronic invertebrates	0.8	
Prodiamine	NA	1.5B (NOEL) x 1 = 1.5	Daphnia magna/ Chronic invertebrates	1.5	
Prometon	100 ^f	98A	Acute nonvascular plants	98	Lowest value 50 ppb or more
Prometryn	28 ^e	1A	Acute nonvascular plants	1	
Propanil	35 ^e	9.1A	Chronic fish	9.1	
Propargite	140 ^e	9A	Chronic invertebrates	9	

Common name	MCL or Lowest Drinking Water Concentration for Protection of Human Health (ppb)	Lowest U.S. EPA Aquatic Acute or Chronic Benchmark (A), or Lowest OPP Database Value (B) Multiplied by Level of Concern ² (LOC) Factor (ppb)	Test type (A) or Species/test type (B)	Lowest Aquatic Toxicity Value or Human Health Protective Level for Drinking Water	Reason for exclusion from draft list for surface water regulation
Propiconazole	91 ^e	93A	Acute nonvascular	91	Lowest value 50 ppb or more
Propoxur	NA	5.5A	Acute invertebrates	5.5	
Propyzamide (pronamide)	2 ^g	600A	Chronic invertebrate	2	
Pyriproxyfen	NA	.01B (NOEL) x 1 = .01	Daphnia magna/ Chronic invertebrates	0.01	
Siduron	NA	.13B (LC50) x .5 = .065	Lepomis macrochirus/ Acute fish	0.065	
Simazine	4 ^a	36A	Acute nonvascular	4	

Common name	MCL or Lowest Drinking Water Concentration for Protection of Human Health (ppb)	Lowest U.S. EPA Aquatic Acute or Chronic Benchmark (A), or Lowest OPP Database Value (B) Multiplied by Level of Concern ² (LOC) Factor (ppb)	Test type (A) or Species/test type (B)	Lowest Aquatic Toxicity Value or Human Health Protective Level for Drinking Water	Reason for exclusion from draft list for surface water regulation
Terbutylazine	NA	3.2B (EC50) x 1 = 3.2	Selenastrum capricornutum/ Acute nonvascular plants	3.2	All uses would qualify for exemption due to intentional application to water.
Tetrachlorvinphos ¹	210 ^e	1.9B (EC50) x .5 = .95	Daphnia magna/ Acute invertebrates	0.95	
Thiobencarb	1 ^c	1A	Chronic invertebrates	1	Already regulated to prevent drift and runoff to surface water.
Triallate	91 ^e	13A	Chronic invertebrates	13	

Common name	MCL or Lowest Drinking Water Concentration for Protection of Human Health (ppb)	Lowest U.S. EPA Aquatic Acute or Chronic Benchmark (A), or Lowest OPP Database Value (B) Multiplied by Level of Concern ² (LOC) Factor (ppb)	Test type (A) or Species/test type (B)	Lowest Aquatic Toxicity Value or Human Health Protective Level for Drinking Water	Reason for exclusion from draft list for surface water regulation
Tribufos (Folex – S,S,S- tributyl phosphorotrithioate)	NA	1.56A	Chronic invertebrates	1.56	
Triclopyr, butoxy ethyl ester	NA	100A (triclopyr)	Acute nonvascular	100	Lowest value 50 ppb or more
Triclopyr, triethylamine salt	NA	100A (triclopyr)	Acute nonvascular	100	Lowest value 50 ppb or more
Trifluralin	4 ^g	1.14A	Chronic fish	1.14	

¹ Single detection

² Factor used by the U.S. EPA to calculate aquatic life benchmarks. See text.

^a CDPH and U.S. EPA MCL

^b U.S. EPA
MCL

^c CDPH
MCL

^d National Academy of Sciences HA (noncancer)

^e U.S. EPA Integrated Risk Information System reference dose (noncancer)

^f U.S. EPA HA (noncancer)

^g U.S. EPA HA (cancer)

^h California notification level

NA=not available