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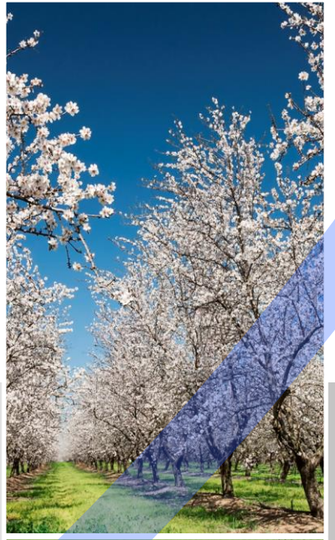
Email: info@aquilogic.com
Telephone: +1.714.770.8040

Agricultural Chemicals



The Contamination Experts

- Responsible Party Identification
- GIS and Geomatics
- Contaminant Hydrogeology
- Fate and Transport Modeling
- Risk Assessment
- Remediation Feasibility Studies
- Soil and Groundwater Remediation
- Natural Resource Damage Assessment
- Water Resources Assessment
- Source Water Assessment and Protection
- Drinking Water Treatment
- Environmental Risk Management
- Litigation Support/Expert Witness
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- Stakeholder/Public Participation
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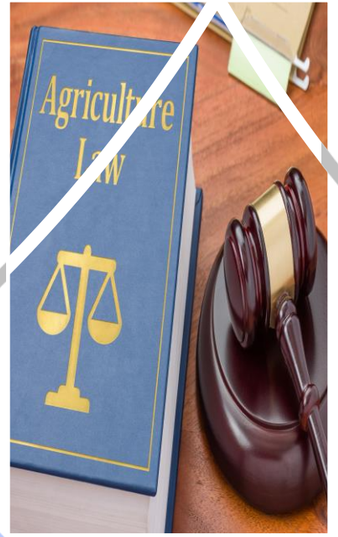

Agricultural Chemicals

The use of pesticides to control weeds, insects, and other pests has resulted in a range of benefits, including increased food production and reduction of insect-borne disease. However, their use has also resulted in adverse effects on the environment, including water quality. Though often misunderstood to refer only to insecticides, the term pesticide also applies to herbicides, fungicides, and various other substances used to control agricultural pests.

The most frequently detected agricultural herbicides in water include atrazine, metolachlor, cyanazine, alachlor, and acetochlor. They are most common in agricultural areas such as the Corn belt and California's Central Valley. Five herbicides commonly used in urban areas (simazine, prometon, tebuthiuron, 2,4-D, and diuron) and three commonly used insecticides (diazinon, chlorpyrifos, and carbaryl) were most frequently detected in urban streams throughout the nation, often at higher concentrations than in agricultural streams.

Total DDT was measured at some of the highest concentrations in bed sediment and fish in parts of the Southeast and in parts of California, Oregon, and Washington, where DDT was historically used on cotton, tobacco, orchards or other crops (USGS, 2006).

Major gaps in critical information about pesticides still persist and continue to present challenges to scientists, managers, and policy-makers. Some of the most important steps needed to fill gaps are listed below:

- Improve tracking of pesticide use in agricultural and non-agricultural areas, including amounts, locations, and timing;
- Add assessments of pesticides not yet studied, including some already in use as well as new pesticides ;
- Improve assessment and understanding of degradates, including their distribution and potential effects;
- Evaluate toxicities of mixtures and their potential to affect humans, aquatic life, and wildlife;
- Evaluate the performance of management practices and their effects on concentrations and transport of pesticides;
- Improve methods for prediction of pesticide levels in unmonitored areas; and
- Sustain and expand long-term monitoring for trends.

Properties of Common Agricultural Chemicals

Compound	Use	Molecular weight (g)	Boiling Point (◦C)	Density (g/cm^3)	Vapor Pressure (mmHg)	Sorption (Log K_{oc}) (unitless)	Log K_{ow} (unitless)	Solubility (mg/L)	Henry's Constant	Diffusion in air (cm^2/s)	Diffusion in water (cm^2/s)	Regulatory Levels		
												CA PHG (µg/L)	CA MCL (µg/L)	US MCL (µg/L)
Alachlor	Herbicide	269.8	100	1.75	2.0×10^{-5}	2.28	3.37	240	8.6×10^{-7}	0.019	5.8×10^{-6}	4	2	2
Atrazine	Herbicide	215.7	200	1.19	3.0×10^{-7}	2.20	2.81	30	1.0×10^{-7}	0.056	5.6×10^{-6}	0.15	1	3
Carbaryl	Insecticide	201.2	Decomposes	1.23	1.4×10^{-6}	2.37	2.35	30	5.0×10^{-7}	0.028	5.6×10^{-6}	-	-	-
Chlordane (gamma)	Pesticide	409.8	175	1.60	4.0×10^{-6}	5.59	6.97	0.02	4.0×10^{-3}	0.033	4.7×10^{-6}	0.03	0.1	2
Chlorpyrifos	Insecticide	350.6	160	1.40	1.9×10^{-5}	3.70	4.66	0.90	1.7×10^{-4}	0.049	5.1×10^{-6}	-	-	-
Cyanazine	Pesticide	240.7	-	1.29	-	1.69	1.72	115	6.7×10^{-10}	0.043	5.8×10^{-6}	-	-	-
Diazinon	Insecticide	304.4	84	1.12	8.4×10^{-5}	2.12	3.86	40	4.7×10^{-6}	0.018	4.9×10^{-6}	-	-	-
Dicamba	Herbicide	221.0	> 200	1.57	9.7×10^{-5}	0.34	2.14	5,600	3.3×10^{-7}	0.060	6.7×10^{-6}	-	-	-
Diuron	Herbicide	233.1	Decomposes at 180-190	1.48	1.0×10^{-7}	2.63	2.67	42	3.0×10^{-8}	0.054	5.3×10^{-6}	-	-	-
Endrin	Insecticide	380.9	245	1.70	6.0×10^{-7}	3.97	5.45	0.25	4.0×10^{-5}	0.013	4.7×10^{-6}	1.8	2	2
Glyphosate	Herbicide	169.1	Decomposes above 200	1.71	8.0×10^{-8}	-13.08	-1.60	12,000	5.8×10^{-11}	0.051	8.3×10^{-6}	900	700	700
Heptachlor	Insecticide	373.3	135	1.58	3.0×10^{-4}	4.07	6.21	0.18	2.4×10^{-2}	0.011	5.7×10^{-6}	0.008	0.01	0.40
Hexachlorobenzene	Fungicide	284.8	332	2.04	1.0×10^{-5}	4.45	5.86	0.01	2.2×10^{-2}	0.054	5.9×10^{-6}	0.03	1	1
Lindane (yHCH)	Insecticide	290.8	323	1.85	3.0×10^{-5}	3.04	4.26	5.8	1.4×10^{-4}	0.014	7.3×10^{-6}	0.032	0.2	0.20
Malathion	Insecticide	330.4	-	1.21	7.9×10^{-6}	2.46	2.29	145	1.0×10^{-6}	0.015	4.4×10^{-6}	-	-	-
Methoxychlor	Insecticide	345.6	436	1.41	1.0×10^{-6}	4.89	5.67	0.05	6.0×10^{-4}	0.016	4.5×10^{-6}	0.09	30	40
Metolachlor	Herbicide	283.3	100 at 0.001 mm Hg	1.12	2.3×10^{-6}	2.85	2.90	864	3.1×10^{-8}	0.036	5.1×10^{-6}	-	-	-
Molinate	Pesticide	187.3	202	1.06	5.6×10^{-3}	1.70	2.91	900	5.0×10^{-5}	0.057	6.0×10^{-6}	1	20	1
Pendimethalin	Herbicide	281.3	330	1.19	7.3×10^{-7}	5.28	5.37	0.57	2.0×10^{-5}	0.038	5.3×10^{-6}	-	-	-
Prometon (pramitol)	Herbicide	225.3	-	1.09	3.4×10^{-6}	2.78	2.88	57.6	7.3×10^{-7}	0.042	5.5×10^{-6}	-	-	-
Simazine	Pesticide	201.7	-	1.33	9.1×10^{-7}	2.47	2.64	40.6	2.5×10^{-7}	0.049	6.4×10^{-6}	4	4	4
Tebuthiuron	Herbicide	228.3	394	1.19	2.0×10^{-5}	1.50	1.79	2,500	5.0×10^{-11}	0.056	5.9×10^{-6}	-	-	-
Trifluralin	Herbicide	335.3	139-140 at 4.2 mm Hg	1.36	1.1×10^{-4}	4.14	5.31	0.60	2.0×10^{-3}	0.015	4.7×10^{-6}	-	-	-

Notes:
K_{ow} = octanol-water partition coefficient; K_{oc} = organic carbon partition coefficient
MCL = maximum contaminant level; PHG = preliminary health goal (Office of Environmental Health Hazard Assessment [OEHHA])

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