Appendices

Appendix A
Toxicity Assessment Details

Appendix A.

California Current-Use Pesticides

For the purpose of this assessment, a list was generated of all a.i.s with at least 5,000 pounds of agricultural use in at least one county in 2003. The entire list of current-use agricultural pesticides is given in Table A-1. This list includes all a.i.s that met the use criteria, including those subsequently eliminated from the assessment due to insufficient toxicity data, or due to involvement in DPR's reevaluation process (pyrethroids, chlorpyrifos, and diazinon dormant spray use). Approximately 75 of the a.i.s in Table A-3 were eliminated due to insufficient acute aquatic toxicity data. Those with insufficient toxicity data are of interest due to that fact that they are applied in California agriculture in significant amounts, but could not be evaluated adequately in the current assessment. Further investigation into the acute aquatic toxicity of some of these a.i.s may be warranted.

Toxicity Assessment Scoring Process

The toxicity score was calculated from average LC50 values. For each organism type, a score was assigned to every average LC50 value in the dataset following the scoring process shown in Table A-2 below. Within each organism group, the individual scores were added.

Note that some a.i.s may have a toxicity rank based on relatively few toxicity tests or due to high toxicity to a single species. Carbaryl, for example, has a very high rank due primarily to one low average LC50 from four tests on a single species.

Initially, toxicity for the entire list of 125 a.i.s was assessed for 13 organism groups. The assessment was subsequently modified to include only toxicity data for the four most commonly tested organism types: fish, crustaceans, aquatic insects, and zooplankton. Only those a.i.s with toxicity data available for at least 3 of the 4 types were included in the assessment. Limiting the assessment in this way allowed for a more complete dataset and more accurate relative comparison of toxicities. Several active ingredients eliminated in this way from the full assessment are worth mentioning due to their reported acute aquatic toxicity to at least one organism type. These are fenbutatin-oxide and pyridaben (fish toxicity) and simazine, atrazine, and diuron (phytoplankton toxicity). Of these, recent use in California agriculture has been low for all except simazine and diuron.

Toxicity Assessment Data Sources

US EPA Office of Pesticide Programs Pesticide Ecotoxicity Database

Description: "Pesticide Ecotoxicity Database, EPA's Office of Pesticide Programs. Data compiled from actual studies reviewed by EPA in conjunction with pesticide registration or reregistration and studies performed by USEPA, USDA and USFWS laboratories

which have been reviewed by Ecological Effects Branch biologists and judged acceptable for use in the ecological risk assessment process."
Available at: http://www.ipmcenters.org/Ecotox/index.cfm

US EPA ECOTOX (AQUIRE) Database
Available at http://www.epa.gov/ecotox/

Description: "The ECOTOX (ECOTOXicology) database provides single chemical toxicity information for aquatic and terrestrial life. ECOTOX is a useful tool for examining impacts of chemicals on the environment. Peer-reviewed literature is the primary source of information encoded in the database. Pertinent information on the species, chemical, test methods, and results presented by the author(s) are abstracted and entered into the database. Another source of test results is independently compiled data files provided by various United States and International government agencies."

PAN Pesticide Database
S. Orme and S. Kegley, 2006.
Available at www.pesticideinfo.org.

Description: The PAN Pesticide Database utilizes the data from the EPA ECOTOX database to calculate an average acute toxicity (LC50) value by organism type/species. In addition to the average acute toxicity values, the data include the number of tests used in each calculation, the common and scientific name of the species, and additional information.

General Rank, Monitoring Priority Ranking Process

To determine the general Monitoring Rank from the Toxicity and Use Ranks (Table 3), the following approach was utilized. Any a.i. with a toxicity rank of high or very high and at least moderate use was place in the high priority category. One a.i with moderate toxicity but very high use (trifluralin) was also given the high priority rank. Of the remaining a.i.s, a high rank or above in either category (Toxicity or Use) resulted in a medium priority rank. The remaining a.i.s were designated low or very low priority. Exceptions are noted in Table 3.

Physical and Chemical Properties

The chemical and physical properties were assessed for the 22 a.i.s. Results are presented in Table A-3 below.

Table A-1.

California Current-Use Pesticides List.				
(S)-metolachlor	Copper Sulfate (Basic)	Glyphosate, Diammonium Salt	Naled	Thiram
1,3-dichloropropene	Copper Sulfate-Penta	Glyphosate, Isopropylamine Salt	Norflurazon	Tribufos
2,4-D, dimethylamine salt	Cryolite	Glyphosate, Monoammonium Salt	Oryzalin	Triclopyr, Triethylamine Salt
2,4-DB acid	Cycloate	Glyphosate-Trimesium	Oxamyl	Triflumiazole
Acephate	Cyfluthrin	Hexazinone	Oxy-Demeton	Trifluralin
Acetamiprid	Cyhalofop Butyl	Hydrogen Cyanamide	Oxyfluorfen	Urea Dihydrogen Sulfate
Alachlor	Cypermethrin	Imidacloprid	Paraquat Dichloride	Vinclozolin
Aldicarb	Cyprodinil	Indoxacarb	Pebulate	Ziram
Atrazine	Diazinon	Iprodione	Pendimethalin	
Avermectin	Dicloran	Kaolin	Permethrin	
Azinphos Methyl	Dicofol	Lambda Cyhalothrin	Phorate (Thimet)	
Azoxystrobin	Dimethoate	Lime-Sulfur	Phosmet	
Benefin	Diquat Dibromide	Linuron	Piperonyl Butoxide	
Bensulide	Disulfoton	Malathion	Potassium N-Methyldithio Carb.	
Bifenazate	Diuron	Mancozeb	Profenofos	
Bifenthrin	Dodine	Maneb	Prometryn	
Bromoxynil	Endosulfan	Mcpa, Dimethylamine Salt	Propanil	
Captan	Endothall	Mefenoxam	Propargite	
Carbaryl	Eptc	Mepiquat Chloride	Propyzamide	
Carbofuran	Esfenvalerate	Metaldehyde	Pyrazon	
Chloropicrin	Ethalfluralin	Metam-Sodium	Pyridaben	
Chlorothalonil	Ethephon	Methamidophos	Simazine	
Chlorpyrifos	Ethoprop	Methidathion	Sodium Chlorate	
Chlorthal-Dimethyl	Fenamiphos	Methomyl	Sodium Tetrathiocarbonate	
Clomazone	Fenbutatin-Oxide	Methyl Bromide	Spinosad	
Copper	Fenhexamid	Methyl Parathion	Sulfur	
Copper Hydroxide	Fenpropathrin	Metribuzin	Tebufenozide	
Copper Oxide	Formetanate HCl	Molinate	Thidiazuron	
Copper Oxychloride	Fosetyl-Al	Msma	Thiobencarb	
Copper Oxychloride Sulfate	Glyphosate	Myclobutanil	Thiophanate-Methyl	

List includes all ais with at least 5,000 pounds of agricultural use in any one county in 2003. Use data from all 58 counties utilized.
Includes ais that were eliminated from the assessment due to insufficient toxicity data or due to DPR reevaluation in progress.

Table A-2. Toxicity Assessment Scoring Process

Ave. LC50 Range (ug/L)	Score
LC50 > 1000	0
100.00 < LC50 ≤ 1000.00	0.01
10.00 < LC50 ≤ 100.00	0.1
1.00 < LC50 ≤ 10.00	1
0.10 < LC50 ≤ 1.00	10
0.01 < LC50 ≤ 0.10	100
0.001 < LC50 ≤ 0.01	1000
≤ 0.001	10000

Score, methidathion

Organism Group	Methidathion Score
crustaceans Total	0.11
fish Total	0.31
insects Total	0.10
zooplankton Total	1.00
Grand Total	**1.52**

See below for details

Example calculation

Active Ingredient	Organism Group	Common Name	Ave Species LC50 (ug/L)	Calculated Score (DPR)
methidathion	crustaceans	American lobster	12	0.1
methidathion	crustaceans	Red swamp crayfish	442.5	0.01
methidathion	fish	Black bullhead	30,000	0
methidathion	fish	Common eel	2,375	0
methidathion	fish	Japanese eel	3,095	0
methidathion	fish	Crucian carp	30,000	0
methidathion	fish	Sheepshead minnow	71.6	0.1
methidathion	fish	Bluegill	16.5	0.1
methidathion	fish	Rainbow trout	35.2	0.1
methidathion	fish	Guppy	500	0.01
methidathion	insects	S. house mosquito	16	0.1
methidathion	zooplankton	Opossum shrimp	1.79	1
methidathion	zooplankton	Rotifer	42,333	0
			TOTAL	**1.52**

Ave. LC50 Data: S. Orme and S. Kegley, PAN Pesticide Database, Pesticide Action Network, North America (San Francisco, CA. 2006), http:www.pesticideinfo.org.

Toxicity Assessment Scoring Process and Calculated Score: DPR

Table A-3. Physio-chemical properties of top 23 toxicity ranked pesticides.

Chemical	Water sol. (ppm)	Koc 9 (ave, mL/g)	Hydrolysis half-life (d)	Soil half-life (d)
Acephate	650000 to 810000	2	no data	3
Azinphos Methyl	9.5 to 33	940	25	44
Carbaryl	100	288	11	< 7 to 27
Carbofuran	291 to 700	46	289	11
Chlorothalonil	0.6 to 1.2	5000	stable	no data
Copper	no data	no data	no data	no data
Diazinon	40 to 68	1520	139	39
Dimethoate	25000 to 39800	20	693	2 to 4
Disulfoton	12 to 25	1345	23	1.9 to 2.4
Endosulfan	0.10 to 0.53	1000 to 20000	no data	27
Malathion	130 to 145	1200	6	< 1
Methamidaphos	2000000	<1	28	0.6 to 6
Methidathion	no data	no data	no data	no data
Methomyl	58000	35	stable	12 to 42
Methyl Parathion	55 to 60	6300	41	no data
Naled	1.5 to 3	157	1	4
Phorate	16 to 50	1057	3	3
Phosmet	20 to 25	668	< 1	no data
Profenofos	20 to 28	2016	24	1.9
Tribufos	23	7700	stable	745
Thiram	16 to 30	670	3	15.2
Trifluralin	0.2 to 1	1200 to 13000	32	116 to 201
Dichlorvos (DDVP)	8000	151	3	no data

Source: USDA 2006.

Hydrolysis half-life at pH 7, unless specified
Soil half-life is for aerobic conditions, unless specified.

Table A-4. Active ingredients with high nonagricultural and low agricultural use. (1)

Chemical
Acrolein
Arsenic Pentoxide
Bacillus Thuringiensis
Borax
Boric Acid
Bromoxynil Butyrate
Calcium Hypochlorite
Carbon Dioxide
Chlorine
Chlorsulfuron
Chromic Acid
Copper Naphthenate
Copper Oxide (IC)
Deltamethrin
Dichlobenil
Disodium Octaborate Tetrahydrate
Ethyl Alcohol
Fipronil (2)
Formaldehyde
Imazalil
Limonene
MCPA, Butoxyethanol Ester
Ortho-Phenylphenol, Sodium Salt
Petroleum Distillates
Petroleum Oil, Unclassified
Propylene Oxide
Sodium Bromide
Sodium Chlorite
Sodium Fluoride
Sulfur Dioxide
Sulfuryl Fluoride

(1) Annual use (pounds ai): Nonagricultural use greater than 5,000 in at least one county; Agricultural use not greater than 5,000 in any one county. DPR 2006a.
Active ingredients were not included in this assessment. See text.

(2) Fipronil monitoring plan currently under development by DPR.