



# Department of Pesticide Regulation



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## MEMORANDUM

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SUBJECT: SUMMARY OF RESULTS FOR FISCAL YEAR 2003/04 GROUND WATER  
PROTECTION LIST MONITORING FOR IMIDACLOPRID AND THREE OF  
ITS DEGRADATES

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### SUMMARY

Imidacloprid, including three degradates, was chosen for monitoring from active ingredients on the Ground Water Protection list. Thirty-three wells were sampled in six counties during October and November 2003. No residues of imidacloprid or imidacloprid degradates were detected in any of the wells. Four wells contained residues of one or more other herbicides or herbicide degradates.

### BACKGROUND

Sixty-two pesticide active ingredients (AIs) are currently on the Ground Water Protection list (Title 3, California Code of Regulations section 6800[b]), which is a list of AIs that have the potential to pollute ground water through normal agricultural use. From 1992 through 2003, a total of 24 AIs (1)(2)(3)(4)(5)(6)(7)(8)(9)(10), were monitored with 40 or more wells sampled for each. A revised monitoring protocol, approved in fiscal year (FY) 1997 (11), is used to select AIs for monitoring based on information about their physico-chemical characteristics, cultural practices for crops on which they are applied, detections in ground water, and any other pertinent information.

The insecticide imidacloprid, along with the imidacloprid guanidine degradate, the urea degradate and the guanidine-olefin degradate, was selected for monitoring during FY 2003/04.



## **METHODS**

Wells were sampled during October and November 2003. Pesticide use report information for 1997-2001 was used to identify counties with the greatest use of imidacloprid (pounds applied). Pesticide use was combined with information on depth to ground water and availability of wells to identify the areas where monitoring should be conducted. Areas containing clusters of high use sections were considered first. Those sections that had shallow depth to ground water were targeted as primary locations for monitoring. Although areas of high use were identified in Kern, Kings, Imperial, and Riverside Counties, they were not selected for monitoring because ground water levels were too deep or wells were not available for monitoring.

Sampling crews drove through the targeted sections of land in each county with the goal of sampling one or more wells per section. If no useable wells were found in a targeted section, attempts were made to locate a well in an adjacent section. For each well sampled, two primary samples, two backup samples, and one field blank sample were collected.

The California Department of Food and Agriculture laboratory performed analyses for imidacloprid, the imidacloprid urea compound (DIJ 9817), and the imidacloprid guanidine compound (BEG 5322), each with a reporting limit of 0.05 parts per billion (ppb) and for the imidacloprid guanidine-olefin compound (NTN 35884) with a reporting limit of 0.10 ppb. A second sample was analyzed using a single analytical screen for atrazine, simazine, diuron, prometon, bromacil, hexazinone, norflurazon, deethylatrazine deisopropylatrazine (ACET), and didealkylated triazine (DACT), each with a reporting limit of 0.05 ppb.

Use of imidacloprid was documented from pesticide use reports for 1997-2001. The total number of pounds applied was determined for each section in which a well was sampled and also for the eight adjoining sections surrounding the monitored section. Land use characteristics were also determined for each section of land in which a well was sampled. The percentage of each land use type was determined based on 1994-1999 Department of Water Resources maps.

## **RESULTS**

A total of 33 wells were sampled in six counties and no imidacloprid or imidacloprid degradate residues were found (Table 1). Residues of certain herbicides were found in three wells in Fresno County, and one well in Tulare County. Simazine, ACET, DACT, and diuron were found in one well each in Tulare and Fresno Counties. Two additional wells in Fresno County contained residues of simazine, ACET, and DACT.

The analytical method used by the California Department of Food and Agriculture laboratory is unequivocal for the nine compounds included in the analytical screen; thus, no verification of those results is necessary.

Imidacloprid use data and land use characteristics are presented by county in Tables 2-7. Each table contains the total number of pounds of imidacloprid, simazine, bromacil, norflurazon, and diuron applied during the years 1997-2001 for the section in which a well was sampled (in section) and also total use for that section plus the eight adjoining sections (9-section). For Ventura County (Table 7), data is also included for atrazine.

## **DISCUSSION**

Imidacloprid is used to control insects on a wide variety of vegetable, field, and fruit crops in California. Quantities applied in the state between 1995 and 2002 have increased nearly four-fold. To date, no detections have been reported in California ground water. Unpublished reports from Long Island, New York have shown that after imidacloprid was applied to sandy soils there, some residues were found in ground water.

In the current study, no imidacloprid residues were detected in ground water in areas where use of the insecticide was high, and where ground water depth and soils created conditions favorable for contamination. The highest statewide use of imidacloprid was in Fresno County, with most concentrated use being in the western part of the county. However, no wells to sample were found in that area. As a result, wells were sampled in other areas that are known to have ground water contaminated by certain herbicide residues. These wells were all part of a network that was being monitored over several years. The one well sampled in Tulare County was also a part of the network and contained herbicide residues.

The greatest number of wells was sampled in the coastal areas of the state in Monterey, San Luis Obispo, Santa Barbara, and Ventura Counties. Monterey County had the second highest statewide use of imidacloprid and 15 wells were sampled there. Many of the wells were located in high imidacloprid use areas with shallow ground water and medium textured soils, conditions conducive to ground water pollution in some areas of the state. Despite those conditions, very few detections of any pesticide have been made in ground water of Monterey County or the other coastal counties monitored in this study.

With the use of imidacloprid in California on the increase, there is still a potential for ground water pollution after residues have more time to move through the soil. Therefore, additional sampling may be needed in the future.

Attachments

## **REFERENCES CITED**

Weaver, D. and Marade J. July 15, 1992. Memorandum to K. S. Goh: Summary of results for FY 1991/92 ground water protection list monitoring.

Weaver, D. and J. Marade. August 23, 1993. Memorandum to J. S. Sanders: Summary of results for FY 1992/93 ground water protection list monitoring.

Weaver, D. and J. Marade. August 19, 1994. Memorandum to K. S. Goh: Summary of results for FY 1993/94 ground water protection list monitoring.

Weaver, D. and J. Marade. June 30, 1995. Memorandum to K. S. Goh: Summary of results for FY 1994/95 ground water protection list monitoring.

Weaver, D. and J. Marade. August 21, 1996. Memorandum to K. S. Goh: Summary of results for FY 1995/96 ground water protection list monitoring.

Weaver, D. and J. Marade. June 30, 1997. Memorandum to K. S. Goh: Summary of results for FY 1996/97 ground water protection list monitoring.

Weaver, D. and J. Marade. June 30, 1998. Memorandum to K. S. Goh: Summary of results for FY 1997/98 ground water protection list monitoring.

Weaver, D. and J. Marade. March 19, 1999. Memorandum to K. S. Goh: Summary of results for FY 1998/99 ground water protection list monitoring.

Weaver, D. and C. Nordmark. May 6, 2002. Memorandum to Bob Rollins: Summary of results for FY 2000/2001 ground water protection list monitoring for alachlor, metolachlor and two degradates of each.

Weaver, D. and C. Nordmark. June 30, 2002. Memorandum to Bob Rollins: Summary of results for FY 2000/2001 ground water protection list monitoring for fenamiphos, fenamiphos sulfoxide, and fenamiphos sulfone.

Weaver, D. April 8, 1997. Revised protocol for selecting ground water protection list active ingredients to be monitored under certain agricultural conditions.

Table 1. Detections of pesticides in wells sampled for imidacloprid and three degradates during 2003-2004 Ground Water Protection List Monitoring. Data are presented only for imidacloprid and for compounds that were detected in at least one well sample <sup>a</sup>.

County	Township/Range- Section	Concentration, parts per billion				
		Imidacloprid + 3 Degradates	Simazine	ACET	DACT	Diuron
Fresno	14S/22E-31	ND <sup>b</sup>	0.104	0.489	0.588	0.071
	14S/23E-34	ND	0.135	0.127	0.367	ND
	15S/21E-09	ND	0.090	0.377	0.372	ND
Monterey	14S/02E-26	ND	ND	ND	ND	ND
	15S/03E-07	ND	ND	ND	ND	ND
	15S/03E-09	ND	ND	ND	ND	ND
	15S/03E-15	ND	ND	ND	ND	ND
	15S/03E-17	ND	ND	ND	ND	ND
	15S/03E-26	ND	ND	ND	ND	ND
	15S/04E-26	ND	ND	ND	ND	ND
	15S/05E-31	ND	ND	ND	ND	ND
	16S/04E-04	ND	ND	ND	ND	ND
	16S/04E-15	ND	ND	ND	ND	ND
	16S/05E-19	ND	ND	ND	ND	ND
	17S/06E-31	ND	ND	ND	ND	ND
	18S/06E-05	ND	ND	ND	ND	ND
	18S/06E-07	ND	ND	ND	ND	ND
	18S/06E-13	ND	ND	ND	ND	ND
San Luis Obispo	11N/35W-24	ND	ND	ND	ND	ND
	11N/35W-26	ND	ND	ND	ND	ND
	32S/13E-33	ND	ND	ND	ND	ND
	32S/13E-33	ND	ND	ND	ND	ND

Table 1. Continued.

County	Township/Range- Section	Concentration, parts per billion				
		Imidacloprid + 3 Degradates	Simazine	ACET	DACT	Diuron
Santa Barbara	07N/34W-31	ND	ND	ND	ND	ND
	10N/33W-20	ND	ND	ND	ND	ND
	10N/33W-21	ND	ND	ND	ND	ND
	10N/34W-09	ND	ND	ND	ND	ND
	10N/34W-18	ND	ND	ND	ND	ND
	10N/35W-09	ND	ND	ND	ND	ND
	10N/35W-12	ND	ND	ND	ND	ND
Tulare	17S/25E-05	ND	0.132	0.566	0.503	0.199
Ventura	01N/21W-17	ND	ND	ND	ND	ND
	01N/21W-21	ND	ND	ND	ND	ND
	01N/22W-02	ND	ND	ND	ND	ND

<sup>a</sup> All samples were analyzed by the CDFA laboratory for imidacloprid, imidacloprid guanidine degradate (BEG 5322), imidacloprid urea degradate (DIJ 9817), and the imidacloprid guanidine olefin degradate (NTN 35884). Each was also analyzed for diuron, prometon, bromacil, norflurazon, atrazine, the atrazine degradate deethylatrazine (DEA), simazine, the atrazine/simazine degradates deisopropylatrazine (ACET), and didealkylated triazine (DACT).

<sup>b</sup> ND = none detected at the reporting limit (RL) of 0.05 parts per billion for all chemicals except the imidacloprid guanidine olefin degradate which had an RL of 0.1 part per billion. The RL is the smallest amount that can be reliably detected in a laboratory test and is set by the testing laboratory for each chemical.

Table 2. Fresno County - Use of imidacloprid and selected herbicides and land use characteristics for sections of land in which wells were sampled for 2003 Ground Water Protection List monitoring.

Township/ Range- Section	Imidacloprid Use		Bromacil Use		Diuron Use		Norflurazon Use		Simazine Use		Land Use <sup>a</sup> (percentage of the section land area)								Right-of-Way Features Present (x)							
	In Section <sup>b</sup>	9-Section <sup>c</sup>	In Section	9-Section	In Section	9-Section	In Section	9-Section	In Section	9-Section	Oranges	Misc. Deciduous	Misc. Field Crop	Grain & Hay	Grapes	Native Vegetation	Farmstead	Urban	Urban Landscaped	Vacant	Paved Road	Unpaved Road	Railroad Tracks	Other Rights of Way	Creeks	Canal/ Ditch
14S/22E-31	40	264	- <sup>d</sup>	-	29	2200	313	1285	176	4673					98	2					X	X		X		X
14S/23E-34	34	153	-	104	79	1400	133	1784	299	4672	4	27	6	29	16		2	6	10		X	X		X		X
15S/21E-09	55	301	-	-	670	2022	410	2380	1121	5030				1	85			12		2	X	X	X			X

<sup>a</sup> Fresno Co. land use data obtained from 1994 Department of Water Resources maps.

<sup>b</sup> Total pounds of pesticide applied from 1997-2001 for imidacloprid and 1997-2002 for all other chemicals in the monitored section, where well was located.

<sup>c</sup> Total pounds of pesticide applied from 1997-2001 for imidacloprid and 1997-2002 for all other chemicals in the monitored section plus the eight surrounding sections.

<sup>d</sup> None of the indicated pesticide applied during the period.

Table 3. Monterey County - Use of imidacloprid and selected herbicides and land use characteristics for sections of land in which wells were sampled for 2003 Ground Water Protection List monitoring.

Township/ Range- Section	Imidacloprid Use		Bromacil Use		Diuron Use		Norflurazon Use		Simazine Use		Land Use <sup>a</sup> (percentage of the section land area)														Right-of-Way Features Present (x)								
	In Section <sup>b</sup>	9-Section <sup>c</sup>	In Section	9-Section	In Section	9-Section	In Section	9-Section	In Section	9-Section	Grain & Hay	Pasture	Misc. Field Crops	Citrus	Asparagus	Cole Crops	Carrots	Celery	Lettuce	Misc. Truck Crops	Broccoli	Cauliflower	Grapes	Native Vegetation	Farmstead	Urban	Vacant/ Idle	Paved Road	Unpaved Road	Railroad Tracks	Other Rights of Way	Creeks	Canal/ Ditch
14S/02E-26	452	2885	<sup>d</sup> -	-	-	214	-	-	-	10					1	1		1	31	54	4	5				2	1	X	X			X	X
15S/03E-07	209	3205	-	-	-	-	-	-	-	33						3		1	38	42	10	5				1	X	X			X	X	
15S/03E-09	376	3180	-	-	42	114	-	-	-	82						4			31	54	1	4			1	3	X	X	X	X		X	
15S/03E-15	796	3573	-	-	72	239	-	-	28	49	1								37	42	8	8	1	1	1		X			X	X		
15S/03E-17	912	2349	-	-	-	62	-	-	33	33	3			1	2			4	17	38	8	5	8		9	3	X	X	X			X	
15S/03E-26	358	3048	-	-	6	6	-	-	-	-	3	1						1	32	39	4	11	4	1	3		X	X					
15S/04E-26	626	2050	-	-	35	369	-	-	-	401	2								21	37	35	1	2	1			X						
15S/05E-31	110	1743	-	-	-	1792	-	-	-	6139		6							2	8	3		69	3	8	2	X	X				X	
16S/04E-04	1129	2543	-	-	-	-	-	-	-	401	1	1					4	5	23	49	12			2	1		X	X		X			
16S/04E-15	3	3358	-	7	-	273	-	-	-	380			1				3	5	24	49	14			2	1		X	X			X		
16S/05E-19	367	2393	-	-	185	2656	-	-	-	-					3			3	21	46	5	8	1	3	1	10	X	X			X		
17S/06E-31	462	2355	-	-	5	1579	-	-	-	596	1	10		1			1	5	29	28	22			4	1	1			X			X	
18S/06E-05	384	2360	-	132	389	1153	-	-	-	899			7		17					32	7	12			2	1		X	X				
18S/06E-07	26	1060	132	132	302	1496	83	83	330	2084	26		3	21	4					5	1		2	37	1		X	X			X		
18S/06E-13	430	2787	-	-	-	-	-	90	-	14	1	1	2				2	5	19	44	18	5			1	2	X	X					

<sup>a</sup> Monterey Co. land use data obtained from 1997 Department of Water Resources maps. Figures are averages for the Spring, Summer and Fall maps.

<sup>b</sup> Total pounds of pesticide applied from 1997-2001 for imidacloprid and 1997-2002 for all other chemicals in the monitored section, where well was located.

<sup>c</sup> Total pounds of pesticide applied from 1997-2001 for imidacloprid and 1997-2002 for all other chemicals in the monitored section plus the eight surrounding sections.

<sup>d</sup> None of the indicated pesticide applied during the period.

Table 4. San Luis Obispo County - Use of imidacloprid and selected herbicides and land use characteristics for sections of land in which wells were sampled for Water Protection List monitoring.

Township/ Range-Section	Imidacloprid Use		Diuron Use		Norflurazon Use		Simazine Use		Land Use <sup>a</sup> (percentage of the section land area)										Right-of-Way Features Present (x)					
	In Section <sup>b</sup>	9-Section <sup>c</sup>	In Section	9-Section	In Section	9-Section	In Section	9-Section	Celery	Lettuce	Misc. Truck Crops	Nursery	Broccoli	Cabbage	Cauliflower	Native Vegetation	Water	Urban	Paved Road	Unpaved Road	Railroad Tracks	Other Rights of Way	Creeks	Canal/ Ditch
11N/35W-24	585	1155	<sup>d</sup> -	6	-	-	-	-				11				50		39	X	X		X		
11N/35W-26	477	2245	-	11	-	64	-	-	11	15	33		26		10	4			X	X			X	
32S/13E-33	707	1605	-	-	-	-	-	3		12	28		9	2		22	4	22	X	X		X	X	X

<sup>a</sup> San Luis Obispo Co. land use data obtained from 1995 Department of Water Resources maps.

<sup>b</sup> Total pounds of pesticide applied from 1997-2001 for imidacloprid and 1997-2002 for all other chemicals in the monitored section, where well was located.

<sup>c</sup> Total pounds of pesticide applied from 1997-2001 for imidacloprid and 1997-2002 for all other chemicals in the monitored section plus the eight surrounding sections.

<sup>d</sup> None of the indicated pesticide applied during the period.

Table 5. Santa Barbara County - Use of imidacloprid and selected herbicides and land use characteristics for sections of land in which wells were sampled for 2003 Ground Water Protection List monitoring.

Township/ Range- Section	Imidacloprid Use		Diuron Use		Norflurazon Use		Simazine Use		Land Use <sup>a</sup> (percentage of the section land area)											Right-of-Way Features Present (x)								
	In Section <sup>b</sup>	9-Section <sup>c</sup>	In Section	9-Section	In Section	9-Section	In Section	9-Section	Misc. Deciduous	Dry Beans	Asparagus	Beans	Celery	Misc. Truck Crops	Nursery	Strawberries	Broccoli	Cabbage	Cauliflower	Native Vegetation	Water	Urban	Paved Road	Unpaved Road	Railroad Tracks	Other Rights of Way	Creeks	Canal/ Ditch
07N/34W-31	413	1626	<sup>d</sup> -	260	47	788	45	599			7	6	8	43	9			10	4			1	X		X	X	X	X
10N/33W-20	401	1826	-	-	-	80	-	507		2			4	42	1	2	3	6	35			2	X	X			X	X
10N/33W-21	366	1600	-	-	-	80	-	507						30		19	4		25	11	3	7	X	X	X	X		X
10N/34W-09	113	1459	-	583	-	-	-	-					7	27	2	5		49	2			7	X	X				X
10N/34W-18	681	2891	183	1159	155	779	-	-	1		2			5			25	7	21	2		21	X	X		X		
10N/35W-09	565	2851	-	68	-	186	-	-					2	16	2		12		9	4		49	X	X	X	X	X	
10N/35W-12	399	2249	-	415	-	561	-	-						26			21		23	2		2	X	X			X	

<sup>a</sup> Santa Barbara Co. land use data obtained from 1995 Department of Water Resources maps.

<sup>b</sup> Total pounds of pesticide applied from 1997-2001 for imidacloprid and 1997-2002 for all other chemicals in the monitored section, where well was located.

<sup>c</sup> Total pounds of pesticide applied from 1997-2001 for imidacloprid and 1997-2002 for all other chemicals in the monitored section plus the eight surrounding sections.

<sup>d</sup> None of the indicated pesticide applied during the period.



Table 7. Ventura County - Use of imidacloprid and selected herbicides and land use characteristics for sections of land in which wells were sampled for 2003 Ground Water Protection List monitoring.

Township/ Range- Section	Imidacloprid Use		Atrazine Use		Bromacil Use		Diuron Use		Norflurazon Use		Simazine Use		Land Use <sup>a</sup> (percentage of the section land area)										Right-of-Way Features Present (x)													
	In Section <sup>b</sup>	9-Section <sup>c</sup>	In Section	9-Section	In Section	9-Section	In Section	9-Section	In Section	9-Section	In Section	9-Section	Lemons	Dry Beans	Turf Farm	Beans	Celery	Lettuce	Onion & Garlic	Bushberries	Strawberries	Peppers	Broccoli	Urban	Landscaped	Paved Road	Unpaved Road	Railroad Tracks	Other Rights of Way	Creeks	Canal/ Ditch					
01N/21W-17	352	2689	- <sup>d</sup>	320	114	855	114	887	-	270	193	2778	93			3			1	1	1	1										X				X
01N/21W-21	229	1626	320	-	-	146	-	146	-	55	-	808		8	4	20	13	18				26	10	1			X								X	
01N/22W-02	262	541	-	-	-	-	2	108	-	-	-	-					6		2		19			67	5	X	X				X					

<sup>a</sup> Ventura Co. land use data obtained from 1994 Department of Water Resources maps

<sup>b</sup> Total pounds of pesticide applied from 1997-2001 for imidacloprid and 1997-2002 for all other chemicals in the monitored section, where well was located.

<sup>c</sup> Total pounds of pesticide applied from 1997-2001 for imidacloprid and 1997-2002 for all other chemicals in the monitored section plus the eight surrounding sections.

<sup>d</sup> None of the indicated pesticide applied during the period.