

# GW 09: Ground Water Monitoring for Imidacloprid and Four Degradates in High Use Areas in California

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## ABSTRACT

Imidacloprid, an active ingredient on the Ground Water Protection List (GWPL), was selected for well monitoring based on its use patterns and physical-chemical properties. Well selection was based on soil type, pounds of imidacloprid applied, depth to water, and well location. From February to March 2009, the Department of Pesticide Regulation (DPR) sampled thirty-four wells in Monterey, San Benito, San Luis Obispo, Santa Barbara, and Ventura counties for imidacloprid and other herbicides on the “triazine screen” (hexazinone, tebuthiuron, simazine, bromacil, prometon, atrazine, norflurazon, and diuron). Monitoring for these other herbicides allows DPR to assess the performance of our ground water protection program. No residues of imidacloprid, imidacloprid degradates, or herbicides on the “triazine screen” were detected in any of the wells tested. These results are similar to a 2004 imidacloprid monitoring study that also yielded no detections of the parent or its degradates. If the use of imidacloprid increases or is applied in a way that facilitates leaching to ground water, the DPR may conduct further monitoring of imidacloprid in the future.

## INTRODUCTION

DPR’s GWPL is a list of pesticides having the potential to pollute ground water. Pursuant to California Food and Agricultural Code (FAC) section 13143, companies seeking to register an agricultural use pesticide containing a new AI must send DPR mobility and persistence data. If these data exceed certain key values and the pesticide label requires or allows direct soil application and/or irrigation soon after application, FAC section 13144 requires DPR to add the pesticide to GWPL. GWPL is contained in the Title 3, California Code of Regulations section 6800. FAC section 13148 requires DPR to monitor pesticides on GWPL to more accurately determine the mobility and persistence of the pesticides and determine if these pesticides have migrated to ground waters of the state due to legal agricultural use.

Since 1990, DPR has sampled 1246 wells for 86 pesticides and pesticide breakdown products as part of GWPL monitoring. (CDPR, 2007a). Recently, the pesticides on the GWPL were ranked according to their use patterns and mobility and persistence data. Those compounds with heavy, increasing use and the ability to leach past the crop root zone, based on the LEACHM model (Hutson 1992), are ranked higher. Imidacloprid was selected for monitoring during fiscal year 2008–2009 based on its high ranking and the availability of a laboratory analysis method.

The wells were also sampled for the presence of hexazinone, tebuthiuron, the known ground water contaminants (Title 3, California Code of Regulations section 6800[a]) and some of their degradates (these pesticides are analyzed collectively as the “triazine screen.”) Monitoring for known ground water contaminants helps DPR assess the adequacy of our ground water protection program and to determine if new GWPLs need to be identified. Monitoring for hexazinone and tebuthiuron, suspected ground water contaminants, provides additional data on which to base a regulatory decision for those compounds, if necessary.

Imidacloprid is a neonicotinoid insecticide that controls a wide variety of species; including (but not limited to) sucking insects, beetles, termites, and fleas. In California, from 1996 to 2003, imidacloprid use was reported on 122 different sites. The ten sites with the highest reported use were (in descending order): structural pest control, lettuce, landscape maintenance, cotton,

grapes, broccoli, cantaloupe, cauliflower, orange, and melons. This monitoring study was conducted to identify whether or not imidacloprid use is impacting California's ground water.

## **MATERIALS AND METHODS**

DPR chose sampling locations based on the pounds of AI applied in a one-square mile area (as reported in the pesticide use reports), soil vulnerability, depth to ground water, and well availability (CDPR, 2007b). Areas with clusters of high use sections, based on use for reporting years 1996–2003, were given high priority (Table 1). High use sections were then evaluated for the presence of wells according to our well inventory database and whether or not they are located in GWPA's (CDPR, 2007a). DPR has classified many sections within the state as GWPA's because they are vulnerable to pesticide contamination of the ground water based on either soil conditions and the depth to ground water (less than 70 feet) or the presence of verified pesticide residues in the ground water of the section (Troiano et al., 2000). If high use sections were located outside of the GWPA's, then they were prioritized based on depth to ground water.

For this study, the majority of the sections with a high use of imidacloprid were located outside of these GWPA's. As a result, areas of high imidacloprid use and with ground water depths that were less than 150 feet and a record of available wells were given highest priority. Most targeted sections had a depth to ground water of 100 feet or less. The sampled sections were located in Monterey, San Benito, San Luis Obispo, Santa Barbara, and Ventura counties (Table 2). Although there were counties with much higher overall use of imidacloprid, DPR did not sample these areas due to a lack of available wells, a lower pounds per section use ratio, and excessive depth to ground water (greater than 150 feet).

DPR selected domestic wells for sampling, with the goal of sampling at least one well in each selected section, according to procedures in SOP FSWA006.01 (Nordmark, 2008b). If the sampling crew could find no suitable wells available in the target section, a well within approximately 0.2 miles of the section could be sampled. Samples were collected using the methods described in SOP FSWA001.01 (Nordmark, 2008a). DPR obtained information regarding the well construction and depth from the well owner. No more than 40 wells were targeted for sampling.

The California Department of Food and Agriculture's (CDFA's) Center for Analytical Chemistry analyzed two primary samples from each well: one for imidacloprid and four of its degradates (imidacloprid urea, imidacloprid guanidine, imidacloprid olefin, and imidacloprid olefinic guanidine) and one for the "triazine screen" (CDFA, 2008a; and CDFA, 2008b). Samples containing known amounts of imidacloprid, disguised as actual samples (blind spikes), were prepared and analyzed in accordance with SOP QAQC001.00 (Segawa, 1995). Samples containing de-ionized water (field blanks) were collected at the same time as the field samples and would have been analyzed to confirm the validity of positive results. The reporting limit for all analytes is 0.05 parts per billion, except for imidacloprid olefin; that analyte has a reporting limit of 0.1 parts per billion. The reporting limit is the smallest amount that can be reliably detected and is set by the testing laboratory for each compound.

## **RESULTS**

A total of 34 wells were sampled in 30 sections in Monterey, San Benito, San Luis Obispo, Santa Barbara, and Ventura counties with no reported detections of imidacloprid, imidacloprid degradates, or pesticides on the “triazine screen.” Results from the samples received during the course of the study were all negative for pesticide residues. Imidacloprid use for the years 1996—2003 and the locations of wells sampled for this study are shown in Figures 1 and 2.

None of the 34 sampled wells tested positive for imidacloprid despite being located in high use areas, some with very shallow depths to ground water. Four of the sections sampled were a GWPA. Similar results were obtained in a GWPL monitoring study conducted in 2004, in which 33 wells were sampled for imidacloprid (Weaver and Nordmark, 2004).

## **CONCLUSION**

Due to its high use and physical-chemical properties, imidacloprid was selected for well monitoring. From February to March 2009, DPR sampled thirty-four wells in Monterey, San Benito, San Luis Obispo, Santa Barbara, and Ventura counties for imidacloprid and other herbicides on the “triazine screen.” No residues of imidacloprid, imidacloprid degradates, or herbicides on the “triazine screen” were detected in any of the wells tested. After sampling 34 wells located in the targeted counties and finding no residues of imidacloprid, DPR decided to suspend further sampling. If imidacloprid use increases, application methods change, or the compound is detected by another agency in ground water, then DPR may conduct further investigations.

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Table 1. Counties with the highest use of imidacloprid for the reporting years of 1996–2003 (CDPR, 2007b). Counties sampled are indicated with an asterisk.

County	Pounds Applied
Los Angeles	140,685
Monterey*	112,806
Fresno	101,471
Imperial	89,060
Kern	59,995
Riverside	42,417
Santa Clara	38,639
Santa Barbara*	33,668
Tulare	25,048
Kings	24,219
Ventura*	23,122
Orange	22,583
San Luis Obispo*	22,348
San Joaquin	21,500
San Diego	20,718
El Dorado	15,029
Sacramento	13,701
Contra Costa	12,532
Madera	12,330
Yolo	9,828
Merced	8,686
Stanislaus	8,144
San Benito*	7,719
Napa	6,910
Alameda	6,646

Table 2. Sections containing wells sampled during 2009 GWPL monitoring. Pounds of imidacloprid applied in each section are given for reporting years 1996–2003 (CDPR, 2007b). Depth to ground water values are from Troiano et al. (2000).

County	Section	Depth to ground water (ft)	Pounds of Imidacloprid applied
Monterey	27M14S02E24	NA <sup>a</sup>	100
	27M14S02E25	53	509
	27M14S02E28	43	154
	27M15S03E01	107	398
	27M15S03E07	53	303
	27M15S03E09	71	519
	27M16S04E15	52	39
	27M16S05E19	62	611
	27M17S05E24	40	779
	27M17S05E36	23	575
	27M18S06E04	22	612
	27M18S06E05	38	476
	27M18S06E14* <sup>b</sup>	42	463
	27M18S06E31	NA	31
	27M19S07E04	51	342
	27M19S07E09	102	347
	27M20S08E15	41	268
San Benito	35M12S04E34	63	324
	35M12S04E35	79	133
San Luis Obispo	40S11N35W28*	17	1181
	40S11N35W34*	27	579
	40M32S13E33*	19	1208
Santa Barbara	42S07N34W30	NA	480
	42S07N34W31	NA	872
	42S07N35W26	NA	600
	42S10N33W21	NA	574
	42S10N34W18	NA	865
	42S10N35W09	NA	856
	42S10N35W24	NA	471
Ventura	56S01N21W21	NA	329

a. NA = Information Not Available.

b. \* = Section is a GWPA.



Figure 1. Imidacloprid Use 1996-2003, GWPAs, and Sampled Well Locations in Monterey and San Benito Counties.

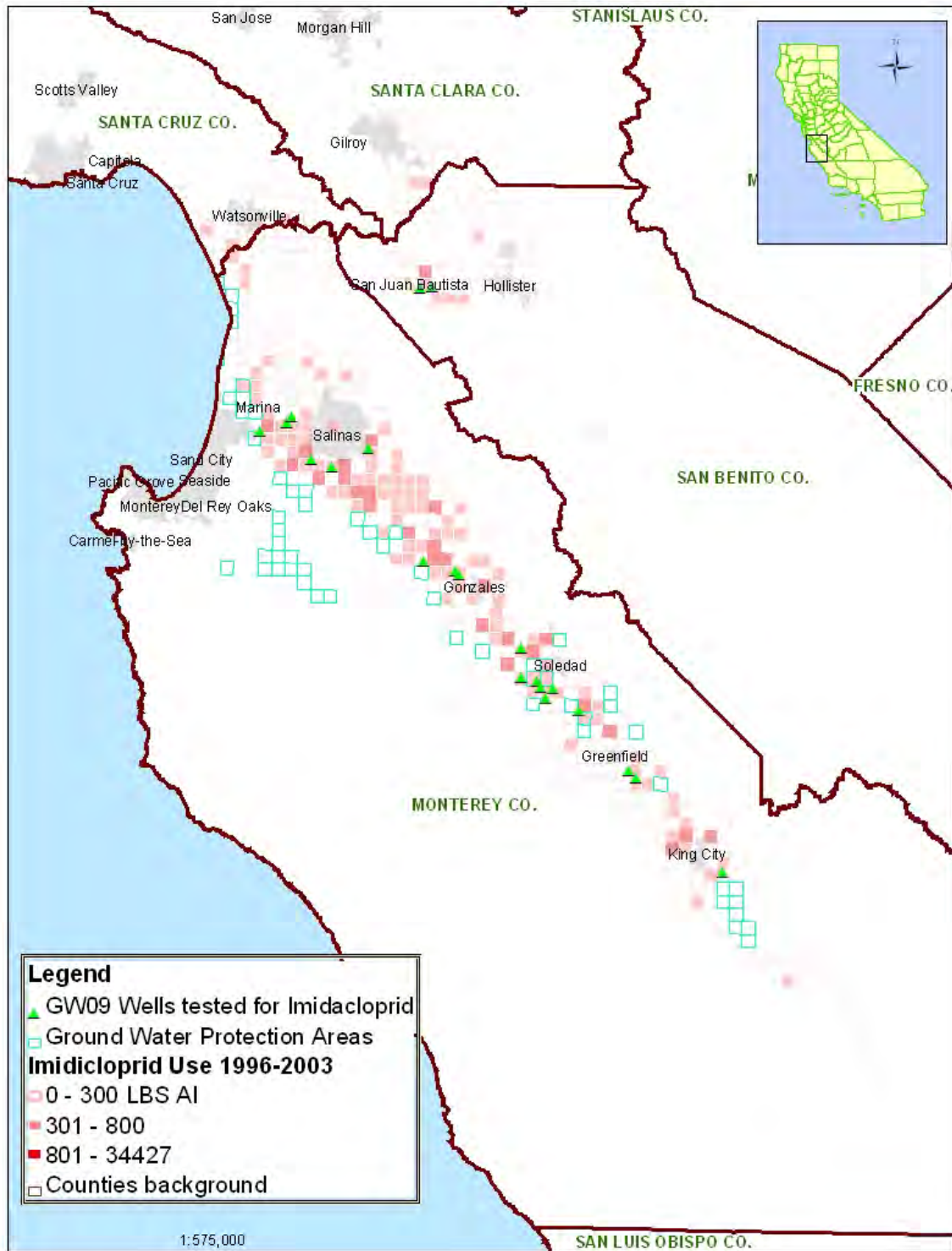


Figure 2. Imidacloprid Use 1996-2003, GWPAs, and Sampled Well Locations in San Luis Obispo, Santa Barbara, and Ventura Counties.

