

STUDY GW17: PROTOCOL FOR GROUND WATER PROTECTION LIST MONITORING FOR IMIDACLOPRID

I. INTRODUCTION

Section 13148 of the California Food and Agricultural Code directs the Department of Pesticide Regulation (DPR) to conduct ground water monitoring for pesticides that have been designated as having the potential to pollute ground water. These pesticides are identified on DPR's Ground Water Protection List (GWPL). DPR annually samples for several pesticides listed on the GWPL in areas of high use to determine if they have migrated to ground water as a result of their legal agricultural use.

Imidacloprid is a systemic, neonicotinoid insecticide used in urban and agricultural environments worldwide to control insects on a wide variety of vegetable, field, and fruit crops. As of April 2017, there are 288 active products containing imidacloprid that are registered in California under a wide variety of trade names (CDPR, 2017a). In California, over 2.9 million pounds of imidacloprid active ingredient have been used on agricultural crops from 1995 to 2015, and use has been steadily increasing since 2000 (Figure 1) (CDPR, 2017b). DPR conducted imidacloprid monitoring studies in 2003 and 2009 and collected a total of 67 well samples from seven counties (Fresno, Monterey, San Benito, San Luis Obispo, Santa Barbara, Tulare, and Ventura). Imidacloprid or imidacloprid degradates were not detected in any of the wells tested (Weaver and Nordmark, 2004; Bergin and Nordmark, 2009). Recently, a few wells have tested positive for imidacloprid in California (CDPR, 2016). The increase in the use of imidacloprid and its detections in wells has made it necessary for DPR to monitor for imidacloprid to determine if current agricultural uses of imidacloprid are resulting in ground water contamination.

II. OBJECTIVE

The purpose of this study is to determine whether imidacloprid or imidacloprid degradates have migrated to ground water in areas of California with high reported agricultural use or in areas identified to be vulnerable to groundwater contamination. Samples will also be analyzed for additional pesticides known to, or with the potential to, contaminate ground water.

III. PERSONNEL

Well sampling will be conducted by the Environmental Monitoring Branch of DPR under the general supervision of Senior Environmental Scientist Joy Dias. Project personnel will include:

Project Leader: Vaneet Aggarwal

Field Coordinator: Craig Nordmark

Laboratory Liaison: Sue Peoples

Analytical Chemistry: Center for Analytical Chemistry, California Department of Food
and Agriculture (CDFA)

Please direct questions regarding this study to Vaneet Aggarwal at (916) 445-5393 or vaneet.aggarwal@cdpr.ca.gov.

IV. STUDY PLAN

Active Ingredient Selection

In addition to the imidacloprid, DPR will also monitor for several main imidacloprid degradates:

- Imidacloprid urea
- Imidacloprid guanidine
- Imidacloprid olefin
- Imidacloprid olefinic guanidine

In order to help assess the effectiveness of our mitigation measures and to determine if regions regulated as Ground Water Protection Areas need to be expanded, DPR routinely analyzes samples for known ground water contaminants such as atrazine, simazine and some of their degradates (3CCR section 6800[a]) using the triazine screen (Table 1). All wells sampled in this study will be screened for these known contaminants.

DPR and CDFA have developed a new multi-analyte screen which consists of 34 analytes on the GWPL (3CCR section 6800 a and b). Samples collected in this study will be analyzed using the new screen. Of these 34 active ingredients, 9 overlap with the triazine screen (Table 1). DPR will use this overlap as a quality control if there are positive detections of these pesticides.

Study Area Selection

Wells will be sought in targeted Public Land Survey System (PLSS) sections based on similarity to areas in Fresno County where imidacloprid detections have been reported in well samples.

The criteria are:

1. Moderate to high use of imidacloprid from 1995 to 2015 in the section or an adjacent section.
2. Depths to ground water in the section of less than 60 feet. Data used will be based on DPR's Depth-to-ground water database (Spurlock, 2000).
3. Previous detection of other pesticide residues by DPR in at least one well in the section or the section is adjacent to one of the previously reported imidacloprid detections.

Up to two wells may be sampled per target section. Wells may be sampled outside the target section if they are within 300 feet of the target section. The majority of the target sections (Table 2) are in Fresno and Tulare Counties.

V. SAMPLING AND ANALYTICAL METHODS

Samples will be collected in accordance with Standard Operating Procedure (SOP) FSWA001.02. Domestic wells will be prioritized for sample collection because they are usually shallower than municipal and irrigation wells. During collection of ground water samples all efforts will be taken to sample water directly from the aquifer as outlined in the SOP (Nordmark and Herrig, 2011).

Chemical analysis will be performed by the CDFG Center for Analytical Chemistry. CDFG will analyze samples for: imidacloprid and imidacloprid degradates using method EMON-SM-13.0, the triazine group of pesticides using method EMON-SM-62.9, and the multi-analyte group (Table 1) using method EMON-SM-05-032. The reporting limit for all analytes is 0.05 parts per billion (ppb), except for imidacloprid olefin which is 0.2 parts per billion.

SOP QAQC001.00 (Segawa, 1995) guidelines will be followed for analytical laboratory quality control and for collecting quality assurance samples in the field.

VI. DATA ANALYSIS

Data obtained from the CDFA laboratory will be used to determine if pesticides are migrating to ground water. These data will also be used to generate a study memorandum detailing the analysis findings. Analytical results will be provided to participating property owners for their respective wells within 12 to 16 weeks of sampling.

VII. TIMETABLE

- May 2017- August 2017: Conduct sampling.
- July 2017-October 2017: Obtain analysis results from CDFA laboratory.
- Provide results to property owners within 30 days of receipt.
- January 2018: Write study memorandum.

VIII. BUDGET

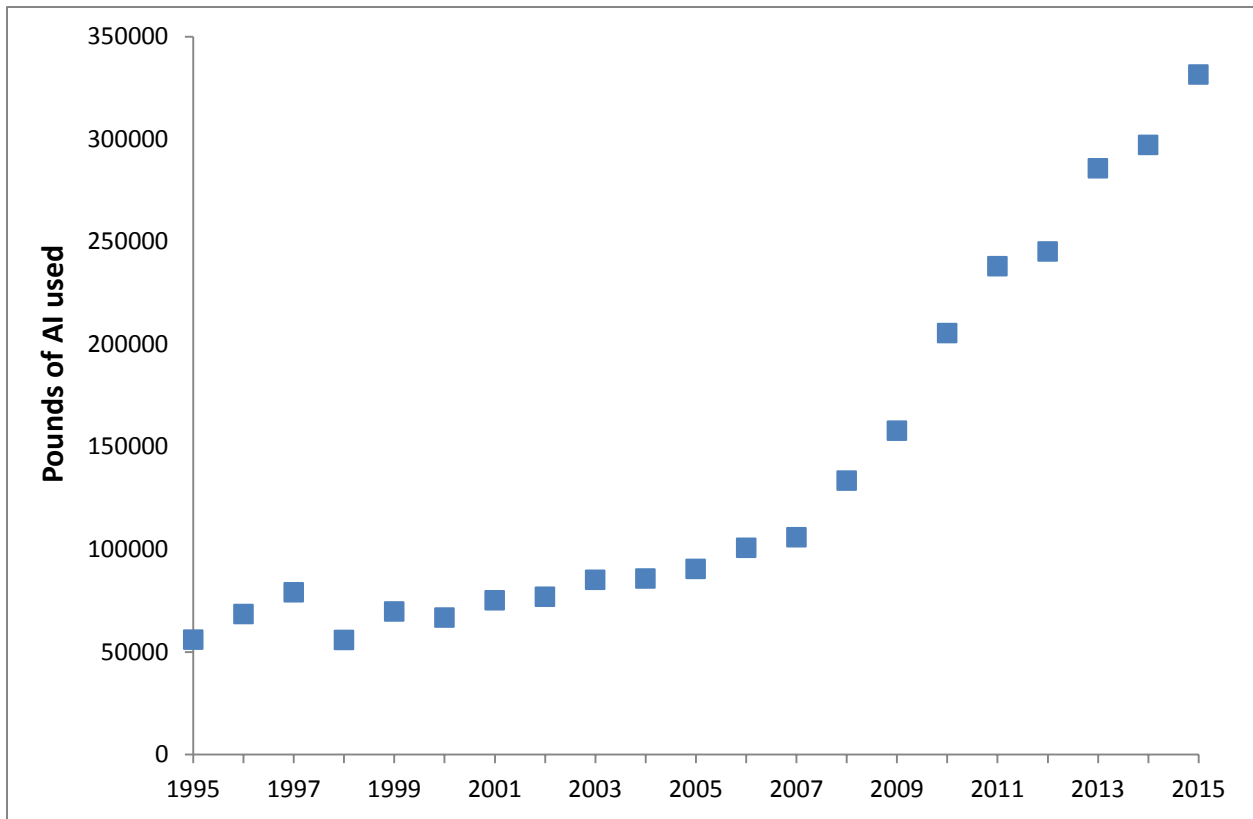
Budget Item	Units	Expense per Unit	Total Expense
Imidacloprid Analysis	≤ 40 Samples	\$930	≤ \$37,000
Triazine Screen	≤ 40 Samples	\$864	≤ \$35,000
Multi-Residue LC/MS	≤ 40 Samples	\$1500	≤ \$60,000
Multi-Residue GC/MS	≤ 40 Samples	\$1000	≤ \$40,000
QC	≤ 12 Samples	\$3000	≤ \$36,000
Travel	≤ 90 Days	\$130	≤ \$11,700
Person Years	≤ 1	\$100,000	≤ \$100,000
Total			≤\$319,700

IX. REFERENCES

- Bergin, R. and C. Nordmark. 2009. GW 09: Ground Water Monitoring for Imidacloprid and Four Degradates in High Use Areas in California. Available at: http://www.cdpr.ca.gov/docs/emon/pubs/ehapreps/report_gw09a.pdf (verified April 19, 2017). California Department of Pesticide Regulation, Sacramento, California.
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- Nordmark, C. and J. Herrig. 2011. SOP FSWA001.02. Obtaining and Preserving Well Water Samples. Available at: <http://www.cdpr.ca.gov/docs/emon/pubs/sops/fswa00102.pdf> (verified April 19, 2017). California Department of Pesticide Regulation, Sacramento, California.
- Segawa, R. 1995. SOP QAQC001.00. Chemistry Laboratory Quality Control. Available at: <http://www.cdpr.ca.gov/docs/emon/pubs/sops/qaqc001.pdf> (verified April 19, 2017). California Department of Pesticide Regulation, Sacramento, California.
- Spurlock, F. 2000 EH 00-02, Procedures for Developing a Depth-to-Ground Water Database. Available at: <http://www.cdpr.ca.gov/docs/emon/pubs/ehapreps/eh0002.pdf> (verified April 19, 2017). California Department of Pesticide Regulation, Sacramento, California.
- Weaver, D.J. and C. Nordmark. 2004. Summary of Results for Fiscal year 2003/04 Ground water Protection List Monitoring for Imidacloprid and Three of its Degradates. Available at: http://em/localdocs/pubs/gw/memos/gwpl/gwpl_0304.pdf (verified April 19, 2017). California Department of Pesticide Regulation, Sacramento, California.

X. FIGURES

Figure 1: Statewide use of Imidacloprid (CDPR, 2017)



XI. TABLES

**Table 1: Pesticide Active Ingredient Screen CDFA Lab Method
(Shading indicates overlapping analytes)**

MULTI-RESIDUE EMON-SM-05-032	TRIAZINE SCREEN EMON-SM-62.9
Atrazine	ACET
Azoxystrobin	Atrazine
Bensulide	Bromacil
Bromacil	Cyanazine
Carbaryl	DACT
Clomazone	DEA
Diazinon	Diuron
Dichloran	Hexazinone
Dichlorbenil	Metribuzin
Dimethenamide	Norflurazon
Dimethoate	Prometon
Diuron	Prometryn
Ethofumesate	Simazine
Ethoprophos	Tebuthiuron
Fludioxonil	
Imidacloprid	
Linuron	
Malathion	
Mefenoxam/Metalaxyl	
Methiocarb	
Metolachlor	
Metribuzin	
Napropamide	
Norflurazon	
Oryzalin	
Phorate	
Prometon	
Prometryn	
Propanil	
Simazine	
Tebuthiuron	
Thiamethoxam	
Thiobencarb	
Triallate	

Table 2: Target Sections for Well Sampling

Imidacloprid Use 1995-2014 (LBSAI)				
COMTRS	In-section	9-Section Area	Detection Wells	Average Depth to Water 1990-99
20M12S17E35	348	3228	1	55
20M13S16E07	71	2605	1	51
10M13S22E35	643	3148	1	27
10M13S22E36	799	4154	1	24
10M14S22E01	876	4086	2	26
10M14S22E31	260	1625	2	30
10M15S22E06	55	2104	3	27
10M15S21E09	415.5	3729	2	35
10M15S23E03	284	1376	1	52
10M15S24E25	716	3724	1	48
10M15S24E26	479	3930	1	46
10M15S24E36	503	3604	1	50
54M16S24E01	293	2884	2	53
54M16S24E12	369	2432	2	47
54M17S25E23	703	8231	1	58
54M17S25E24	1495	10625	2	50
54M17S25E13	914	10640	1	37
54M17S26E20	1136	9491	2	26
54M17S26E18	1610	10906	2	22
54M17S26E19	1695	10800	2	38
54M17S26E31	686	5613	1	60
54M17S26E29	505	8599	2	43
54M17S26E30	778	8640	2	54
54M18S27E08	812	3641	2	39
54M18S27E09	656	2673	2	34
54M18S27E17	486	5564	5	36
54M18S27E19	677	5135	2	33
54M20S27E31	368	3403	3	27
54M21S27E05	504	2166	1	19
54M20S27E30	406	3838	1	24