

Monitoring Groundwater Concentrations of Pesticides in Sensitive Areas with High Agricultural Use Study 228 - Well Network Sampling - Annual Update 2024

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INTRODUCTION

This update summarizes the annual results of pesticide concentrations detected in a network of primarily domestic wells monitored for more than 20 years throughout California's San Joaquin Valley. The Well Network is located throughout Fresno and Tulare counties, in areas vulnerable to groundwater contamination and high agricultural use of pesticides based on historical monitoring ([Well Inventory Database](#)) and reported pesticide use ([Pesticide Use Reporting](#)) data. In 2024, the California Department of Pesticide Regulation's (DPR) Groundwater Protection Program (GWPP) analyzed groundwater samples from 58 wells for pesticide residues using the Triazine Screen and the Multi-Analyte Screen.

Background

In 1999, DPR initiated the Well Network Study to monitor potential changes in groundwater pesticide concentrations due to new regulations with enforceable management practices designed to minimize pesticide movement to groundwater (Garretson, 1999; Davalos, 2021). When this study was initiated, the selected wells had been previously sampled by DPR and had residues of simazine, bromacil, or diuron. Wells in the Well Network continue to be sampled for these pesticides annually. Due to the vulnerability of the study area, the Well Network has also served as an experimental area to monitor additional pesticides that have the potential to contaminate groundwater.

Troiano et al. (2013) reported a statistical analysis of data collected from 2000 to 2012 in the Well Network, along with a full description of this study, including characterization of the conditions of the vulnerable areas, pesticide use, and the required mitigation measures. An additional statistical trend analysis was conducted on data collected from 61 of the original Well Network wells between 1999 to 2022 (Ruud, 2026). Annual summaries of study results have been reported since 2008. More recently, the annual summaries have included a trend analysis of changing pesticide and pesticide degradate residue concentrations since either 1999 or the first year an analyte was sampled for. The analysis in Troiano et al. (2013) and the tables included in the annual summaries suggest that DPR's regulatory actions have resulted in measurable decreases in both detection frequencies and well water

concentrations for many regulated pesticides (Davalos, 2021; Garretson, 1999; Ruud, 2026; Troiano et al., 2013).

This summary of the 2024 Well Network monitoring presents the data in the following order:

- Sampling locations: [Figure 1](#), [Table 1](#), and [Table 2](#)
- Pesticides and degradates analyzed: [Table 3](#) through [Table 5](#)
- Monitoring results: [Table 6](#) through [Table 9](#)
- Historical data: [Table 10](#) through [Table 12](#)
- QA/QC results: [Table 13](#) through [Table 14](#)

GWPP scientists would like to express their gratitude to the volunteers who have generously allowed us to sample their wells for over 20 years. Their participation has been crucial for monitoring emerging groundwater pesticide contaminants and establishing trends—work that could not have been accomplished without their participation.

METHODS

Sampling Methods

DPR's GWPP scientists conducted the study according to the protocol (Davalos, 2021) and followed the standard operating procedures (SOPs) for collecting samples (Kocis, 2022). Sampling occurred between April 22, 2024, and May 21, 2024.

Study Area

The Well Network's well locations are in areas susceptible to pesticide movement to groundwater within Fresno and Tulare counties ([Figure 1](#), [Table 1](#), and [Table 2](#)). Areas vulnerable to groundwater contamination from agricultural use of pesticides are characterized by coarse soils that are susceptible to pesticides leaching through the soil into groundwater or by hardpan soils vulnerable to pesticide runoff into sensitive areas with conduits to groundwater. To regulate pesticide use in vulnerable soil areas of California, DPR designated certain one-square-mile sections of land that were determined to be sensitive to the movement of pesticides to groundwater as Groundwater Protection Areas (GWPA's). In GWPA's, pesticides and their degradates listed in California Code of Regulations, Title 3, Section 6800(a) are regulated to mitigate their movement to groundwater. Three types of GWPA's are designated: leaching, runoff, and combined leaching/runoff. The GWPA's surrounding the Well Network are shown in [Figure 1](#). GWPA's, sections, vulnerability and regulations are described in the 2025 annual well sampling report, [Sampling for Pesticide Residues in California Well Water](#).

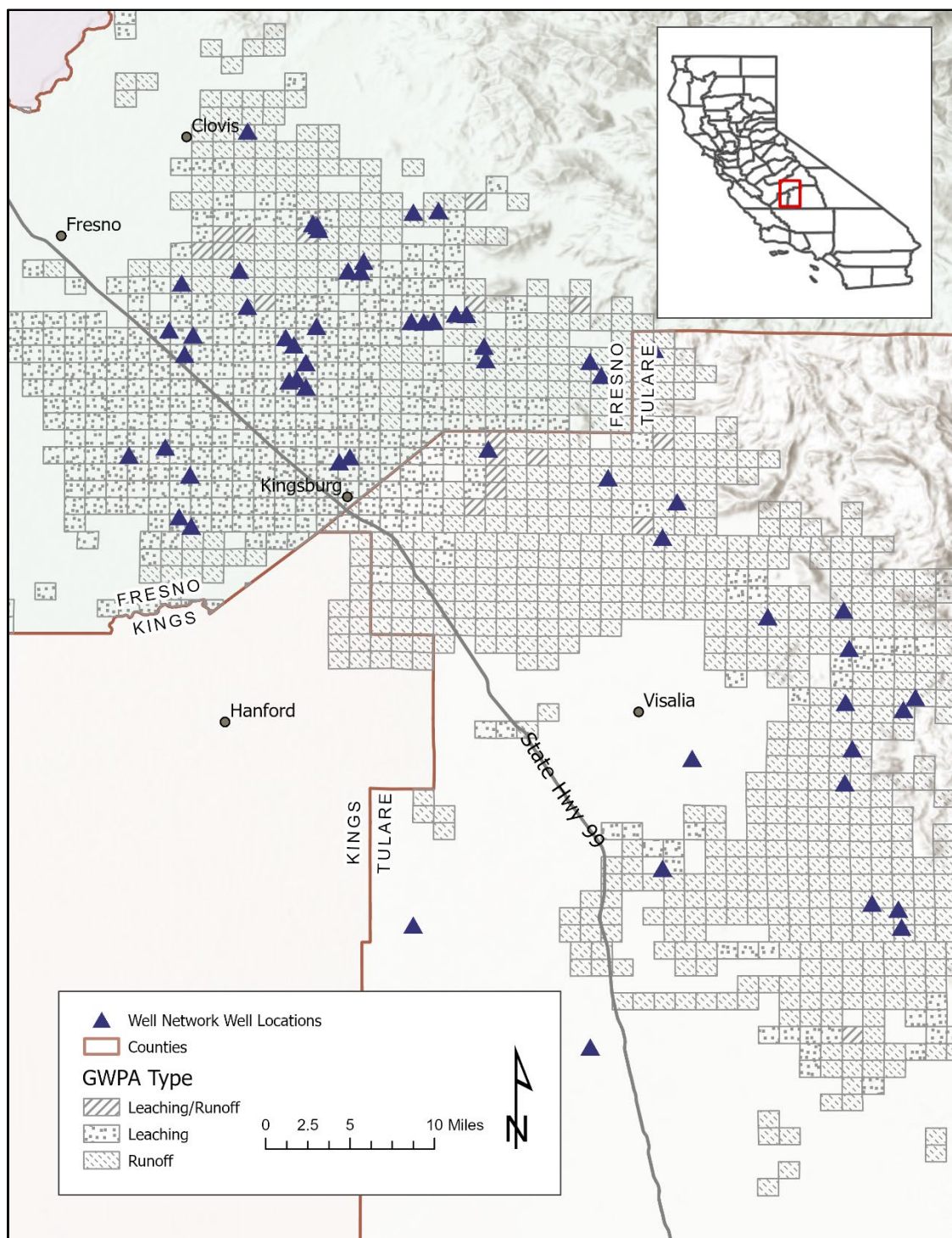


Figure 1. Location of the Well Network wells in Fresno and Tulare counties overlaying Groundwater Protection Areas (GWPA).

Wells Sampled

Fifty-eight wells ([Table 1](#) and [Table 2](#)) in the Well Network were sampled in 2024. Four wells were added

to the Well Network in 2023; all four wells are located outside currently existing GWPAs. Not all wells in the Well Network are sampled every year due to changes in participation, wells going dry, and new wells being drilled to replace decommissioned wells. For this reason, well numbers used by DPR to differentiate sampling locations are not consecutive.

Table 1. Well locations in Fresno County.

Well Number	Township/Range-Section
1	13S/21E-01
2	13S/22E-33
3	13S/23E-28
4	13S/23E-32
5	14S/21E-13
7B	14S/21E-21
8	14S/21E-25
12	14S/22E-03
13	14S/22E-12
14	14S/22E-13
16	14S/22E-14
20B	14S/23E-32
21	14S/23E-33
22	14S/23E-34
23B	14S/23E-35
24	15S/21E-03
25	15S/21E-05
26	15S/21E-09
30A	15S/22E-05
32A	15S/22E-09
35	15S/22E-16
36	15S/22E-20
37	15S/22E-21
44A	15S/23E-02
45	15S/23E-12
47	15S/24E-14
50	16S/21E-05
51	16S/21E-07
52	16S/21E-16
53A	16S/21E-33
54A	16S/21E-34
56	16S/22E-11
57	16S/22E-11
89	13S/22E-33
90	15S/22E-05
92	14S/23E-33
94	15S/24E-10
95	14S/22E-33

Table 2. Well locations in Tulare County.

Well Number	Township/Range-Section
49	15S/25E-05
58	16S/23E-01
59A	16S/24E-14
61	16S/25E-28
63A	17S/25E-05
65	17S/26E-26
68	18S/26E-02
71	18S/26E-23
72	18S/27E-21
73	18S/27E-29
74	19S/26E-01
75A	19S/26E-14
80	20S/26E-24
84	20S/27E-20
86	20S/27E-32
96	17S/26E-29
100 [†]	22S/24E-02
101 [†]	20S/23E-28
102 [†]	19S/25E-10
103 [†]	20S/25E-08

[†]Wells added to the Well Network in 2023 and located outside existing GWPAs.

Analytical Methods

The California Department of Food and Agriculture's Center for Analytical Chemistry (CDFA Laboratory) analyzed samples using the Triazine Screen analytical method EMON-SM-62.9, revision 6 (CDFA, 2023a), and the Multi-Analyte Screen analytical method EMON-SM-05-032, revision 3 (CDFA, 2023b). These methods are highly specific and have been determined by DPR to provide unequivocal identification of the chemicals analyzed (Aggarwal, 2023a; 2023b). The reporting limit (RL) for each analyte ranged from 0.01 parts per billion (ppb) to 0.05 ppb ([Table 3](#) through [Table 5](#)). The Triazine Screen includes 15 analytes analyzed by Liquid Chromatography Mass Spectrometry (LC-MS/MS) ([Table 3](#)), and the Multi-Analyte Screen includes 16 analytes by Gas Chromatography Mass Spectrometry (GC-MS/MS) and 41 analytes by LC-MS/MS ([Table 4](#) and [Table 5](#)).

In 2024, groundwater samples from 58 wells were analyzed using the Triazine and Multi-Analyte Screens.

Table 3. Triazine Screen MDLs and RLs in ppb (µg/L) (EMON-SM-62.9 Rev.6, CDFA, 2023a).

Analyte	MDL	RL
ACET*	0.00185	0.02
Atrazine	0.00243	0.02
Bromacil	0.00223	0.02
Clothianidin	0.00139	0.02
DACT*	0.00209	0.02
DEA*	0.00141	0.02
Diuron	0.00169	0.02
DSMN*	0.00283	0.01
Hexazinone	0.00174	0.01
Metribuzin	0.00316	0.02
Norflurazon	0.00232	0.02
Prometon	0.00245	0.02
Prometryn	0.00251	0.02
Simazine	0.00267	0.02
Tebuthiuron	0.00182	0.02

*Acronyms are ACET = deethyl-simazine or deisopropyl-atrazine (degradate of atrazine and simazine), DACT = diaminochlorotriazine (degradate of simazine), DEA = deethyl-atrazine (degradate of atrazine), DSMN = desmethylnorflurazon (degradate of norflurazon).

Table 4. Multi-Analyte Screen MDLs and RLs in ppb (µg/L) by GC-MS/MS (EMON-SM-05-032 Rev. 3, CDFA, 2023b).

Analyte	MDL	RL
Benfluralin	0.00400	0.05
Clomazone	0.00600	0.05
Dichloran	0.00500	0.05
Dichlobenil	0.00500	0.03
Disulfoton	0.00600	0.05
EPTC*	0.00300	0.05
Ethoprophos	0.00400	0.03
Fonofos	0.00600	0.03
Malathion	0.00600	0.03
Parathion ethyl	0.00600	0.03
Parathion methyl	0.00400	0.03
Phorate	0.00400	0.03
Piperonyl butoxide	0.00400	0.03
Prometryn	0.00600	0.03
Propanil	0.00600	0.05
Triallate	0.00500	0.03

*EPTC = S-ethyl dispropylthiocarbamate.

Table 5. Multi-Analyte Screen MDLs and RLs in ppb (µg/L) by LC-MS/MS (EMON-SM-05-032 Rev. 3, CDFA, 2023b).

Analyte	MDL	RL
AIBA*	0.00700	0.02
Alachlor	0.00100	0.03
Atrazine	0.00300	0.02
Azinphos-methyl	0.00600	0.05
Azoxystrobin	0.00200	0.02
Bensulide	0.00300	0.02
Bromacil	0.00400	0.02
Carbaryl	0.00300	0.02
Carbofuran	0.00100	0.02
Chlorantraniliprole	0.00200	0.02
Cyprodinil	0.00200	0.02
Diazinon	0.00200	0.03
Dimethenamid	0.00300	0.02
Dimethoate	0.00500	0.02
Diuron	0.00200	0.02
Ethofumesate	0.00400	0.03
Fenamiphos	0.00200	0.03
Fludioxonil	0.00400	0.03
Flupyradifurone	0.00400	0.02
Flutriafol	0.00200	0.02
Imidacloprid	0.00300	0.02
Isoxaben	0.00200	0.02
Linuron	0.00200	0.02
Mefenoxam/metalaxyl**	0.00200	0.02
Methiocarb	0.00300	0.02
Metolachlor	0.00300	0.02
Methomyl	0.00500	0.02
Methoxyfenozide	0.00300	0.03
Metribuzin	0.00200	0.02
Myclobutanil	0.00400	0.02
Napropamide	0.00200	0.02
Norflurazon	0.00200	0.02
Oryzalin	0.00500	0.05
Prometon	0.00300	0.02
Propiconazole	0.00200	0.02
Pyraclostrobin	0.00200	0.02
Simazine	0.00300	0.02
Tebuthiuron	0.00200	0.02
Thiamethoxam	0.00600	0.02
Thiobencarb	0.00200	0.02
Uniconazole	0.00400	0.05

*AIBA=2-amino-N-isopropyl benzamide, mefenoxam and metalaxyl are indistinguishable stereoisomers.

RESULTS

Results in [Table 6](#) through [Table 9](#) have been entered into DPR's Well Inventory Database (DPR, 2025).

Triazine Screen

The monitoring results for the 58 wells sampled for Triazine Screen analytes are shown in [Table 6](#) and [Table 7](#). Of these, 24 wells were in leaching GWPAs, 29 in runoff GWPAs, one in a combined leaching/runoff GWPAs, and four were not in a GWPAs. Most wells (51 of 58) had detections of one or more pesticides or degradates on the Triazine Screen in the samples collected and analyzed. Excluding metribuzin and prometryn, each analyte on the screen was detected in at least one well. All detected analytes, except hexazinone and tebuthiuron, are 6800(a) pesticides or degradates on the Groundwater Protection List and are regulated in GWPAs. All four wells added to the Well Network in 2023 are located outside existing GWPAs and had detections of 6800(a) pesticides or degradates. These detections will be evaluated separately by DPR. Hexazinone was determined not to pollute at concentrations detected by DPR (Reardon, 2011).

In 2023, the Triazine Screen method was updated to include clothianidin, a neonicotinoid insecticide. As a result, clothianidin was detected in groundwater for the first time within the Well Network. These detections prompted DPR to initiate a study to conduct statewide sampling in high use areas and assess the extent of its presence (Henda and Hawkins, 2024). Additionally, the reporting limits for ACET, DACT, and metribuzin were all lowered to 0.02 ppb.

Multi-Analyte Screen

The monitoring results for the 58 wells sampled for Multi-Analyte Screen analytes are shown in [Table 8](#). The table includes quantifiable and estimated trace detections for pesticides that are unique to the Multi-Analyte Screen. Key findings include:

Analytes with Quantifiable Detections

The following six pesticides were detected at or above the RL concentrations in at least one of the wells sampled ([Table 8](#)):

- Chlorantraniliprole
- Fludioxonil
- Flutriafol
- Imidacloprid
- Mefenoxam/metalaxyl
- Methoxyfenozide

Previous detections of imidacloprid were provided as evidence for the formal review process required by the Pesticide Contamination Prevention Act (Davalos, 2022). As per sections 13149 and 13150 of the California Food and Agricultural Code of the Pesticide Contamination Prevention Act, in cases where a pesticide's active ingredient, specified ingredient, or degradation product is initially detected and confirmed in groundwater as a result of legal agricultural use, the law necessitates a formal review to assess whether the pesticide's usage can continue and, if so, under what condition. After formal review, imidacloprid was found not to pollute or threaten to pollute groundwater at concentrations detected in California (Henderson, 2022). DPR will continue to monitor for imidacloprid in groundwater.

Several pesticides detected in the Well Network are being evaluated through ongoing studies:

- Chlorantraniliprole, flutriafol, and methoxyfenozide: Their detection in 2021 prompted ongoing statewide sampling for the three analytes in high use areas (Afyuni and Nordmark, 2022), as well as the decision to analyze all wells in the Well Network with the Multi-Analyte Screen in 2022.
- Fludioxonil: Currently under investigation as part of a separate study (Kocis, 2020).
- Mefenoxam/metalaxyl: Evaluated in a small-scale study (Hawkins, 2025).

Analytes with Trace Detections

The following three pesticides were detected at trace levels in at least one of the wells sampled ([Table 8](#)):

- Azoxystrobin
- Dichloran
- Thiamethoxam

Analytes Not Detected

The following 41 analytes were not detected in any of the samples collected:

AIBA (2-amino-N-isopropyl benzamide), alachlor, azinphos-methyl, benfluralin, bensulide, carbaryl, carbofuran, clomazone, cyprodinil, diazinon, dichlobenil, dimethenamid, dimethoate, disulfoton, EPTC (S-ethyl dispropylthiocarbamate), ethofumesate, ethoprophos, fenamiphos, flupyradifurone, fonofos, isoxaben, linuron, malathion, methiocarb, methomyl, metribuzin, metolachlor, myclobutanil, napropamide, oryzalin, parathion ethyl, parathion methyl, phorate, piperonyl butoxide, prometryn, propanil, propiconazole, pyraclostrobin, thiobencarb, triallate, and uniconazole.

Replicate Analyses in Both Triazine and Multi-Analyte Screens

A comparison of results from common analytes between the Triazine and Multi-Analyte Screens are shown in [Table 9](#). The common analytes are atrazine, bromacil, diuron, norflurazon, prometon, simazine, and tebuthiuron. Overall, the results are generally similar between the two analytical methods. Approximately 67% of comparisons were non-detect (ND) in both methods, and most analytes detected in one method were also detected in the other. This indicates good overall agreement between the Multi-Analyte and Triazine screens. Minor differences were observed, especially at lower concentrations near the method detection limit (MDL), where one method identifies trace concentrations while the other reports ND, reflecting differences in analytical sensitivity.

Summary of Previous Years' Monitoring Results

Triazine Screen

Triazine Screen results from 1999 through 2024 are presented in [Table 10](#) and [Table 11](#) as the percent of wells with detections above the RL and the means of those detections. In 2023, the reporting limits for ACET, DACT, and metribuzin were revised lower to 0.02 ppb, and this change is still in use. The lower reporting limits contributed to lower mean concentrations observed for ACET and DACT (see [Table 11](#)). A comprehensive report similar to Troiano, et al. (2013) that evaluates long-term trends was recently completed (Ruud, 2026).

Multi-Analyte Screen

An overview of the Multi-Analyte Screen detections from 2014 through 2024 is presented in [Table 12](#), not including analytes reported on the Triazine Screen. The Multi-Analyte Screen method has been updated in recent years to add new analytes. Results vary year-to-year depending on the version of the method used and the number of wells analyzed using this method.

Results Tables

Table 6. Triazine Screen sampling results from 2024 (part 1). Concentrations in ppb (µg/L). Concentrations at or above the reporting limit are bold. Trace detections are noted with “Trace” with the estimated concentration in parenthesis.

Well Number	ACET	Atrazine	Bromacil	Clothianidin	DACT	DEA	Diuron	DSMN
1	Trace (0.0199)	ND	ND	ND	0.0969	ND	ND	ND
2	Trace (0.0198)	ND	ND	ND	Trace (0.0195)	ND	Trace (0.00454)	Trace (0.00317)
3	0.0403	ND	ND	0.207	0.0491	ND	ND	ND
4	0.163	0.0301	0.419	Trace (0.00158)	0.611	0.0206	Trace (0.0155)	0.179
5	0.171	ND	ND	Trace (0.00273)	0.533	Trace (0.00556)	ND	0.210
7B	0.0459	ND	Trace (0.00985)	ND	0.190	Trace (0.00419)	Trace (0.00791)	ND
8	0.124	Trace (0.00753)	Trace (0.0171)	ND	0.226	0.0261	0.0244	Trace (0.00995)
12	0.131	ND	0.214	ND	0.211	ND	0.0208	Trace (0.00465)
13	0.0840	ND	0.0760	ND	0.331	Trace (0.00218)	0.0204	0.0922
14	ND	ND	ND	ND	ND	ND	ND	ND
16	0.0898	ND	0.0314	ND	0.163	ND	Trace (0.0142)	0.121
20B	Trace (0.00237)	ND	ND	0.103	ND	ND	ND	ND
21	ND	ND	ND	ND	ND	ND	ND	ND
22	0.101	ND	ND	ND	0.266	ND	ND	0.0595
23B	0.204	ND	0.466	ND	0.453	Trace (0.00221)	0.0329	0.0617
24	ND	ND	ND	Trace (0.00474)	ND	ND	ND	0.0496
25	0.0268	ND	ND	ND	0.0224	ND	ND	0.0365
26	0.0845	ND	ND	0.102	0.143	ND	ND	0.0498
30A	0.126	ND	ND	ND	0.188	Trace (0.00397)	Trace (0.0154)	0.0524
32A	Trace (0.00698)	ND	ND	ND	Trace (0.0130)	ND	ND	ND
35	0.0650	ND	ND	ND	0.144	ND	Trace (0.0125)	0.0905
36	Trace (0.00243)	ND	ND	ND	Trace (0.00580)	ND	ND	ND
37	ND	ND	ND	ND	ND	ND	ND	ND
44A	0.0537	ND	Trace (0.0102)	ND	0.108	ND	Trace (0.0119)	0.0157
45	Trace (0.0109)	ND	ND	ND	Trace (0.0180)	Trace (0.00254)	Trace (0.0113)	Trace (0.00735)
47	0.321	Trace (0.00501)	ND	ND	1.19	0.0273	Trace (0.00968)	0.0146
49	0.293	ND	ND	ND	3.50	Trace (0.00531)	ND	0.169
50	ND	ND	ND	ND	ND	ND	ND	ND

Well Number	ACET	Atrazine	Bromacil	Clothianidin	DACT	DEA	Diuron	DSMN
51	0.0257	ND	ND	ND	0.0856	ND	ND	0.0115
52	0.0421	ND	ND	ND	0.0778	ND	ND	ND
53A	ND	ND	ND	ND	ND	ND	ND	ND
54A	Trace (0.0131)	ND	ND	ND	0.0336	ND	ND	Trace (0.00545)
56	0.213	ND	ND	ND	0.863	Trace (0.00164)	ND	ND
57	0.0909	ND	ND	ND	0.246	ND	ND	0.0153
58	Trace (0.00643)	ND	ND	ND	ND	ND	ND	ND
59A	0.212	Trace (0.00348)	0.706	ND	0.692	Trace (0.00775)	0.0296	1.66
61	0.134	ND	0.0325	ND	0.959	Trace (0.00942)	Trace (0.00361)	0.0343
63A	Trace (0.00844)	Trace (0.00720)	ND	ND	0.0305	Trace (0.00986)	Trace (0.00707)	ND
65	Trace (0.00694)	ND	ND	ND	Trace (0.00725)	ND	ND	ND
68	ND	ND	ND	ND	ND	ND	ND	ND
71	0.247	ND	0.145	ND	0.847	ND	Trace (0.0170)	0.465
72	0.517	ND	Trace (0.00701)	ND	1.41	Trace (0.0124)	Trace (0.00958)	0.0358
73	0.110	ND	ND	Trace (0.00679)	0.887	0.0215	ND	0.0483
74	0.509	ND	0.408	ND	1.03	Trace (0.0133)	0.0264	0.0349
75A	0.592	ND	0.509	ND	1.36	Trace (0.00508)	0.0252	0.0358
80	0.173	ND	0.0967	ND	0.608	ND	Trace (0.0121)	0.0127
84	Trace (0.0164)	ND	0.0269	ND	0.0539	ND	ND	ND
86	0.538	ND	ND	ND	2.93	0.0251	ND	ND
89	0.0329	ND	Trace (0.00948)	ND	0.0667	ND	Trace (0.0157)	0.0670
90	0.101	0.0306	Trace (0.00955)	ND	0.142	0.0887	Trace (0.0187)	0.0111
92	0.236	ND	ND	ND	0.275	Trace (0.00226)	0.0406	0.133
94	0.330	ND	ND	Trace (0.0135)	3.43	Trace (0.00249)	ND	0.403
95	ND	ND	ND	ND	ND	ND	ND	ND
96	0.293	ND	0.213	ND	1.99	Trace (0.00357)	Trace (0.0172)	0.0208
100	Trace (0.00750)	Trace (0.00468)	ND	ND	Trace (0.0111)	Trace (0.0121)	Trace (0.0177)	ND
101	0.267	ND	ND	Trace (0.00321)	1.83	Trace (0.00222)	Trace (0.0163)	ND
102	0.0352	ND	ND	ND	0.0299	Trace (0.00751)	ND	ND
103	Trace (0.0119)	ND	ND	0.0381	0.0393	ND	Trace (0.00413)	0.0192

ND = not detected (below the method detection limit listed in [Table 3](#)).

Table 7. Triazine Screen sampling results from 2024 (part 2). Concentrations in ppb (µg/L). Concentrations at or above the reporting limit are bold. Trace detections are noted with “Trace” with the estimated concentration in parenthesis. Propazine was added as a surrogate and is reported as % recovery.

Well Number	Hexazinone	Metribuzin	Norflurazon	Prometon	Prometryn	Simazine	Tebuthiuron	Propazine %*
1	ND	ND	ND	ND	ND	ND	ND	63.5
2	ND	ND	ND	ND	ND	Trace (0.0106)	ND	54.0
3	ND	ND	ND	ND	ND	0.0338	ND	47.2
4	ND	ND	0.129	Trace (0.00737)	ND	0.0361	ND	54.0
5	ND	ND	Trace (0.00468)	ND	ND	0.0627	ND	67.0
7B	Trace (0.00219)	ND	ND	ND	ND	Trace (0.00797)	ND	57.5
8	ND	ND	ND	ND	ND	0.0563	ND	63.5
12	ND	ND	ND	ND	ND	Trace (0.00868)	ND	64.0
13	ND	ND	0.0585	ND	ND	Trace (0.0171)	ND	66.0
14	ND	ND	ND	ND	ND	ND	ND	62.5
16	ND	ND	0.0386	ND	ND	0.0334	ND	51.0
20B	ND	ND	ND	ND	ND	ND	ND	43.7
21	ND	ND	ND	ND	ND	ND	ND	47.5
22	ND	ND	ND	ND	ND	0.0515	ND	58.0
23B	ND	ND	Trace (0.00752)	ND	ND	0.0346	ND	52.5
24	ND	ND	Trace (0.00477)	ND	ND	ND	ND	58.0
25	ND	ND	ND	ND	ND	0.0235	ND	64.5
26	ND	ND	ND	ND	ND	0.0237	ND	44.7
30A	ND	ND	0.0453	ND	ND	0.0449	ND	60.0
32A	ND	ND	ND	ND	ND	ND	ND	70.0
35	ND	ND	Trace (0.0188)	Trace (0.00263)	ND	0.0350	ND	51.5
36	ND	ND	ND	ND	ND	Trace (0.00658)	ND	61.5
37	ND	ND	ND	ND	ND	ND	ND	48.5
44A	ND	ND	Trace (0.00233)	ND	ND	0.0232	ND	61.0
45	ND	ND	ND	ND	ND	Trace (0.00368)	ND	53.0
47	Trace (0.00209)	ND	ND	ND	ND	Trace (0.0186)	ND	57.5
49	ND	ND	Trace (0.0141)	ND	ND	0.0319	ND	47.7
50	ND	ND	ND	ND	ND	ND	ND	50.5
51	ND	ND	ND	ND	ND	Trace (0.0138)	ND	60.5
52	ND	ND	ND	ND	ND	Trace (0.00634)	ND	64.5
53A	ND	ND	ND	ND	ND	ND	ND	64.5
54A	ND	ND	ND	ND	ND	ND	ND	64.0

Well Number	Hexazinone	Metribuzin	Norflurazon	Prometon	Prometryn	Simazine	Tebuthiuron	Propazine %*
56	ND	ND	ND	ND	ND	0.0555	ND	55.5
57	ND	ND	ND	ND	ND	0.0280	ND	66.0
58	ND	ND	ND	ND	ND	Trace (0.0141)	ND	59.0
59A	ND	ND	0.378	ND	ND	Trace (0.0122)	ND	69.5
61	ND	ND	ND	ND	ND	0.0306	ND	57.0
63A	ND	ND	ND	ND	ND	ND	ND	63.0
65	ND	ND	ND	ND	ND	Trace (0.00392)	Trace (0.00308)	53.5
68	ND	ND	ND	ND	ND	ND	ND	59.5
71	ND	ND	0.0830	ND	ND	0.0390	ND	57.0
72	ND	ND	0.0274	ND	ND	0.0476	ND	59.0
73	ND	ND	ND	ND	ND	Trace (0.00502)	ND	62.0
74	ND	ND	0.0466	ND	ND	0.0432	ND	57.5
75A	ND	ND	0.0243	ND	ND	0.0422	ND	56.0
80	ND	ND	ND	ND	ND	Trace (0.00811)	ND	63.5
84	ND	ND	ND	ND	ND	ND	ND	63.5
86	ND	ND	ND	ND	ND	0.0271	ND	61.0
89	ND	ND	Trace (0.00813)	ND	ND	0.0237	ND	52.0
90	0.0250	ND	Trace (0.00948)	ND	ND	0.0454	Trace (0.0143)	61.0
92	ND	ND	0.0500	ND	ND	0.0390	ND	68.0
94	ND	ND	0.0730	ND	ND	0.0225	ND	67.5
95	ND	ND	ND	ND	ND	ND	ND	67.0
96	ND	ND	Trace (0.0192)	ND	ND	Trace (0.0130)	ND	60.0
100	ND	ND	ND	ND	ND	ND	ND	58.0
101	ND	ND	ND	ND	ND	Trace (0.00985)	ND	63.5
102	ND	ND	ND	ND	ND	Trace (0.0168)	ND	62.0
103	ND	ND	Trace (0.00349)	ND	ND	Trace (0.0140)	ND	58.0

ND = not detected (below the method detection limit listed in [Table 3](#)).

*Propazine was added as a surrogate for QA/QC purposes.

Table 8. Sampling results for 2024 of the nine analytes with detections in at least one well that are unique to the Multi-Analyte Screen (CDFA, 2023b). Concentrations in ppb (µg/L). Forty-one analytes were not detected in any well and are not shown in this table. Concentrations at or above the reporting limit are bolded. Trace detections are noted with “Trace” with the estimated concentration in parenthesis.

Well Number	Analytes Unique to the Multi-Analyte Screen with Detections in at Least One Well								
	Azoxystrobin	Chlorantraniliprole	Dichloran*	Fludioxonil	Flutriafol	Imidacloprid	Mefenoxam/Metalaxyl	Methoxyfenozide	Thiamethoxam
1	ND	ND	ND	ND	ND	ND	ND	ND	ND
2	ND	Trace (0.00386)	ND	ND	ND	Trace (0.0124)	ND	Trace (0.0119)	ND
3	ND	ND	ND	ND	ND	ND	ND	ND	Trace (0.0139)**
4	ND	ND	ND	ND	ND	Trace (0.00470)	ND	ND	ND
5	ND	ND	ND	ND	ND	0.0570	ND	ND	ND
7B	ND	ND	ND	ND	ND	ND	ND	ND	ND
8	ND	ND	Trace (0.0110)	ND	ND	ND	ND	ND	ND
12	ND	ND	ND	ND	ND	ND	ND	ND	ND
13	ND	ND	ND	ND	ND	ND	ND	ND	ND
14	ND	Trace (0.00321)	ND	ND	ND	ND	ND	ND	ND
16	ND	ND	ND	ND	ND	0.0273**	ND	ND	ND
20B	ND	0.196**	ND	ND	ND	0.108	ND	Trace (0.0158)	ND
21	ND	0.0286**	ND	ND	Trace (0.00717)**	ND	ND	Trace (0.0214)**	ND
22	ND	0.252**	ND	ND	0.106**	Trace (0.00530)**	ND	0.301**	ND
23B	ND	ND	ND	ND	ND	0.0345**	Trace (0.00608)**	ND	ND
24	ND	ND	ND	ND	ND	0.0262	ND	ND	ND
25	ND	ND	ND	ND	ND	Trace (0.00345)	ND	ND	ND
26	ND	ND	ND	ND	ND	0.0216	ND	ND	ND
30A	ND	ND	ND	0.568**	ND	ND	ND	0.106	ND

Well Number	Analytes Unique to the Multi-Analyte Screen with Detections in at Least One Well								
	Azoxystrobin	Chlorantran iliprole	Dichloran*	Fludioxonil	Flutriafol	Imidacloprid	Mefenoxam/ Metalaxyl	Methoxyfenozide	Thiamethoxam
32A	ND	ND	ND	ND	ND	ND	ND	ND	ND
35	ND	ND	ND	ND	ND	ND	ND	ND	ND
36	ND	ND	ND	ND	ND	ND	Trace (0.00786)**	ND	ND
37	ND	ND	ND	ND	ND	ND	ND	ND	ND
44A	ND	ND	ND	ND	ND	ND	ND	ND	ND
45	ND	ND	ND	ND	ND	0.0460**	ND	ND	ND
47	ND	ND	ND	ND	ND	ND	ND	ND	ND
49	ND	ND	ND	ND	ND	0.0220**	ND	Trace (0.00669)**	ND
50	ND	ND	ND	ND	ND	ND	ND	Trace (0.0132)**	ND
51	ND	ND	ND	ND	ND	ND	ND	ND	ND
52	ND	ND	ND	ND	ND	ND	ND	ND	ND
53A	ND	ND	ND	ND	ND	ND	ND	ND	ND
54A	Trace (0.00659)**	ND	ND	ND	ND	ND	ND	ND	ND
56	ND	ND	ND	ND	ND	ND	ND	ND	ND
57	ND	ND	ND	ND	ND	ND	ND	ND	ND
58	ND	Trace (0.00366)	ND	ND	ND	ND	ND	Trace (0.0104)	ND
59A	ND	ND	ND	ND	ND	ND	ND	ND	ND
61	ND	ND	ND	ND	ND	ND	ND	ND	ND
63A	ND	ND	ND	ND	ND	ND	ND	ND	ND
65	ND	Trace (0.00532)	ND	ND	ND	ND	ND	Trace (0.0113)	ND
68	ND	ND	ND	ND	ND	ND	ND	Trace (0.0116)**	ND
71	ND	ND	ND	ND	ND	ND	ND	ND	ND
72	ND	ND	ND	ND	ND	ND	ND	ND	ND
73	ND	Trace (0.00766)**	ND	ND	ND	Trace (0.00875)**	ND	Trace (0.00576)**	ND

Well Number	Analytes Unique to the Multi-Analyte Screen with Detections in at Least One Well								
	Azoxystrobin	Chlorantraniliprole	Dichloran*	Fludioxonil	Flutriafol	Imidacloprid	Mefenoxam/Metalaxyl	Methoxyfenozide	Thiamethoxam
74	ND	ND	ND	ND	ND	ND	ND	ND	ND
75A	ND	ND	ND	ND	ND	ND	ND	ND	ND
80	ND	ND	ND	ND	ND	ND	ND	ND	ND
84	ND	ND	ND	ND	ND	ND	ND	ND	ND
86	ND	ND	ND	ND	ND	ND	ND	ND	ND
89	ND	ND	ND	ND	ND	ND	ND	ND	ND
90	ND	ND	ND	ND	ND	ND	ND	ND	ND
92	ND	ND	ND	ND	ND	ND	ND	ND	ND
94	ND	ND	ND	ND	ND	ND	ND	ND	ND
95	ND	ND	ND	ND	ND	Trace (0.00670)	ND	ND	ND
96	ND	ND	ND	ND	ND	ND	0.146	ND	ND
100	ND	ND	ND	ND	ND	ND	ND	ND	ND
101	ND	ND	ND	ND	ND	ND	ND	ND	ND
102	ND	ND	ND	ND	ND	ND	ND	ND	ND
103	ND	ND	ND	ND	ND	ND	ND	ND	ND

ND = not detected (below the method detection limit listed in [Table 4](#) and [Table 5](#)).

*Dichloran trace detection in Well 8 is suspected to be due to laboratory contamination. The sample was also impacted by a refrigerator issue at the CDFA laboratory.

**Replicate sample is reported because it was higher.

Table 9. Comparison of 2024 results for replicate analyses in the Multi-Analyte and Triazine Screens. Concentrations in ppb (µg/L). The table includes results for the seven analytes detected out of the nine analytes analyzed in both methods.

Well Number	Analytes in Both the Multi-Analyte and Triazine Screens*													
	Atrazine		Bromacil		Diuron		Norflurazon		Prometon		Simazine		Tebuthiuron	
	Multi-Analyte	Triazine	Multi-Analyte	Triazine	Multi-Analyte	Triazine	Multi-Analyte	Triazine	Multi-Analyte	Triazine	Multi-Analyte	Triazine	Multi-Analyte	Triazine
1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2	ND	ND	ND	ND	Trace (0.00746)	Trace (0.00454)	Trace (0.00232)	ND	ND	ND	0.0243	Trace (0.0106)	ND	ND
3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0746**	0.0338	ND	ND
4	0.0582	0.0301	0.536	0.419	0.0232	Trace (0.0155)	0.188	0.129	Trace (0.0136)	Trace (0.00737)	0.0689	0.0361	ND	ND
5	ND	ND	ND	ND	Trace (0.00248)	ND	Trace (0.00782)	Trace (0.00468)	ND	ND	0.106	0.0627	ND	ND
7B	ND	ND	Trace (0.0121)	Trace (0.00985)	Trace (0.0111)	Trace (0.00791)	ND	ND	ND	ND	Trace (0.0148)	Trace (0.00797)	ND	ND
8	Trace (0.0129)	Trace (0.00753)	0.0249	Trace (0.0171)	0.0381	0.0244	ND	ND	ND	ND	0.108	0.0563	ND	ND
12	ND	ND	0.173	0.214	Trace (0.0175)	0.0208	ND	ND	ND	ND	Trace (0.00884)	Trace (0.00868)	ND	ND
13	ND	ND	0.116	0.0760	0.0306	0.0204	0.0892	0.0585	ND	ND	0.0294	Trace (0.0171)	ND	ND
14	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
16	ND	ND	0.0392**	0.0314	0.0214	Trace (0.0142)	0.0587**	0.0386	ND	ND	0.0687**	0.0334	ND	ND
20B	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
21	ND	ND	ND	ND	Trace (0.00611)**	ND	ND	ND	ND	ND	ND	ND	ND	ND
22	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0923**	0.0515	ND	ND
23B	ND	ND	0.723**	0.466	0.0531**	0.0329	Trace (0.0137)**	Trace (0.00752)	ND	ND	0.0707**	0.0346	ND	ND
24	ND	ND	ND	ND	ND	ND	Trace (0.00847)**	Trace (0.00477)	ND	ND	ND	ND	ND	ND
25	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0352**	0.0235	ND	ND
26	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0544**	0.0237	ND	ND

Well Number	Analytes in Both the Multi-Analyte and Triazine Screens*													
	Atrazine		Bromacil		Diuron		Norflurazon		Prometon		Simazine		Tebuthiuron	
	Multi-Analyte	Triazine	Multi-Analyte	Triazine	Multi-Analyte	Triazine	Multi-Analyte	Triazine	Multi-Analyte	Triazine	Multi-Analyte	Triazine	Multi-Analyte	Triazine
30A	ND	ND	ND	ND	0.0262	Trace (0.0154)	0.0720**	0.0453	ND	ND	0.0747**	0.0449	ND	ND
32A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
35	ND	ND	ND	ND	0.0204**	Trace (0.0125)	0.0300**	Trace (0.0188)	ND	Trace (0.00263)	0.0704**	0.0350	ND	ND
36	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	Trace (0.0145)**	Trace (0.00658)	ND	ND
37	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	Trace (0.00656)**	ND	ND	ND
44A	ND	ND	Trace (0.0154)	Trace (0.0102)	Trace (0.0182)	Trace (0.0119)	Trace (0.00383)	Trace (0.00233)	ND	ND	0.0432	0.0232	ND	ND
45	ND	ND	ND	ND	Trace (0.0152)	Trace (0.0113)	ND	ND	ND	ND	Trace (0.00736)**	Trace (0.00368)	ND	ND
47	Trace (0.00819)	Trace (0.00501)	0.0266	ND	Trace (0.0141)	Trace (0.00968)	Trace (0.00211)	ND	ND	ND	0.0321	Trace (0.0186)	ND	ND
49	ND	ND	ND	ND	ND	ND	0.0257**	Trace (0.0141)	ND	ND	0.0661**	0.0319	ND	ND
50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
51	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0224	Trace (0.0138)	ND	ND
52	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	Trace (0.0137)**	Trace (0.00634)	ND	ND
53A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
54A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	Trace (0.00673)**	ND	ND	ND
56	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0982	0.0555	ND	ND
57	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0523	0.0280	ND	ND
58	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0263	Trace (0.0141)	ND	ND
59A	Trace (0.00556)	Trace (0.00348)	1.07	0.706	0.0495	0.0296	0.684	0.378	ND	ND	0.0220	Trace (0.0122)	ND	ND

Well Number	Analytes in Both the Multi-Analyte and Triazine Screens*													
	Atrazine		Bromacil		Diuron		Norflurazon		Prometon		Simazine		Tebuthiuron	
	Multi-Analyte	Triazine	Multi-Analyte	Triazine	Multi-Analyte	Triazine	Multi-Analyte	Triazine	Multi-Analyte	Triazine	Multi-Analyte	Triazine	Multi-Analyte	Triazine
61	ND	ND	0.0457	0.0325	Trace (0.00536)	Trace (0.00361)	Trace (0.00231)	ND	ND	ND	0.0457	0.0306	ND	ND
63A	Trace (0.0107)	Trace (0.00720)	ND	ND	Trace (0.0100)	Trace (0.00707)	ND	ND	ND	ND	ND	ND	ND	ND
65	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	Trace (0.00798)	Trace (0.00392)	Trace (0.00535)	Trace (0.00308)
68	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
71	ND	ND	0.187	0.145	0.0251	Trace (0.0170)	0.112	0.0830	ND	ND	0.0657	0.0390	ND	ND
72	ND	ND	Trace (0.00838)**	Trace (0.00701)	Trace (0.0131)**	Trace (0.00958)	0.0425	0.0274	ND	ND	0.0868	0.0476	ND	ND
73	ND	ND	ND	ND	Trace (0.00568)**	ND	ND	ND	ND	ND	Trace (0.00871)**	Trace (0.00502)	ND	ND
74	ND	ND	0.594**	0.408	0.0429	0.0264	0.0716	0.0466	ND	ND	0.0816**	0.0432	ND	ND
75A	ND	ND	0.657	0.509	0.0368	0.0252	0.0363	0.0243	ND	ND	0.0736	0.0422	ND	ND
80	ND	ND	0.131	0.0967	Trace (0.0174)	Trace (0.0121)	ND	ND	ND	ND	Trace (0.0128)	Trace (0.00811)	ND	ND
84	ND	ND	0.0354	0.0269	ND	ND	ND	ND	ND	ND	Trace (0.00685)	ND	ND	ND
86	Trace (0.00616)**	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0502	0.0271	ND	ND
89	ND	ND	Trace (0.0135)**	Trace (0.00948)	0.0236**	Trace (0.0157)	Trace (0.0135)**	Trace (0.00813)	ND	ND	0.0466**	0.0237	ND	ND
90	0.0477**	0.0306	Trace (0.0140)**	Trace (0.00955)	0.0276**	Trace (0.0187)	Trace (0.0158)**	Trace (0.00948)	ND	ND	0.0730	0.0454	0.0240**	Trace (0.0143)
92	ND	ND	ND	ND	0.0560**	0.0406	0.0696**	0.0500	ND	ND	0.0593**	0.0390	ND	ND
94	ND	ND	ND	ND	ND	ND	0.107	0.0730	ND	ND	0.0352	0.0225	ND	ND
95	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
96	ND	ND	0.323	0.213	0.0256	Trace (0.0172)	0.0276	Trace (0.0192)	ND	ND	0.0230	Trace (0.0130)	ND	ND
100	Trace (0.00803)	Trace (0.00468)	ND	ND	0.0262	Trace (0.0177)	ND	ND	ND	ND	ND	ND	ND	ND

Well Number	Analytes in Both the Multi-Analyte and Triazine Screens*													
	Atrazine		Bromacil		Diuron		Norflurazon		Prometon		Simazine		Tebuthiuron	
	Multi-Analyte	Triazine	Multi-Analyte	Triazine	Multi-Analyte	Triazine	Multi-Analyte	Triazine	Multi-Analyte	Triazine	Multi-Analyte	Triazine	Multi-Analyte	Triazine
101	ND	ND	ND	ND	0.0238	Trace (0.0163)	ND	ND	ND	ND	Trace (0.0175)	Trace (0.00985)	ND	ND
102	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0246	Trace (0.0168)	ND	ND
103	ND	ND	ND	ND	Trace (0.00722)	Trace (0.00413)	Trace (0.00620)	Trace (0.00349)	ND	ND	0.0290	Trace (0.0140)	ND	ND

ND = not detected (below the method detection limit listed in [Table 3](#) through [Table 5](#)).

*The following two analytes were duplicated in both screens but were not detected in any of the samples: metribuzin, prometryn.

**Replicate sample is reported because it was higher.

Table 10. Yearly percent (%) of wells with detections above the reporting limit (RL) for each analyte detected on the Triazine Screen.

Year	ACET	Atrazine	Bromacil	Clothianidin	DACT	DEA	Diuron	DSMN	Hexazinone	Norflurazon	Prometon	Simazine
1999	94.7	5.3	40	-	85.3	8	60	-	0	17.3	1.3	86.7
2000	89.2	4.1	37.8	-	89.2	4.1	50	-	1	17.6	1.4	82.4
2001	94.4	4.2	39.4	-	85.9	8.5	59.2	-	1.4	22.5	1.4	85.9
2002	94.3	4.3	38.6	-	88.6	12.9	64.3	-	0	15.7	1.4	92.9
2003	88.9	4.2	40.3	-	86.1	9.7	61.1	-	0	20.8	1.4	86.1
2004	86.8	4.4	33.8	-	85.3	8.8	57.4	44.1	0	25	1.5	80.9
2005	88.2	4.4	33.8	-	75	5.9	54.4	45.6	0	23.5	1.5	70.6
2006	83.3	4.5	37.9	-	83.3	7.6	51.5	44	0	22.7	1.5	72.7
2007	85.5	2.9	31.9	-	85.5	5.8	46.4	44.9	0	29	1.4	76.8
2008	85.3	4.4	33.8	-	85.3	5.9	50	44	0	20.6	1.5	69.1
2009	88.2	2.9	30.9	-	85.3	4.4	45.6	47.1	0	20.6	1.5	60.3
2010	80.9	2.9	29.4	-	85.3	4.4	38.2	50	1.5	27.9	1.5	63.2
2011	76.5	4.4	30.9	-	79.4	5.9	32.4	52.9	1.5	27.9	0	55.9
2012	82.4	2.9	25	-	80.9	4.4	36.8	50	0	27.9	0	58.8
2013	76.1	1.5	26.9	-	83.6	6	13.4	41.8	0	20.9	0	58.2
2014	75	3.1	31.3	-	79.7	6.3	15.6	45.3	1.6	21.9	1.6	57.8
2015	76.2	1.6	23.8	-	84.1	3.2	9.5	34.9	0	19	1.6	49.2
2016	78.7	1.6	26.2	-	82	3.3	16.4	41	0	21.3	1.6	50.8
2017	60.7	1.6	23	-	70.5	1.6	6.6	36.1	0	21.3	0	39.3
2018	57.4	1.6	23	-	65.6	4.9	4.9	36.1	0	21.3	0	36.1
2019	61.7	1.7	20	-	63.3	1.7	1.7	35	0	13.3	0	31.7
2020	59.3	1.7	22	-	67.8	3.4	6.8	35.6	0	16.9	0	39
2021*	61.7	1.7	23.3	-	65.0	8.3	28.3	60.0	3.3	26.7	1.7	63.3
2022	69.5	3.4	30.5	-	69.5	15.3	33.9	61.0	1.7	28.8	1.7	66.1
2023	68.9	1.6	23.0	4.9	77.0	8.2	19.7	62.3	1.6	23.0	0	55.7
2024	63.8	3.4	22.4	6.9	72.4	10.3	13.8	51.7	1.7	19.0	0	43.1
Mean	78.0	3.1	30.0	5.9	79.3	6.5	33.8	45.9	0.6	22.0	1.0	62.8
SD	11.8	1.2	6.5	1.4	8.0	3.2	20.7	8.4	0.9	4.2	0.7	17.2

[-] = Not analyzed because the well was not available for sampling, the analyte was not part of the method at the time of sampling, or the method was not used to analyze samples from the well. DSMN was first included in the analysis in 2004. Metribuzin and prometryn were included in 2021 but were not detected. Clothianidin was added to the Triazine Screen in 2023.

*Higher number of detections beginning in 2021 was due to the lower RLs for the analytical methods.

Table 11. Yearly mean concentrations above the reporting limit (RL) in ppb (µg/L) for each analyte detected on the Triazine Screen.

Year	ACET	Atrazine	Bromacil	Clothianidin	DACT	DEA	Diuron	DSMN	Hexazinone	Norflurazon	Prometon	Simazine
1999	0.48	0.08	0.96	-	0.82	0.11	0.35	-	ND	0.16	0.07	0.13
2000	0.47	0.08	1.31	-	0.75	0.13	0.35	-	0.07	0.14	0.06	0.11
2001	0.5	0.1	1.12	-	0.97	0.13	0.33	-	0.05	0.11	0.1	0.12
2002	0.58	0.08	0.85	-	1.08	0.09	0.31	-	ND	0.28	0.09	0.13
2003	0.55	0.11	0.99	-	0.89	0.12	0.31	-	ND	0.18	0.08	0.14
2004	0.5	0.12	1.12	-	0.85	0.15	0.28	0.22	ND	0.21	0.09	0.10
2005	0.38	0.1	0.95	-	0.66	0.17	0.25	0.25	ND	0.24	0.09	0.10
2006	0.42	0.09	0.88	-	0.82	0.13	0.28	0.27	ND	0.23	0.06	0.10
2007	0.40	0.07	0.85	-	0.80	0.1	0.26	0.26	ND	0.13	0.06	0.10
2008	0.38	0.07	0.81	-	0.68	0.1	0.21	0.25	ND	0.24	0.07	0.09
2009	0.39	0.07	0.79	-	0.67	0.12	0.2	0.23	ND	0.21	0.06	0.09
2010	0.41	0.11	0.83	-	0.70	0.15	0.17	0.27	0.05	0.19	0.09	0.10
2011	0.4	0.09	0.82	-	0.71	0.15	0.12	0.23	0.07	0.19	ND	0.09
2012	0.39	0.09	0.65	-	0.82	0.12	0.1	0.24	ND	0.19	ND	0.09
2013	0.39	0.08	0.82	-	0.75	0.08	0.13	0.25	ND	0.19	ND	0.09
2014	0.35	0.1	0.67	-	0.68	0.06	0.13	0.26	ND	0.2	0.1	0.08
2015	0.32	0.06	0.64	-	0.69	0.12	0.13	0.22	ND	0.19	0.11	0.08
2016	0.36	0.08	0.71	-	0.90	0.14	0.07	0.24	ND	0.18	0.09	0.08
2017	0.24	0.07	0.83	-	0.85	0.12	0.06	0.19	ND	0.11	ND	0.07
2018	0.28	0.08	0.59	-	0.87	0.09	0.08	0.24	ND	0.13	ND	0.07
2019	0.25	0.08	0.38	-	0.72	0.16	0.08	0.19	ND	0.13	ND	0.07
2020	0.24	0.09	1.24	-	0.77	0.1	0.07	0.24	ND	0.15	ND	0.07
2021	0.24	0.06	0.53	-	0.76	0.05	0.03	0.18	0.03	0.13	0.07	0.05
2022	0.25	0.04	0.58	-	0.73	0.04	0.03	0.19	0.04	0.13	0.03	0.05
2023	0.18*	0.04	0.45	0.16	0.58*	0.04	0.03	0.16	0.04	0.10	ND	0.05
2024	0.18	0.03	0.26	0.11	0.67	0.03	0.03	0.14	0.03	0.09	ND	0.04
Mean	0.37	0.08	0.79	0.14	0.78	0.11	0.17	0.22	0.05	0.17	0.08	0.09
SD	0.11	0.02	0.25	0.04	0.11	0.04	0.11	0.04	0.015	0.05	0.02	0.03

[-] = Not analyzed because the well was not available for sampling, the analyte was not part of the method at the time of sampling, or the method was not used to analyze samples from the well. DSMN was first included in the analysis in 2004. Clothianidin was added to the Triazine Screen in 2023.

*Lower mean concentrations for ACET and DACT were due to lower reporting limits for both analytes in 2023.

Table 12. Summary of wells with Multi-Analyte Screen detections (other than Triazine Screen analytes) from 2014 through 2024. Concentrations in ppb (µg/L).

Well #	Township/ Range-Section	Analyte	Sample Year										
			2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
8	14S/21E-03	Azoxystrobin	ND	ND	ND	ND	ND	ND	-	-	ND	0.0318	ND
54A	16S/21E-34	Azoxystrobin	-	-	-	-	-	-	-	-	-	-	Trace
2	13S/22E-33	Imidacloprid	ND	ND	ND	ND	Trace	Trace	ND	0.024**	Trace	Trace	Trace
3	13S/23E-28	Imidacloprid	ND	ND	ND	ND	ND	ND	-	-	Trace	Trace	ND
4	13S/23E-32	Imidacloprid	ND	ND	ND	Trace	ND	ND	-	-	Trace	Trace	Trace
5	14S/21E-13	Imidacloprid	ND	ND	ND	Trace	Trace	Trace	ND	Trace	0.0699	0.0412***	0.0570
7	14S/21E-21	Imidacloprid	ND	ND	ND	ND	ND	ND	-	-	ND	0.0229	-
13	14S/22E-12	Imidacloprid	ND	ND	ND	ND	ND	ND	-	-	Trace	Trace	ND
15	14S/22E-14	Imidacloprid	ND	ND	ND	0.066	0.091	0.085	0.106	0.126	0.102	0.0293	-
16	14S/22E-14	Imidacloprid	ND	ND	ND	ND	ND	ND	-	-	0.0440	Trace	0.0273***
18	14S/22E-31	Imidacloprid	0.059	0.665	-	-	-	-	-	-	-	-	-
20	14S/23E-32	Imidacloprid	-	ND	ND	ND	ND	ND	-	-	Trace	Trace***	-
20B	14S/23E-32	Imidacloprid	-	-	-	-	-	-	-	-	0.0388***	Trace***	0.108
21	14S/23E-33	Imidacloprid	-	0.065	ND	ND	ND	ND	-	-	0.0242	ND	ND
22	14S/23E-34	Imidacloprid	-	0.120	0.080	0.090	Trace	Trace	-	Trace	Trace***	Trace	Trace
23	14S/23E-35	Imidacloprid	-	0.218	0.209	0.534	0.536	0.470	0.073	-	-	-	-
23B	14S/23E-35	Imidacloprid	-	-	-	-	-	-	-	0.0253***	0.0720	0.0370	0.0345
24	15S/21E-03	Imidacloprid	ND	ND	ND	Trace	Trace	Trace	0.112	0.088	0.0668	0.0431***	0.0262
25	15S/21E-05	Imidacloprid	ND	ND	ND	ND	ND	ND	-	-	Trace	ND	Trace
26	15S/21E-09	Imidacloprid	Trace	0.051	0.072	0.167	0.053	ND	-	0.0348**	0.0368	0.0374***	0.0216
29	15S/22E-03	Imidacloprid	ND	Trace	ND	5.970	0.095	Trace	0.053	0.046**	-	-	-
36	15S/22E-20	Imidacloprid	ND	ND	ND	ND	ND	ND	-	-	Trace	Trace	ND
45	15S/23E-12	Imidacloprid	-	ND	ND	ND	ND	ND	-	-	ND	Trace	0.0460***
47	15S/24E-14	Imidacloprid	-	ND	0.644	ND	ND	ND	-	ND	ND	ND	ND
48	15S/24E-36	Imidacloprid	-	ND	Trace	Trace	-	-	-	-	-	-	-
49	15S/25E-05	Imidacloprid	-	ND	ND	ND	ND	ND	-	-	ND	0.0604	0.0220***
54	16S/21E-34	Imidacloprid	-	ND	ND	ND	ND	ND	-	-	0.0304	0.0235	-
72	18S/27E-21	Imidacloprid	-	ND	ND	ND	ND	ND	-	-	ND	Trace	ND
73	18S/27E-29	Imidacloprid	-	ND	ND	ND	ND	ND	-	-	ND	Trace	Trace
94	15S/24E-10	Imidacloprid	-	ND	ND	ND	ND	ND	-	-	Trace	ND	ND
95	14S/22E-33	Imidacloprid	ND	ND	ND	ND	ND	ND	-	-	Trace	ND	Trace
37	15S/22E-21	Oryzalin	Trace	ND	ND	ND	ND	ND	-	-	ND	ND	ND
44	15S/23E-02	Oryzalin	-	Trace	ND	ND	ND	ND	-	-	ND	-	-
4	13S/23E-32	Mefenoxam/Metalaxyl*	ND	ND	ND	ND	ND	ND	-	-	Trace	ND	ND
23B	14S/23E-35	Mefenoxam/Metalaxyl*	-	-	-	-	-	-	-	ND	ND	ND	Trace

Well #	Township/ Range-Section	Analyte	Sample Year										
			2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
29	15S/22E-03	Mefenoxam/Metalaxyl*	ND	Trace	ND	ND	ND	ND	ND	Trace	-	-	-
36	15S/22E-20	Mefenoxam/Metalaxyl*	ND	ND	ND	ND	ND	ND	-	-	Trace	Trace	Trace
49	15S/25E-05	Mefenoxam/Metalaxyl*	-	ND	ND	ND	ND	ND	-	-	ND	Trace	ND
54	16S/21E-34	Mefenoxam/Metalaxyl*	-	ND	ND	ND	ND	ND	-	-	Trace	Trace	-
74	19S/26E-01	Mefenoxam/Metalaxyl*	-	ND	ND	ND	ND	ND	-	-	ND	0.0465***	ND
96	27S/26E-30	Mefenoxam/Metalaxyl*	-	-	-	-	-	-	-	-	0.173	0.156***	0.146
74	19S/26E-01	Metolachlor	-	Trace	ND	ND	ND	ND	-	-	ND	ND	ND
30A	15S/22E-05	Fludioxonil	-	ND	Trace	0.066	0.165	0.380	0.333	0.316***	0.484	0.667***	0.568***
4	13S/23E-32	Propanil	ND	ND	ND	0.060	ND	ND	-	-	ND	ND	ND
2	13S/22E-33	Methoxyfenozide	-	-	-	-	-	-	-	ND	ND	Trace	Trace
19	14S/23E-34	Methoxyfenozide	-	-	-	-	-	-	-	-	0.162	0.126	-
20B	14S/23E-32	Methoxyfenozide	-	-	-	-	-	-	-	-	Trace	Trace	Trace
21	14S/23E-33	Methoxyfenozide	-	-	-	-	-	-	-	-	ND	Trace	Trace***
22	14S/23E-34	Methoxyfenozide	-	-	-	-	-	-	-	0.201	0.229	0.0533	0.301***
26	15S/21E-09	Methoxyfenozide	-	-	-	-	-	-	-	Trace**	ND	ND	ND
29	15S/22E-03	Methoxyfenozide	-	-	-	-	-	-	-	Trace	-	-	-
30A	15S/22E-05	Methoxyfenozide	-	-	-	-	-	-	-	0.0872***	0.122	0.119***	0.106
49	15S/25E-05	Methoxyfenozide	-	-	-	-	-	-	-	-	ND	Trace	Trace***
50	16S/21E-14	Methoxyfenozide	-	-	-	-	-	-	-	-	ND	Trace	Trace***
58	16S/23E-01	Methoxyfenozide	-	-	-	-	-	-	-	-	ND	ND	Trace
65	17S/26E-26	Methoxyfenozide	-	-	-	-	-	-	-	-	ND	Trace***	Trace
68	18S/26E-02	Methoxyfenozide	-	-	-	-	-	-	-	-	ND	Trace	Trace***
73	18S/27E-29	Methoxyfenozide	-	-	-	-	-	-	-	-	ND	Trace***	Trace***
94	15S/24E-10	Methoxyfenozide	-	-	-	-	-	-	-	-	ND	0.0241	ND
2	13S/22E-33	Chlorantraniliprole	-	-	-	-	-	-	-	ND	ND	ND	Trace
3	13S/23E-28	Chlorantraniliprole	-	-	-	-	-	-	-	-	ND	Trace	ND
14	14S/22E-13	Chlorantraniliprole	-	-	-	-	-	-	-	-	ND	Trace	Trace
15	14S/22E-14	Chlorantraniliprole	-	-	-	-	-	-	-	Trace	Trace	Trace	-
19	14S/23E-34	Chlorantraniliprole	-	-	-	-	-	-	-	-	0.220	0.337	-
20	14S/23E-32	Chlorantraniliprole	-	-	-	-	-	-	-	-	0.0445	0.0316	-
20B	14S/23E-32	Chlorantraniliprole	-	-	-	-	-	-	-	-	0.0820	0.202***	0.196***
21	14S/23E-33	Chlorantraniliprole	-	-	-	-	-	-	-	-	Trace	Trace	0.0286***
22	14S/23E-34	Chlorantraniliprole	-	-	-	-	-	-	-	0.266	0.0978***	0.0318	0.252***
49	15S/25E-05	Chlorantraniliprole	-	-	-	-	-	-	-	-	ND	Trace	ND
58	16S/23E-01	Chlorantraniliprole	-	-	-	-	-	-	-	-	ND	ND	Trace
65	17S/26E-26	Chlorantraniliprole	-	-	-	-	-	-	-	-	ND	Trace	Trace

Well #	Township/ Range-Section	Analyte	Sample Year										
			2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
68	18S/26E-02	Chlorantraniliprole	-	-	-	-	-	-	-	-	Trace	Trace	ND
73	18S/27E-29	Chlorantraniliprole	-	-	-	-	-	-	-	-	ND	Trace	Trace***
94	15S/24E-10	Chlorantraniliprole	-	-	-	-	-	-	-	-	ND	Trace	ND
95	14S/22E-33	Chlorantraniliprole	-	-	-	-	-	-	-	-	ND	Trace***	ND
19	14S/23E-34	Flutriafof	-	-	-	-	-	-	-	-	0.0754	1.13	-
21	14S/23E-33	Flutriafof	-	-	-	-	-	-	-	-	ND	Trace	Trace***
22	14S/23E-34	Flutriafof	-	-	-	-	-	-	-	0.226	0.209	0.0568	0.106***
94	15S/24E-10	Flutriafof	-	-	-	-	-	-	-	-	ND	Trace	ND
21	14S/23E-33	Isoxaben	-	-	-	-	-	-	-	-	ND	Trace	ND
19	14S/23E-34	Myclobutanil	-	-	-	-	-	-	-	-	-	0.0500***	-
19	14S/23E-34	Propiconazole	-	-	-	-	-	-	-	-	ND	Trace	-
21	14S/23E-33	Propiconazole	-	-	-	-	-	-	-	-	ND	Trace	ND
72	18S/27E-21	Thiobencarb	-	ND	ND	ND	ND	ND	-	-	ND	Trace	ND
3	13S/23E-28	Thiamethoxam	ND	ND	ND	ND	ND	ND	-	-	ND	Trace	Trace
20B	14S/23E-32	Thiamethoxam	-	-	-	-	-	-	-	-	Trace	ND	ND

ND = Not detected (below the method detection limit listed in [Table 4](#) and [Table 5](#)).

Trace = result is < RL but > MDL.

[-] = Not analyzed because the well was not available for sampling, the analyte was not part of the method at the time of sampling, or the method was not used to analyze samples from the well. Some analytes (e.g., methoxyfenozide, chlorantraniliprole, and flutriafof) were not analyzed for until 2021.

*Mefenoxam and metalaxyl are stereoisomers and cannot be analytically distinguished.

**RL from 2014–2020 was 0.05 ppb; from 2021–2024 the RL was 0.02 ppb for chlorantraniliprole, imidacloprid, flutriafof, and mefenoxam, and 0.03 ppb for fludioxonil and methoxyfenozide.

***Replicate sample is reported because it was higher.

QUALITY CONTROL RESULTS

Laboratory and field quality control were conducted according to the Chemistry Laboratory Quality Control SOP (Peoples, 2019) and the results are summarized in [Table 13](#). All quality control (QC) results are available upon request.

For samples and matrix spikes, the CDFA Laboratory evaluates recoveries for control limits established when the method was developed, as well as ongoing control limits. The CDFA Laboratory and the Environmental Monitoring Branch (EM) Quality Assurance (QA) Officer conducted a detailed review of the QC data and the associated sample results and determined that the recoveries outside of control limits in the spiked sample sets do not significantly impact the reported data.

Matrix Spikes

Triazine Screen

Fourteen total matrix spikes were analyzed in duplicate for the Triazine Screen. All analytes were spiked at 0.2 ppb. The mean recoveries for the 15 analytes and the propazine surrogate analyte ranged from 58.8 to 91.8%. The standard deviation of the recoveries ranged from 2.9 to 9.4%. Of the 210 spiked analytes, 81 were below the lower control limits, and one exceeded the upper control limits. Propazine surrogate recoveries were below the lower control limits in 11 of 14 continuing QC samples and in 56 of 58 samples analyzed ([Table 7](#)).

Multi-Analyte Screen

For the Multi-Analyte Screen, matrix spikes were extracted and split to be analyzed along with sets of samples for both the LC-MS/MS and GC-MS/MS instruments. Ten matrix spikes were analyzed along with ten sets of samples using LC-MS/MS. All analytes were spiked at 0.1 ppb. The mean recoveries for the 41 analytes, as well as the atrazine-d5 and imidacloprid-d4 surrogate analytes, ranged from 66.6 to 111.3%. The standard deviation of recoveries ranged from 6.1 to 28.4%. Out of 410 spiked analytes on the LC/MS screen, 61 were outside the control limits. Imidacloprid-d4 surrogate recoveries were within control limits in nine of ten continuing QC samples and 71 of 106 samples analyzed. Atrazine-d5 surrogate recoveries were within control limits in eight of ten continuing QC samples and 80 of 106 samples analyzed.

Eight matrix spikes were analyzed along with sets of samples using GC-MS/MS for the Multi-Analyte Screen. All analytes were spiked at 0.1 ppb. The mean recoveries for the 16 analytes ranged from 89.7 to 118.8%. The standard deviation of recoveries ranged from 11.8 to 27.6%. Three out of 128 spiked analytes were above the upper control limits.

Blind Spikes

A blind spike consists of analyte-free groundwater (matrix-blank sample) fortified with the chosen analytes and spiked by a chemist other than the chemist extracting and analyzing that screen. The EM QA Officer submitted the blind spike to the laboratory disguised as a field sample according to the SOP (Ganapathy, 2005). Three Triazine and four Multi-Analyte blind spikes were submitted throughout the study period ([Table 13](#)). Results are presented based on the blind spikes prepared by the laboratory. Of the 34 analytes spiked, recoveries of 26 analytes (76.5%) were within the control limits, while recoveries of eight analytes were outside the control limits. All blind spike results are presented in [Table 14](#).

Laboratory and Field Blanks

A laboratory matrix blank and deionized water field blanks were part of the QAQC for this study as described in Davalos (2021) and Peoples (2019). All laboratory matrix blanks had no detections. Thiobencarb was detected at trace concentration in one field blank ([Table 13](#)).

Table 13. Laboratory and field quality control (QC) summary.

QC Type	Triazine Screen	Multi-Analyte Screen	Total Number	QC Summary
Continuing QC matrix-spikes	14	18	32	159 out of 782 analytes were outside the control limits: 93 Triazine spikes and 66 Multi-Analyte spikes
Blind spikes	3	4	7	8 out of 34 analytes were outside the control limits
Laboratory matrix-blanks	7	10	17	All non-detected
Field blanks	9	9	18	Out of 504 analytes, 1 showed trace detection of thiobencarb* while the remaining analytes were non-detected

*Thiobencarb was detected once in a field blank at a low level (0.00763 ppb), above the MDL (0.002 ppb) but below the reporting limit (0.02 ppb); this detection is suspected to be a method sensitivity error. The same sample was also impacted by a refrigerator issue at the CDFA laboratory.

Table 14. Blind spike levels and recoveries.

Analysis Date	Analysis	Analyte	Spike Level (ppb)	Result (ppb)	% Recovery	Control Limit Exceeded*
5/17/2024 (LC) 5/16/2024 (GC)	Multi-Analyte	Chlorantraniliprole	0.10	0.0960	96.0	no
		Diuron	0.10	0.0947	94.7	no
		Flutriafol	0.10	0.102	102.0	no
		EPTC	0.25	0.240	96.0	no
		Flupyradifurone	0.10	0.0881	88.1	no
5/17/2024	Triazine	Clothianidin	0.10	0.0663	66.3	no
		DACT	0.10	0.0572	57.2	YES
		Diuron	0.15	0.105	70.0	no
		Norflurazon	0.10	0.0679	67.9	YES
		DSMN	0.05	0.0346	69.2	YES
5/24/2024 (LC) 5/28/24 (GC)	Multi-Analyte	Dichloran	0.25	0.219	87.6	no
		EPTC	0.25	0.204	81.6	no
		Mefenoxam	0.10	0.0771	77.1	YES
		Methoxyfenozide	0.15	0.145	96.7	no
		Thiamethoxam	0.10	0.0666	66.6	YES
5/21/2024	Triazine	Clothianidin	0.15	0.100	66.7	no
		DACT	0.15	0.0845	56.3	YES
		Diuron	0.10	0.0695	69.5	no
		Norflurazon	0.15	0.107	71.3	no
		DSMN	0.10	0.0752	75.2	no
5/28/2024 (LC) 6/17/2024 (GC)	Multi-Analyte	Chlorantraniliprole	0.10	0.0910	91.0	no
		Diuron	0.10	0.102	102.0	no
		EPTC	0.25	0.263	105.2	no
		Flupyradifurone	0.10	0.0960	96.0	no
		Flutriafol	0.10	0.117	117.0	YES
6/17/2024 (LC) 7/5/2024 (GC)	Multi-Analyte	Chlorantraniliprole	0.10	0.0938	93.8	no
		Dichloran	0.25	0.138	55.2	no
		Flupyradifurone	0.10	0.101	101.0	no
		Mefenoxam	0.15	0.120	80.0	no
6/4/2024	Triazine	Clothianidin	0.10	0.0703	70.3	no
		DACT	0.10	0.0666	66.6	YES
		Diuron	0.15	0.116	77.3	no
		Norflurazon	0.10	0.0748	74.8	no
		DSMN	0.05	0.0401	80.2	no

*Control limits are available in the analytical methods (CDFA,2023a; 2023b)

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