

Study 228: Monitoring the Concentrations of Detected Pesticides in Wells Located in Highly Sensitive Areas (Well Network Sampling)

Annual Update 2019

Introduction:

This update summarizes the annual results of a monitoring project that documents pesticide concentrations in domestic wells located in the San Joaquin Valley of California. The California Department of Pesticide Regulation (CDPR) initiated this study to monitor levels of herbicides in wells located in areas that are highly vulnerable to pesticide movement to groundwater to determine the efficacy of groundwater protection regulations implemented in those areas. The wells were sampled annually from 1999 through 2019 (Garretson, 1999). This update includes the results of the 2019 sampling. A statistical analysis of data collected from 1999-2012 is reported in Troiano et al., 2013. This study is ongoing and updates of results are posted annually.

Study Area: Fresno and Tulare Counties

Most Recent Sampling Period: 4/3/19 – 7/2/19

Number of Wells Sampled: 60

Pesticides and Pesticide Degradates Monitored:

1. Triazine Screen – 11 analytes by Liquid Chromatography Mass Spectrometry (LC/MS) including: atrazine, bromacil, diuron, hexazinone, norflurazon, prometon, simazine, deethyl atrazine (DEA), deisopropyl atrazine (ACET), diamino chlorotriazine (DACT), and desmethyl norflurazon (DMN).
2. Multi-Analyte Screen (Previously referred to as the Multi Residue Screen) –
 - (a) 25 analytes by Liquid Chromatography Mass Spectrometry (LC/MS) including: atrazine, azoxystrobin, bensulide, bromacil, carbaryl, diazinon, dimethenamide, dimethoate, diuron, ethofumesate, fludioxonil, imidacloprid, linuron, mefenoxam/metalaxyl, methiocarb, metolachlor, metribuzin, napropamide, norflurazon, oryzalin, prometon, simazine, tebuthiuron, thiamethoxam, and thiobencarb.
 - (b) 9 analytes by Gas Chromatography Mass Spectrometry (GC/MS) including: clomazone, dichloran, dichlorbenil, ethoprophos, malathion, phorate, prometryn, propanil, and triallate.

Results for Annual Triazine Screen and Multi-Analyte Screen Monitoring:

Results for each well are included in Tables 1-2 and are entered into the California Department of Pesticide Regulation's Well Inventory Database (CDPR, 2020). The California Department of Food and Agriculture, Center for Analytical Chemistry, analyzed all samples using the Triazine Screen analytical method EM 62.9 (CDFA, 2009) and Multi-Analyte Screen analytical method EMON-SM-05-032 (CDFA, 2013). The reporting limit for each analyte is 0.05 ppb ($\mu\text{g/L}$). A summary of the Multi-Analyte Screen detections from 2014 through 2019 is presented in Table 3 (it does not include any analytes that are also reported on the Triazine Screen). Summaries of the Triazine Screen results from 1999 through 2019, including the percent of wells with positive detections for each analyte and the mean values of those detections, are presented in Tables 4-5.

Positive detections (other than Triazine Screen analytes) from the Multi-Analyte Screen:

1. Imidacloprid
 - (a) 0.470 ppb Well #23
 - (b) 0.085 ppb Well #15
 - (c) Trace Well #2
 - (d) Trace Well #5
 - (e) Trace Well #22
 - (f) Trace Well #24
 - (g) Trace Well #29

2. Fludioxonil
 - (a) 0.380 ppb Well #30A

Both of these analytes are currently being investigated further by CDPR (Aggarwal, 2019; Kocis, 2020).

The following analytes were not detected at or above the reporting limit of 0.05 ppb in any of the wells sampled:

1. Triazine Screen - hexazinone and prometon
2. Multi-Analyte Screen -

LC/MS: azoxystrobin, bensulide, carbaryl, dimethenamide, dimethoate, ethofumesate, linuron, mefenoxam/metalaxyl, methiocarb, metolachlor, metribuzin, napropamide, oryzalin, prometon, tebuthiuron, thiamethoxam, and thiobencarb

GC/MS: clomazone, dichloran, dichlorbenil, ethoprophos, malathion, phorate, prometryn, propanil, and triallate

References:

Aggarwal, V. 2019. Study GW17A: Protocol for Additional Groundwater Protection List Monitoring for Imidacloprid. Environmental Monitoring Branch, Department of Pesticide Regulation, California Environmental Protection Agency, Sacramento, California. Available at: https://www.cdpr.ca.gov/docs/emon/pubs/protocol/study_gw17a_imdacloprid.pdf (verified February 28, 2020).

CDFA. 2009. EM 62.9. Determination of Atrazine, Bromacil, Cyanazine, Diuron, Hexazinone, Metribuzin, Norflurazon, Prometon, Prometryn, Simazine, Deethyl Atrazine (DEA), Deisopropyl Atrazine (ACET), Diamino Chlorotrazine (DACT), Desmethyl Norflurazon (DMN), Tebuthiuron and the Metabolites Tebuthiuron-104, Tebuthiuron-106, Tebuthiuron-107 and Tebuthiuron-108 in Well Water and River Water By Liquid Chromatography- Atmospheric Pressure Chemical Ionization Mass Spectrometry (Revised 2009).

CDFA. 2013. EMON-SM-05-032. Determination of 46 Pesticides in Well Water by Liquid Chromatography Coupled to Linear Ion Trap Quadrupole and Gas Chromatography Coupled to Triple Quadrupole Mass Spectrometer.

CDPR. 2020. Well Inventory Database. California Department of Pesticide Regulation, Sacramento, California. Data for 2019 will be available in mid-2020 at: https://www.cdpr.ca.gov/docs/emon/grndwtr/well_inventory_database/index.htm.

Garretson, C. 1999. Protocol for Monitoring the Concentration of Detected Pesticides in Wells Located in Highly Sensitive Areas. Study 182. Environmental Monitoring Branch, Department of Pesticide Regulation, California Environmental Protection Agency, Sacramento, California.

Kocis, T. 2020. Study 328: Protocol for Follow-up Groundwater Monitoring of Fludioxonil. Environmental Monitoring Branch, Department of Pesticide Regulation, California Environmental Protection Agency, Sacramento, California. Available at: https://www.cdpr.ca.gov/docs/emon/pubs/protocol/study328_protocol_fludioxonil.pdf (verified February 28, 2020).

Troiano, J., C. Garretson, A. DaSilva, J. Marade, and T. Barry. 2013. Pesticide and Nitrate Trends in Domestic Wells where Pesticide Use Is Regulated in Fresno and Tulare Counties, California. J. Environ. Qual. doi:10.2134/jeq2013.06.0219.

Table 1. 2019 Triazine Screen sampling results in ppb (µg/L).

Well Number	ACET	Atrazine	Bromacil	DACT	DEA	Diuron	DMN	Hexazinone	Norflurazon	Prometon	Simazine	Propazine Recovery in %
1	T	nd	nd	T	nd	nd	nd	nd	nd	nd	nd	88.5
2	T	nd	nd	T	nd	nd	nd	nd	nd	nd	T	83.0
3	0.057	nd	nd	T	nd	nd	0.088	nd	nd	nd	0.056	73.5
4	0.172	T	0.276	0.168	nd	T	0.140	nd	0.209	nd	0.076	85.5
5	0.339	nd	nd	0.561	T	nd	0.262	nd	nd	nd	0.087	83.0
6	0.603	nd	nd	0.968	nd	T	nd	nd	nd	nd	0.076	80.0
7	0.197	nd	nd	0.609	T	nd	T	T	nd	nd	0.052	87.5
8	0.138	nd	T	0.155	T	T	nd	nd	nd	nd	0.082	83.5
12	0.319	nd	0.303	0.205	nd	T	nd	nd	nd	nd	T	84.0
13	0.097	nd	0.451	0.191	nd	T	0.153	nd	0.091	nd	T	89.0
14	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	88.0
15	0.062	nd	nd	0.085	nd	T	0.130	nd	T	nd	0.057	83.0
16	0.186	nd	0.086	0.349	nd	T	0.287	nd	0.093	nd	0.066	82.5
19	0.054	nd	nd	0.053	nd	nd	0.164	nd	nd	nd	T	75.5
20	T	nd	nd	T	nd	nd	nd	nd	nd	nd	T	88.0
21	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	75.0
22	0.224	nd	nd	0.579	nd	nd	0.066	nd	nd	nd	0.079	80.5
23	0.116	nd	nd	0.241	nd	nd	T	nd	nd	nd	T	75.5
24	nd	nd	nd	T	nd	nd	0.206	nd	T	nd	nd	76.0
25	T	nd	nd	T	nd	nd	T	nd	nd	nd	T	78.0
26	0.243	nd	nd	0.235	nd	nd	0.115	nd	nd	nd	0.075	78.0
28	nd	nd	nd	T	nd	nd	nd	nd	nd	nd	T	88.0
29	T	nd	nd	0.092	nd	nd	0.218	nd	T	nd	T	87.5
30A	0.177	nd	nd	0.243	nd	T	T	nd	T	nd	0.079	64.5
32	0.162	nd	nd	0.186	nd	nd	0.425	nd	0.240	nd	0.069	72.5
35	T	nd	nd	0.093	nd	nd	0.218	nd	T	nd	T	79.0
36	T	nd	nd	T	nd	nd	nd	nd	nd	nd	T	83.5
37	T	nd	nd	T	nd	nd	T	nd	T	nd	T	86.5
43	0.189	nd	nd	0.110	nd	T	0.074	nd	0.078	nd	0.085	81.5
44	0.091	nd	0.074	0.105	nd	T	T	nd	nd	nd	T	96.5
45	T	nd	nd	T	nd	T	nd	nd	nd	nd	nd	85.0
47	0.110	nd	nd	0.264	nd	nd	T	nd	nd	nd	T	72.5
49	0.386	nd	nd	2.660	nd	nd	0.083	nd	nd	nd	T	62.0
50	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	73.5
51	T	nd	nd	T	nd	nd	nd	nd	nd	nd	nd	78.5
52	0.052	nd	nd	0.053	nd	nd	T	nd	nd	nd	0.064	87.5
53A	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	94.5
54	T	nd	nd	T	nd	nd	nd	nd	nd	nd	T	82.0
56	0.388	nd	nd	0.903	nd	nd	nd	nd	nd	nd	0.090	80.5
57	0.105	nd	nd	0.267	nd	nd	T	nd	nd	nd	T	79.0
58	T	nd	nd	T	nd	nd	T	nd	nd	nd	T	83.5
59A	0.100	nd	0.566	0.383	T	T	0.134	nd	0.073	nd	nd	69.0

nd = none detected (below the method detection limit listed in Table 6)

T = Trace (positive result between the method detection limit and the reporting limit listed in Table 6)

Propazine added as a surrogate for QA/QC purposes

Table 1. cont'd. 2019 Triazine Screen sampling results in ppb (µg/L).

Well Number	ACET	Atrazine	Bromacil	DACT	DEA	Diuron	DMN	Hexazinone	Norflurazon	Prometon	Simazine	Propazine Recovery in %
61	0.143	nd	0.528	1.070	T	nd	nd	nd	nd	nd	T	78.0
63A	nd	nd	nd	T	nd	nd	nd	nd	nd	nd	nd	90.5
65	T	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	82.0
68	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	82.0
69	0.468	nd	0.339	2.240	nd	T	nd	nd	nd	nd	T	75.0
71	0.369	nd	1.100	0.916	nd	T	0.807	nd	0.236	nd	T	73.0
72	0.618	nd	T	1.530	T	T	T	nd	T	nd	0.067	79.5
73	0.122	nd	nd	1.040	T	nd	0.061	nd	nd	nd	nd	78.5
74	0.618	nd	0.424	0.993	T	T	T	nd	T	nd	0.079	83.0
75A	0.802	nd	0.346	0.883	nd	T	nd	nd	nd	nd	0.068	79.0
80	0.051	nd	T	0.314	nd	nd	nd	nd	nd	nd	nd	84.5
84	T	nd	T	T	nd	nd	nd	nd	nd	nd	nd	82.0
86	0.671	nd	nd	4.830	T	nd	nd	nd	nd	nd	T	76.0
89	0.059	nd	T	0.058	nd	T	0.066	nd	nd	nd	T	86.5
90	0.167	0.083	0.069	0.177	0.156	0.079	T	T	T	nd	0.081	83.0
92	0.262	nd	nd	0.229	nd	T	0.104	nd	0.057	nd	T	79.0
94	0.508	nd	nd	3.360	nd	nd	0.195	nd	T	nd	T	74.0
95	nd	nd	nd	T	nd	nd	nd	nd	nd	nd	nd	86.5

nd = none detected (below the method detection limit listed in Table 6)

T = Trace (positive result between the method detection limit and the reporting limit listed in Table 6)

Propazine added as a surrogate for QA/QC purposes

Table 2. 2019 Multi-Analyte Screen sampling results in ppb ($\mu\text{g/L}$). The table includes the results for the two analytes with detections that are only included in the Multi-Analyte Screen and for the six analytes that are duplicated in the two screens.

Well Number	Analytes unique to Multi-Analyte Screen		Analytes in both the Triazine Screen and the Multi-Analyte Screen					
	Fludioxonil	Imidacloprid	Atrazine	Bromacil	Diuron	Norflurazon	Prometon	Simazine
1	nd	nd	nd	nd	nd	nd	nd	nd
2	nd	T	nd	nd	nd	nd	nd	T
3	nd	nd	nd	0.274	T	0.195	nd	0.071
4	nd	nd	nd	0.288	T	0.202	nd	0.075
5	nd	T	nd	nd	nd	nd	nd	0.101
6	nd	nd	nd	nd	T	nd	nd	0.073
7	nd	nd	nd	nd	nd	nd	nd	0.051
8	nd	nd	nd	T	T	nd	nd	0.053
12	nd	nd	nd	0.277	T	nd	nd	T
13	nd	nd	nd	0.617	T	0.106	nd	T
14	nd	nd	nd	nd	nd	nd	nd	nd
15	nd	0.085	nd	nd	T	T	nd	0.069
16	nd	nd	nd	0.094	T	0.119	nd	0.081
19	nd	nd	nd	nd	nd	nd	nd	T
20	nd	nd	nd	nd	nd	nd	nd	T
21	nd	nd	nd	nd	nd	nd	nd	nd
22	nd	T	nd	nd	nd	nd	nd	0.087
23	nd	0.470	nd	0.102	T	T	nd	0.100
24	nd	T	nd	nd	nd	T	nd	nd
25	nd	nd	nd	nd	nd	nd	nd	T
26	nd	nd	nd	nd	nd	nd	nd	0.081
28	nd	nd	nd	nd	nd	nd	nd	nd
29	nd	T	nd	nd	T	T	nd	nd
30A	0.380	nd	nd	nd	T	T	nd	0.095
32	nd	nd	nd	nd	nd	0.296	nd	0.076
35	nd	nd	nd	nd	T	T	T	0.083
36	nd	nd	nd	nd	nd	nd	nd	nd
37	nd	nd	nd	nd	nd	T	nd	T
43	nd	nd	nd	nd	T	0.093	nd	0.096
44	nd	nd	nd	0.080	T	nd	nd	T
45	nd	nd	nd	nd	T	nd	nd	nd
47	nd	nd	nd	nd	T	nd	nd	T
49	nd	nd	nd	nd	nd	T	nd	0.066
50	nd	nd	nd	nd	nd	nd	nd	nd

nd = none detected (below the method detection limit listed in Table 7)

T = Trace (positive result between the method detection limit and the reporting limit listed in Table 7)

There were no positive detections for the following analytes that were included in the Multi-Analyte Screen: LC/MS-azoxystrobin, bensulide, carbaryl, dimethenamide, dimethoate, ethofumesate, linuron, mefenoxam/metalaxyl, methiocarb, metolachlor, metribuzin, napropamide, oryzalin, prometon, tebuthiuron, thiamethoxam, and thiobencarb; GC/MS-clomazone, dichloran, dichlorbenil, ethoprophos, malathion, phorate, prometryn, propanil, and triallate

Table 2. cont'd. 2019 Multi-Analyte Screen sampling results in ppb (µg/L). The table includes the results for the two analytes with detections that are only included in the Multi-Analyte Screen and for the six analytes that are duplicated in the two screens.

Well Number	Analytes unique to Multi-Analyte Screen		Analytes in both the Triazine Screen and the Multi-Analyte Screen					
	Fludioxonil	Imidacloprid	Atrazine	Bromacil	Diuron	Norflurazon	Prometon	Simazine
51	nd	nd	nd	nd	nd	nd	nd	nd
52	nd	nd	nd	nd	nd	nd	nd	0.073
53A	nd	nd	nd	nd	nd	nd	nd	nd
54	nd	nd	nd	nd	nd	nd	nd	T
56	nd	nd	nd	nd	nd	nd	nd	0.096
57	nd	nd	nd	nd	nd	nd	nd	T
58	nd	nd	nd	nd	nd	nd	nd	T
59A	nd	nd	nd	0.541	T	0.092	nd	nd
61	nd	nd	nd	0.945	nd	nd	nd	T
63A	nd	nd	nd	nd	nd	nd	nd	nd
65	nd	nd	nd	nd	nd	nd	nd	nd
68	nd	nd	nd	nd	nd	nd	nd	nd
69	nd	nd	nd	0.363	T	T	nd	nd
71	nd	nd	nd	1.23	T	0.356	nd	0.053
72	nd	nd	nd	0.051	T	T	nd	0.073
73	nd	nd	nd	nd	nd	nd	nd	nd
74	nd	nd	nd	0.534	T	T	nd	0.089
75A	nd	nd	nd	0.396	T	nd	nd	0.076
80	nd	nd	nd	T	nd	nd	nd	nd
84	nd	nd	nd	T	nd	nd	nd	nd
86	nd	nd	nd	nd	nd	nd	nd	T
89	nd	nd	nd	T	T	nd	nd	T
90	nd	nd	0.087	0.073	0.089	T	nd	0.081
92	nd	nd	nd	nd	T	0.056	nd	0.053
94	nd	nd	nd	nd	nd	T	nd	T
95	nd	nd	nd	nd	nd	nd	nd	nd

nd = none detected (below the method detection limit listed in Table 7)

T = Trace (positive result between the method detection limit and the reporting limit listed in Table 7)

There were no positive detections for the following analytes that were included in the Multi-Analyte Screen: LC/MS-azoxystrobin, bensulide, carbaryl, dimethenamide, dimethoate, ethofumesate, linuron, mefenoxam/metalaxyl, methiocarb, metolachlor, metribuzin, napropamide, oryzalin, prometon, tebuthiuron, thiamethoxam, and thiobencarb; GC/MS-clomazone, dichloran, dichlorbenil, ethoprophos, malathion, phorate, prometryn, propanil, and triallate

Table 3. Summary of wells with Multi-Analyte Screen detections (other than Triazine analytes) from 2014 through 2019 in ppb ($\mu\text{g/L}$).

Well #	Township/Range-Section	Analyte	Sample Year					
			2014	2015	2016	2017	2018	2019
2	13S/22E-33	Imidacloprid	nd	nd	nd	nd	T	T
4	13S/23E-32	Imidacloprid	nd	nd	nd	T	nd	nd
5	14S/21E-13	Imidacloprid	nd	nd	nd	T	T	T
15	14S/22E-14	Imidacloprid	nd	nd	nd	0.066	0.091	0.085
18	14S/22E-31	Imidacloprid	0.059	0.665	Dry	NLS	NLS	NLS
21	14S/23E-33	Imidacloprid	NS	0.065	nd	nd	nd	nd
22	14S/23E-34	Imidacloprid	NS	0.120	0.080	0.090	T	T
23	14S/23E-35	Imidacloprid	NS	0.218	0.209	0.534	0.536	0.470
24	15S/21E-03	Imidacloprid	nd	nd	nd	T	T	T
26	15S/21E-09	Imidacloprid	T	0.051	0.072	0.167	0.053	nd
29	15S/22E-03	Imidacloprid	nd	T	nd	5.970*	0.095*	T*
47	15S/24E-14	Imidacloprid	NS	nd	0.644	nd	nd	nd
48	15S/24E-36	Imidacloprid	NS	nd	T	T	NLS	NLS
37	15S/22E-21	Oryzalin	T	nd	nd	nd	nd	nd
44	15S/23E-02	Oryzalin	NS	T	nd	nd	nd	nd
29	15S/22E-03	Mefenoxam/Metalaxyl	nd	T	nd	nd	nd	nd
74	19S/26E-01	Metalachlor	NS	T	nd	nd	nd	nd
30A	15S/22E-05	Fludioxonil	NS	nd	T	0.066	0.165	0.380
4	13S/23E-32	Propanil	nd	nd	nd	0.060	nd	nd

nd = none detected (below the method detection limit listed in Table 7)

T = Trace (positive results between the method detection limit and the reporting limit listed in Table 7)

NS = Well not sampled in 2014. 27 wells for Multi-Analyte Screen were sampled in 2014

Dry = Well went dry.

* = Well 29 services house which is vacant

NLS = Well is no longer sampled

Table 4. Yearly percent (%) of wells positive for each analyte on the Triazine Screen.

	ACET	Atrazine	Bromacil	DACT	DEA	Diuron	DMN	Hexazinone	Norflurazon	Prometon	Simazine
1999	94.7	5.3	40.0	85.3	8.0	60.0	NA*	0.0	17.3	1.3	86.7
2000	89.2	4.1	37.8	89.2	4.1	50.0	NA*	1.0	17.6	1.4	82.4
2001	94.4	4.2	39.4	85.9	8.5	59.2	NA*	1.4	22.5	1.4	85.9
2002	94.3	4.3	38.6	88.6	12.9	64.3	NA*	0.0	15.7	1.4	92.9
2003	88.9	4.2	40.3	86.1	9.7	61.1	NA*	0.0	20.8	1.4	86.1
2004	86.8	4.4	33.8	85.3	8.8	57.4	44.1	0.0	25.0	1.5	80.9
2005	88.2	4.4	33.8	75.0	5.9	54.4	45.6	0.0	23.5	1.5	70.6
2006	83.3	4.5	37.9	83.3	7.6	51.5	44.0	0.0	22.7	1.5	72.7
2007	85.5	2.9	31.9	85.5	5.8	46.4	44.9	0.0	29.0	1.4	76.8
2008	85.3	4.4	33.8	85.3	5.9	50.0	44.0	0.0	20.6	1.5	69.1
2009	88.2	2.9	30.9	85.3	4.4	45.6	47.1	0.0	20.6	1.5	60.3
2010	80.9	2.9	29.4	85.3	4.4	38.2	50.0	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	0.0	55.9
2012	82.4	2.9	25.0	80.9	4.4	36.8	50.0	0.0	27.9	0.0	58.8
2013	76.1	1.5	26.9	83.6	6.0	13.4	41.8	0.0	20.9	0.0	58.2
2014	75.0	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	0.0	19.0	1.6	49.2
2016	78.7	1.6	26.2	82.0	3.3	16.4	41.0	0.0	21.3	1.6	50.8
2017	60.7	1.6	23.0	70.5	1.6	6.6	36.1	0.0	21.3	0.0	39.3
2018	57.4	1.6	23.0	65.6	4.9	4.9	36.1	0.0	21.3	0.0	36.1
2019	61.7	1.7	20.0	63.3	1.7	1.7	35.0	0.0	13.3	0.0	31.7

Mean	81.2	3.3	31.3	81.4	5.9	36.9	43.3	0.3	21.8	1.0	65.0
SD	10.7	1.3	6.3	7.1	2.7	21.4	5.5	0.6	4.1	0.7	17.7

*= Not Analyzed - DMN was not included in the analysis until 2004

Table 5. Yearly mean in ppb ($\mu\text{g/L}$) for each analyte on the Triazine Screen.

	ACET	Atrazine	Bromacil	DACT	DEA	Diuron	DMN	Hexazinone	Norflurazon	Prometon	Simazine
1999	0.48	0.08	0.96	0.82	0.11	0.35	NA*	nd	0.16	0.07	0.13
2000	0.47	0.08	1.31	0.75	0.13	0.35	NA*	0.07	0.14	0.06	0.11
2001	0.50	0.10	1.12	0.97	0.13	0.33	NA*	0.05	0.11	0.10	0.12
2002	0.58	0.08	0.85	1.08	0.09	0.31	NA*	nd	0.28	0.09	0.13
2003	0.55	0.11	0.99	0.89	0.12	0.31	NA*	nd	0.18	0.08	0.14
2004	0.50	0.12	1.12	0.85	0.15	0.28	0.22	nd	0.21	0.09	0.10
2005	0.38	0.10	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	0.10	0.26	0.26	nd	0.13	0.06	0.10
2008	0.38	0.07	0.81	0.68	0.10	0.21	0.25	nd	0.24	0.07	0.09
2009	0.39	0.07	0.79	0.67	0.12	0.20	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	0.40	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	0.10	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	0.10	0.67	0.68	0.06	0.13	0.26	nd	0.20	0.10	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

Mean	0.40	0.09	0.84	0.79	0.12	0.20	0.24	0.06	0.18	0.08	0.10
SD	0.09	0.02	0.20	0.11	0.03	0.10	0.03	0.01	0.04	0.02	0.02

*= Not Analyzed - DMN was not included in the analysis until 2004

nd = none detected (below the method detection limits listed in Table 6)

Table 6. Triazine Screen Method Detection Limits and Reporting Limits.

Analyte	MDL	RL
ACET	0.013	0.05
Atrazine	0.015	0.05
Bromacil	0.02	0.05
DACT	0.0063	0.05
DEA	0.01	0.05
Diuron	0.043	0.05
DMN	0.015	0.05
Hexazinone	0.025	0.05
Metribuzin	0.0125	0.05
Norflurazon	0.0063	0.05
Prometon	0.012	0.05
Simazine	0.0135	0.05

Table 7. Multi-Analyte Screen Method Detection Limits and Reporting Limits.

Analyte	MDL	RL
Atrazine	0.0152	0.05
Azoxystrobin	0.0111	0.05
Bensulide	0.0392	0.05
Bromacil	0.012	0.05
Carbaryl	0.0254	0.05
Clomazone	0.0168	0.05
Diazinon	0.0493	0.05
Dichloran	0.0235	0.05
Dichlorbenil	0.0237	0.05
Dimethenamide	0.0207	0.05
Dimethoate	0.015	0.05
Diuron	0.0111	0.05
Ethofumesate	0.018	0.05
Ethoprophos	0.0178	0.05
Fludioxonil	0.0117	0.05
Imidacloprid	0.0118	0.05
Malathion	0.0272	0.05
Mefenoxam	0.0199	0.05
Methiocarb	0.0146	0.05
Metolachlor	0.0166	0.05
Metribuzin	0.0117	0.05
Napropamide	0.0174	0.05
Norflurazon	0.0112	0.05
Oryzalin	0.0128	0.05
Phorate	0.0168	0.05
Prometon	0.013	0.05
Prometryn	0.0204	0.05
Propanil	0.0217	0.05
Simazine	0.0141	0.05
Tebuthiuron	0.0141	0.05
Thiamethoxam	0.0086	0.05
Thiobencarb	0.0169	0.05
Triallate	0.0147	0.05