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

## Annual Update 2018

**Introduction:**

This report summarizes the annual results of a monitoring project that documents pesticide concentrations in domestic wells located in the San Joaquin Valley of California. This study was initiated to monitor levels of herbicides in wells located in areas that are highly vulnerable to pesticide movement to groundwater in order to determine efficacy of groundwater protection regulations implemented in those areas. The wells were sampled annually from 1999 through 2018 (Garretson, 1999). Included here are the results of the 2018 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:** 4/3/18 – 5/31/18

**Number of Wells Sampled:** 60

**Pesticides, Pesticide Degradates, and Chemicals Monitored:**

1. Annual triazine screen – 11 analytes including: atrazine, bromacil, diuron, hexazinone, norflurazon, prometon, simazine, ACET, DACT, DEA, and DMN.

2. Multi Residue screen –

    (a) 29 analytes by Liquid Chromatography Mass Spectrometry (LC/MS) including: atrazine, azinphos-methyl, azoxystrobin, bensulide, bromacil, carbaryl, carbofuran, diazinon, dimethenamide, dimethoate, diuron, ethofumesate, fenamiphos, fludioxonil, imidacloprid, linuron, mefenoxam/metalaxyl, methiocarb, metolachlor, metribuzin, napropamide, norflurazon, oryzalin, prometon, simazine, tebuthiuron, thiamethoxam, thiobencarb, and uniconizole.

    (b) 15 analytes by Gas Chromatography Mass Spectrometry (GC/MS) including: alachlor, clomazone, dichloran, dichlorbenil, disulfoton, ethoprophos, ethyl parathion, fonofos, malathion, methyl parathion, phorate, piperonyl butoxide, prometryn, propanil, and triallate.

3. Dacthal and breakdown products – 3 analytes including: dacthal (DCPA), dacthal monoacid (MTP), and dacthal diacid (TPA).

**Results for Annual Triazine Screen Monitoring, Multi Residue Screen, and Dacthal:**

Results for each well are included in Tables 1-2 and in the California Department of Pesticide Regulation well inventory database (CDPR, 2016). The California Department of Food and Agriculture, Center for Analytical Chemistry analyzed all samples according to Triazine Screen analytical method EM 62.9 (CDFA, 2009), Multi Residue Screen analytical method EMON-SM-05-032 (CDFA, 2013), and/or Dacthal analytical method EMON-SM-05-040 (CDFA, 2016). The reporting limit for each analyte is 0.05 ug/L. A summary of positive results (other than triazine screen analytes) for the Multi Residue Screen from 2014 through 2018 is presented in Table 3. Chemistry results and quality control data are presented in Tables 4-8.

Positive detections (other than triazine screen analytes) from Multi Residue screen:

1. Imidacloprid
   (a) 0.536 ug/L Well #23
   (b) 0.095 ug/L Well #29*
   (c) 0.091 ug/L Well #15
   (d) 0.053 ug/L Well #26
   (e) Trace Well #2
   (f) Trace Well #4
   (g) Trace Well #22
   (h) Trace Well #24

   ***** Well 29 services a house that is vacant.

2. Fludioxonil
   (a) 0.165 ug/L† Well 30A

   † This detection does not meet the standard for determination of legal agricultural use and will be investigated further.

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

1. Triazine Screeen -

   Hexazinone
   Prometon

2. Dacthal Screen -

   Dacthal
   MTP
   TPA

3. Multi Residue Screen -

LC/MS:
Axinphos-methyl
Azoxystrobin
Bensulide
Carbary
Carbofuran
Diazinon
Dimethenamide
Dimethoate
Ethofumesate
Fenamiphos
Linuron
Mefenoxam/Metalaxy
Methiocarb
Metolachlor
Metribuzin
Napropamide
Oryzalin
Tebuthiuron
Thiamethoxam
Thiobencarb
Uniconazole

GC/MS:
Alachlor
Clomazone
Dichloran
Dichlorbenil
Disulfoton
Ethoprophos
Ethyl parathion
Fonofos
Malathion
Methyl Parathion
Phorate
Piperonyl Butoxide
Prometryn
Propanil
Triallate

**References**

CDFA, 2009. EM 62.9 Determination of Atrazine, Bromacil, Cyanazine, Diuron, Hexazinone, Metribuzin, Norflurazon, Prometon, Prometryn, Simazine, Deethyl Atrazine (DEA), Deisopropyl Atrazine ( ACET), Diamino Chlorotraizine (DACT), 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) Available at: https://www.cdpr.ca.gov/docs/emon/pubs/anl_methds/emon-sm-62_9.pdf (verified February 26, 2019).

CDFA, 2013. EMON-SM-05-032 Determination of 44 Pesticides in Well Water by Liquid Chromatography Coupled to Linear Ion Trap Quadrupole and Gas Chromatography Coupled to Triple Quadrupole Mass Spectrometer. Available at: https://www.cdpr.ca.gov/docs/emon/pubs/anl_methds/emon-sm-05-032.pdf (verified February 26, 2019).

CDFA, 2016. EMON-SM-05-040 Analysis of Dacthal, Dacthal Monoacid, and Dacthal Diacid in Well Water using Gas Chromatography/MSD. Available at: https://www.cdpr.ca.gov/docs/emon/pubs/anl_methds/emon-sm-05-040.pdf (verified February 26, 2019).

CDPR. 2016. Well inventory data base. California Department of Pesticide Regulation, Sacramento, California. Available at: https://www.cdpr.ca.gov/docs/emon/grndwtr/well_inventory_database/index.htm (verified February 26, 2019).

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.

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 Available at: http://www.cdpr.ca.gov/docs/emon/pubs/ehapref/pesticide_well_trends.pdf (verified February 26, 2019).

**Table 1.** Spring 2018 Triazine Screen Sampling Results in ug/L (ppb)

| Sample Number | Well Number | Date Sampled | ACET | Atrazine | Bromacil | DACT | DEA | Diuron | DMN | Hexazinone | Norflurazon | Prometon | Simazine | Propazine | RL in ug/l |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2818 | 1 | 5/31/18 | T | | | 0.052 | | | | | | | | 81.6 | 0.05 |
| 2812 | 2 | 5/29/18 | T | | | T | | | | | | | T | 70.5 | 0.05 |
| 2813 | 3 | 5/29/18 | T | | | T | | | T | | | | T | 74.0 | 0.05 |
| 2817 | 4 | 5/29/18 | 0.345 | T | 2.120 | 1.250 | T | T | 0.247 | | 0.193 | T | 0.070 | 82.0 | 0.05 |
| 2808 | 5 | 5/21/18 | 0.306 | | | 0.583 | T | | 0.215 | | T | | 0.071 | 66.5 | 0.05 |
| 2801 | 6 | 5/21/18 | 0.561 | | | 0.999 | | T | | | | | 0.062 | 66.0 | 0.05 |
| 2815 | 7 | 5/21/18 | 0.074 | | | 0.225 | | | T | | | | T | 73.0 | 0.05 |
| 2806 | 8 | 5/21/18 | 0.177 | | T | 0.283 | T | T | | | | | 0.073 | 70.5 | 0.05 |
| 2839 | 12 | 5/29/18 | 0.294 | | 0.338 | 0.266 | | T | | | | | T | 82.5 | 0.05 |
| 2819 | 13 | 5/23/18 | 0.074 | | 0.563 | 0.201 | | T | 0.134 | | 0.069 | | T | 83.5 | 0.05 |
| 2820 | 14 | 5/23/18 | | | | | | | | | | | | 82.5 | 0.05 |
| 2816 | 15 | 5/23/18 | 0.060 | | | 0.130 | | T | 0.130 | | T | | 0.062 | 80.0 | 0.05 |
| 2807 | 16 | 5/23/18 | 0.168 | | | 0.581 | | T | 0.446 | | 0.158 | | 0.062 | 69.5 | 0.05 |
| 2826 | 19 | 4/17/18 | 0.106 | | | 0.181 | | T | 0.316 | | T | | 0.057 | 86.0 | 0.05 |
| 2827 | 20 | 4/17/18 | T | | | | | | | | | | T | 83.5 | 0.05 |
| 2783 | 21 | 4/17/18 | | | | | | 0.073 | T | | | | | 74.0 | 0.05 |
| 2830 | 22 | 4/18/18 | 0.213 | | | 0.841 | | | 0.082 | | | | 0.080 | 88.5 | 0.05 |
| 2828 | 23 | 4/18/18 | 0.148 | | 0.070 | 0.266 | | T | 0.086 | | T | | 0.063 | 64.0 | 0.05 |
| 2803 | 24 | 5/8/18 | | | | | | | 0.297 | | 0.059 | | | 88.0 | 0.05 |
| 2799 | 25 | 5/8/18 | T | | | T | | T | T | | | | T | 82.0 | 0.05 |
| 2789 | 26 | 5/8/18 | T | | | 0.069 | | | 0.066 | | | | T | 76.5 | 0.05 |
| 2796 | 28 | 5/1/18 | T | | | T | | | | | | | T | 72.5 | 0.05 |
| 2790 | 29 | 5/2/18 | T | | | 0.113 | | | 0.160 | | T | | | 73.5 | 0.05 |
| 2800 | 30A | 5/14/18 | 0.148 | | | 0.268 | | T | T | | 0.054 | | 0.072 | 77.5 | 0.05 |
| 2795 | 32 | 5/2/18 | 0.111 | | | 0.173 | | | 0.398 | | 0.232 | | 0.057 | 68.0 | 0.05 |
| 2797 | 35 | 5/2/18 | 0.096 | | | 0.161 | | T | 0.087 | | T | T | 0.073 | 77.0 | 0.05 |
| 2786 | 36 | 5/2/18 | | | | | | | T | | | | T | 71.5 | 0.05 |
| 2798 | 37 | 5/2/18 | T | | | 0.084 | | | 0.110 | | 0.074 | | 0.085 | 91.0 | 0.05 |
| 2832 | 43 | 4/18/18 | 0.145 | | | 0.119 | | T | 0.091 | | 0.084 | | 0.087 | 72.5 | 0.05 |
| 2831 | 44 | 4/18/18 | 0.063 | | 0.050 | 0.149 | | T | | | T | | T | 79.5 | 0.05 |
| 2829 | 45 | 4/18/18 | | | | T | | 0.075 | T | | | | | 70.0 | 0.05 |
| 2834 | 47 | 4/19/18 | 0.436 | T | | 1.090 | 0.051 | T | T | | | | T | 90.5 | 0.05 |
| 2836 | 49 | 4/19/18 | 0.664 | | | 3.100 | T | | 0.341 | | T | | 0.074 | 80.0 | 0.05 |
| 2785 | 50 | 5/1/18 | | | | | | | | | | | | 60.5 | 0.05 |
| 2787 | 51 | 5/1/18 | T | | | T | | | | | | | | 72.5 | 0.05 |
| 2792 | 52 | 4/23/18 | 0.092 | | | 0.173 | | | 0.110 | | | | 0.068 | 72.0 | 0.05 |
| 2838 | 53A | 4/23/18 | | | | | | | | | | | | 79.0 | 0.05 |
| 2791 | 54 | 4/23/18 | | | | T | | | | | | T | T | 78.0 | 0.05 |
| 2793 | 56 | 5/1/18 | 0.220 | | | 0.626 | | | | | | | 0.067 | 70.5 | 0.05 |
| 2788 | 57 | 5/1/18 | 0.096 | | | 0.252 | | | T | | | | T | 70.0 | 0.05 |
| 2825 | 58 | 4/9/18 | T | | | T | | | T | | | | T | 77.5 | 0.05 |
| 2822 | 59A | 4/9/18 | 0.312 | T | 0.942 | 0.849 | 0.078 | T | 0.830 | | 0.366 | | T | 81.5 | 0.05 |

Blank spaces = None Detected (<0.05 ug/L)

T = Trace (found below detection limit at a level too low to be reliably quantified)

Propazine added as a surrogate for QA/QC purposes

**Table 1. cont'd.** Spring 2018 Triazine Screen Sampling Results in ug/L (ppb)

| Sample Number | Well Number | Date Sampled | ACET | Atrazine | Bromacil | DACT | DEA | Diuron | DMN | Hexazinone | Norflurazon | Prometon | Simazine | Propazine | RL in ug/l |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2824 | 61 | 4/9/18 | 0.315 | | 1.340 | 1.940 | T | T | T | | | | 0.060 | 75.0 | 0.05 |
| 2775 | 63A | 4/5/18 | | | | T | | | | | | | | 75.5 | 0.05 |
| 2778 | 65 | 4/5/18 | T | | | T | | | | | | | T | 72.0 | 0.05 |
| 2777 | 68 | 4/5/18 | | | | | | | | | | | | 69.0 | 0.05 |
| 2821 | 69 | 4/5/18 | 0.434 | | 0.537 | 2.330 | | T | | | | | T | 81.0 | 0.05 |
| 2774 | 71 | 4/4/18 | 0.386 | | 0.465 | 1.000 | | T | 0.764 | | 0.260 | | T | 66.5 | 0.05 |
| 2776 | 72 | 4/4/18 | 0.552 | | 0.057 | 1.650 | T | T | T | | T | | 0.064 | 70.5 | 0.05 |
| 2772 | 73 | 4/4/18 | 0.092 | | | 1.320 | T | | T | | | | | 73.5 | 0.05 |
| 2782 | 74 | 4/4/18 | 0.507 | | 0.312 | 0.970 | T | | | | 0.058 | | 0.073 | 85.5 | 0.05 |
| 2784 | 75A | 4/3/18 | 0.802 | | 0.403 | 0.752 | | T | | | | | 0.065 | 78.0 | 0.05 |
| 2781 | 80 | 4/3/18 | 0.392 | | 1.070 | 2.280 | | T | | | | | T | 78.0 | 0.05 |
| 2780 | 84 | 4/3/18 | T | | T | T | | | | | | | | 77.5 | 0.05 |
| 2779 | 86 | 4/3/18 | 0.651 | | | 6.320 | T | | | | T | | T | 71.5 | 0.05 |
| 2811 | 89 | 5/29/18 | T | | T | 0.063 | | T | 0.055 | | | | T | 72.0 | 0.05 |
| 2802 | 90 | 5/14/18 | 0.123 | 0.075 | 0.058 | 0.195 | 0.137 | 0.079 | T | T | T | | 0.072 | 85.0 | 0.05 |
| 2823 | 92 | 4/17/18 | 0.268 | | | 0.247 | | T | 0.122 | | 0.068 | | T | 80.5 | 0.05 |
| 2837 | 94 | 4/19/18 | 0.452 | | | 2.610 | | T | 0.227 | | 0.057 | | T | 81.5 | 0.05 |
| 2805 | 95 | 5/14/18 | T | | | | | | | | | | T | 96.5 | 0.05 |

Blank spaces = None Detected (<0.05 ug/L)
T = Trace (found below detection limit at a level too low to be reliably quantified)
Propazine added as a surrogate for QA/QC purposes

**Table 2.** Results for 2018 Triazine Screen vs Multi Residue Screen in ug/L (ppb). The table includes the six analytes that are duplicated in the two screens plus any positive or trace detections for analytes that are only included in the Multi Residue screen.

| Well | Atrazine | | Bromacil | | Diuron | | Norflurazon | | Prometon | | Simazine | | Fludioxinil | Imidacloprid |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Number | MR | Tri | MR | Tri | MR | Tri | MR | Tri | MR | Tri | MR | Tri | MR | MR |
| 1 | | | | | T | | | | | | | | | |
| 2 | | | | | | | | | | | T | T | | T |
| 3 | | | | | | | | | | | 0.058 | T | | |
| 4 | T | T | 2.980 | 2.120 | T | T | 0.241 | 0.193 | T | T | 0.084 | 0.070 | | |
| 5 | | | | | | | T | T | | | 0.100 | 0.071 | | T |
| 6 | | | | | T | T | | | | | 0.084 | 0.062 | | |
| 7 | | | | | | | | | | | 0.050 | T | | |
| 8 | | | T | T | T | T | | | | | 0.093 | 0.073 | | |
| 12 | | | 0.519 | 0.338 | T | T | | | | | T | T | | |
| 13 | | | 0.603 | 0.563 | T | T | 0.083 | 0.069 | | | T | T | | |
| 14 | | | | | | | | | | | | | | |
| 15 | | | | | T | T | T | T | | | 0.068 | 0.062 | | 0.091 |
| 16 | | | | | T | T | 0.196 | 0.158 | | | 0.077 | 0.062 | | |
| 19 | | | | | T | T | T | T | | | 0.063 | 0.057 | | |
| 20 | | | | | | | | | | | T | T | | |
| 21 | | | | | 0.096 | 0.073 | | | | | | | | |
| 22 | | | | | | | | | | | 0.083 | 0.080 | | T |
| 23 | | | 0.094 | 0.070 | 0.061 | T | T | T | | | 0.091 | 0.063 | | 0.536 |
| 24 | | | | | | | 0.074 | 0.059 | | | | | | T |
| 25 | | | | | T | T | | | | | T | T | | |
| 26 | | | | | | | T | | | | T | T | | 0.053 |
| 28 | | | | | | | | | | | T | T | | |
| 29 | | | | | | | T | T | | | | | | 0.095 |
| 30A | | | | | T | T | 0.065 | 0.054 | | | 0.082 | 0.072 | 0.165 | |
| 32 | | | | | | | 0.326 | 0.232 | | | 0.088 | 0.057 | | |
| 35 | | | | | 0.066 | T | T | T | T | T | 0.091 | 0.073 | | |
| 36 | | | | | | | | | | | | T | | |
| 37 | | | | | | | 0.074 | 0.074 | | | 0.053 | 0.085 | | |
| 43 | | | | | T | T | 0.087 | 0.084 | | | 0.081 | 0.087 | | |
| 44 | | | 0.053 | 0.050 | T | T | | T | | | T | T | | |
| 45 | | | | | 0.104 | 0.075 | | | | | | | | |
| 47 | | T | | | T | T | | | | | T | T | | |
| 49 | | | | | | | T | T | | | 0.078 | 0.074 | | |
| 50 | | | | | | | | | | | | | | |
| 51 | | | | | | | | | | | | | | |
| 52 | | | | | | | | | | | 0.082 | 0.068 | | |
| 53A | | | | | | | | | | | | | | |
| 54 | | | | | | | | | 0.073 | T | T | T | | |
| 56 | | | | | | | | | | | 0.095 | 0.067 | | |
| 57 | | | | | | | | | | | T | T | | |
| 58 | | | | | | | | | | | 0.054 | T | | |
| 59A | T | T | 1.010 | 0.942 | T | T | 0.376 | 0.366 | | | | T | | |
| 61 | | | 1.570 | 1.340 | T | T | | | | | 0.072 | 0.060 | | |
| 63A | | | | | | | | | | | | | | |
| 65 | | | | | | | | | | | T | T | | |

Blank spaces = None Detected
Detection Limit = 0.05 ug/L
T = Trace (positive results below the detection limit, too low to reliably quantify)
MR = Multi Residue screen
Tri = Triazine screen

**Table 2. cont'd.** Results for 2018 Triazine Screen vs Multi Residue Screen in ug/L (ppb). The table includes the six analytes that are duplicated in the two screens plus any positive or trace detections for analytes that are only included in the Multi Residue screen.

| Well | Atrazine | | Bromacil | | Diuron | | Norflurazon | | Prometon | | Simazine | | Fludioxinil | Imidacloprid |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Number | MR | Tri | MR | Tri | MR | Tri | MR | Tri | MR | Tri | MR | Tri | MR | MR |
| 65 | | | | | | | | | | | T | T | | |
| 68 | | | | | | | | | | | | | | |
| 69 | | | 0.802 | 0.537 | T | T | | | | | T | T | | |
| 71 | | | 0.879 | 0.465 | T | T | 0.363 | 0.260 | | | 0.056 | T | | |
| 72 | | | 0.069 | 0.057 | T | T | T | T | | | 0.074 | 0.064 | | |
| 73 | | | | | | | | | | | | | | |
| 74 | | | 0.244 | 0.312 | T | | T | 0.058 | | | 0.055 | 0.073 | | |
| 75A | | | 0.562 | 0.403 | T | T | | | | | 0.078 | 0.065 | | |
| 80 | | | 1.040 | 1.070 | T | T | | | | | T | T | | |
| 84 | | | T | T | | | | | | | | | | |
| 86 | | | | | | | | T | | | T | T | | |
| 89 | | | T | T | T | T | | | | | T | T | | |
| 90 | 0.091 | 0.075 | 0.067 | 0.058 | 0.092 | 0.079 | T | T | | | 0.084 | 0.072 | | |
| 92 | | | 0.051 | | | T | 0.066 | 0.068 | | | 0.055 | T | | |
| 94 | | | | | T | T | 0.063 | 0.057 | | | T | T | | |
| 95 | | | | | | | | | | | | T | | |

Blank spaces = None Detected
Detection Limit = 0.05 ug/L
T = Trace (positive results below the detection limit, too low to reliably quantify)
MR = Multi Residue screen
Tri = Triazine screen

**Table 3.** Summary of Positive Results (other than triazine screen analytes) for Multi Residue Screen from 2014 through 2018 in ug/L (ppb).

| | | | Sample Year | | | | |
|---|---|---|---|---|---|---|---|
| Well # | Township/Range-Section | Analyte | 2014 | 2015 | 2016 | 2017 | 2018 |
| 2 | 13S22E-33 | Imidacloprid | nd | nd | nd | nd | T |
| 4 | 13S/23E-32 | Imidacloprid | nd | nd | nd | T | nd |
| 5 | 14S/21E-13 | Imidacloprid | nd | nd | nd | T | T |
| 15 | 14S/22E-14 | Imidacloprid | nd | nd | nd | 0.066 | 0.091 |
| 18 | 14S/22E-31 | Imidacloprid | 0.059 | 0.665 | Dry | Dry | Dry |
| 21 | 14S/23E-33 | Imidacloprid | NS | 0.065 | nd | nd | nd |
| 22 | 14S/23E-34 | Imidacloprid | NS | 0.120 | 0.080 | 0.090 | T |
| 23 | 14S/23E-35 | Imidacloprid | NS | 0.218 | 0.209 | 0.534 | 0.536 |
| 24 | 15S/21E-03 | Imidacloprid | nd | nd | nd | T | T |
| 26 | 15S/21E-09 | Imidacloprid | T | 0.051 | 0.072 | 0.167 | 0.053 |
| 29 | 15S/22E-03 | Imidacloprid | nd | T | nd | 5.970* | 0.095* |
| 47 | 15S/24E-14 | Imidacloprid | NS | nd | 0.644 | nd | nd |
| 48 | 15S/24E-36 | Imidacloprid | NS | nd | T | T | NLS |
| | | | | | | | |
| 37 | 15S/22E-21 | Oryzalin | T | nd | nd | nd | nd |
| 44 | 15S/23E-02 | Oryzalin | NS | T | nd | nd | nd |
| | | | | | | | |
| 29 | 15S/22E-03 | Mefenoxam/Metalaxyl | nd | T | nd | nd | nd |
| | | | | | | | |
| 74 | 19S/26E-01 | Metalachlor | NS | T | nd | nd | nd |
| | | | | | | | |
| 30A | 15S/22E-05 | Fludioxonil | NS | nd | T | 0.066 | 0.165 |
| | | | | | | | |
| 4 | 13S/23E-32 | Propanil | nd | nd | nd | 0.060 | nd |
| | | | | | | | |

nd = none detected (below detection limit of 0.05ug/L)

NS = Well not sampled in 2014 (27 wells were sampled in 2014)

Dry = Well went dry and was unable to be sampled

* = Well 29 services a house which is vacant

NLS = Well is no longer sampled

**Table 4.** Quality Control – Triazine Screen Matrix Spike Percent Recoveries

Analytes: Triazine Screen
Reporting Limit: 0.05ug/L
Lab: CDFA

QC Matrix: CDPR Ground water
Method: EM 62.9
Spike Level: 0.200ug/L

| | Percent Recovery | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Extraction Date | ACET | Atrazine | Bromacil | DACT | DEA | Diuron | DMN | Hexazinone | Norflurazon | Prometon | Simazine | Propazine |
| | 73.0 | 77.5 | 90.5 | 87.0 | 77.5 | 79.0 | 84.0 | 78.0 | 83.0 | 78.0 | 72.0 | 87.5 |
| 4/16/2018 | 64.5 | 66.0 | 70.5 | 69.5 | 60.0 | 64.5 | 69.5 | 62.5 | 75.0 | 64.5 | 67.0 | 74.5 |
| | 66.0 | 64.0 | 73.0 | 63.0 | 64.5 | 72.5 | 75.0 | 73.5 | 78.5 | 76.0 | 63.0 | |
| 4/17/2018 | 65.0 | 68.0 | 76.0 | 68.0 | 65.0 | 73.5 | 80.5 | 71.5 | 80.0 | 66.5 | 64.0 | |
| | 65.0 | 67.5 | 80.0 | 77.5 | 64.0 | 67.0 | 79.0 | 69.5 | 79.5 | 71.0 | 67.5 | 79.5 |
| 4/30/2018 | 65.0 | 65.5 | 76.0 | 83.0 | 66.5 | 66.0 | 75.0 | 70.0 | 76.5 | 73.5 | 68.5 | 72.5 |
| | 76.0 | 83.0 | 84.5 | 95.0 | 72.5 | 76.0 | 78.5 | 71.5 | 89.5 | 83.0 | 84.0 | 96.5 |
| 5/1/2018 | 68.0 | 66.5 | 72.0 | 73.0 | 61.0 | 60.0 | 72.5 | 66.5 | 67.0 | 71.5 | 73.0 | 87.5 |
| | 65.0 | 72.5 | 68.0 | 84.0 | 70.5 | 75.5 | 73.5 | 72.5 | 74.0 | 76.0 | 73.5 | 84.5 |
| 5/22/2018 | 61.5 | 67.5 | 66.0 | 84.5 | 64.0 | 69.0 | 65.5 | 66.5 | 68.5 | 70.5 | 68.0 | 76.5 |
| | 62.0 | 64.0 | 71.5 | 77.5 | 65.0 | 65.5 | 65.5 | 70.5 | 70.0 | 69.0 | 67.5 | 85.0 |
| 5/23/2018 | 65.0 | 74.5 | 76.5 | 69.0 | 73.0 | 75.5 | 77.0 | 75.0 | 78.5 | 77.0 | 74.5 | 91.5 |
| | 69.5 | 67.0 | 68.5 | 75.5 | 74.5 | 76.0 | 70.0 | 65.5 | 71.0 | 69.0 | 68.5 | 66.5 |
| 6/13/2018 | 70.5 | 69.5 | 71.0 | 75.5 | 78.5 | 78.0 | 70.5 | 68.5 | 75.5 | 72.0 | 70.5 | 67.5 |
| | 72.0 | 81.5 | 80.0 | 83.0 | 84.0 | 82.0 | 76.5 | 78.0 | 79.5 | 85.5 | 82.0 | 79.5 |
| 6/21/2018 | 73.0 | 79.0 | 81.5 | 88.5 | 84.0 | 81.0 | 84.0 | 78.5 | 82.5 | 85.5 | 78.5 | 82.0 |
| Mean | 67.6 | 70.8 | 75.3 | 78.3 | 70.3 | 73 | 74.8 | 71.1 | 76.8 | 74.3 | 71.4 | 80.8 |
| SD | 4.3 | 6.3 | 6.6 | 8.7 | 7.7 | 6.5 | 5.7 | 4.7 | 5.9 | 6.4 | 6.0 | 8.8 |
| | | | | | | | | | | | | |
| Observed Minimum | 61.5 | 64.0 | 66.0 | 63.0 | 60.0 | 60.0 | 65.5 | 62.5 | 67.0 | 64.5 | 63.0 | 66.5 |
| LCL | 53.8 | 52.3 | 55.0 | 57.0 | 48.8 | 53.0 | 55.8 | 57.2 | 54.5 | 56.0 | 56.5 | 52.9 |
| UCL | 82.7 | 92.7 | 92.9 | 104 | 96.6 | 94.7 | 90.9 | 85.4 | 96.7 | 95.8 | 91.5 | 111 |
| Observed Maximum | 76.0 | 83.0 | 90.5 | 95.0 | 84.0 | 82.0 | 84.0 | 78.5 | 89.5 | 85.5 | 84.0 | 96.5 |

New Control Limit based on 2017 QC Data

LCL = Lower Control Limit : Method Validation Mean minus 3 X SD

UCL = Upper Control Limit : Method Validation Mean plus 3 X SD

One matrix blank was run with each extraction set, no detections were found.

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

**Table 5.** Quality Control – Multi Residue LC/MS Screen Matrix Spike Percent Recoveries

Analytes: Multi Residue LC/MS Screen
Reporting Limit: 0.05ug/L
Lab: CDFA

QC Matrix: CDPR Ground water
Method: EMON-SM-05-032
Spike Level: 0.200ug/L

| | Percent Recovery (%) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Extraction Date | Atrazine | Azinphos-methyl | Azoxystrobin | Bensulide | Bromacil | Carbaryl | Carbofuran | Diazinon | Dimethenamide | Dimethoate | Diuron | Ethofumesate | Fenamiphos | Fludioxonil | Imidacloprid | Linuron | Mefenoxam/Metalaxyl | Methiocarb | Metolachlor | Metribuzin | Napropamide | Norflurazon | Oryzalin | Prometon | Simazine | Tebuthiuron | Thiamethoxam | Thiobencarb | Uniconazole |
| 4/18/2018 | 99.0 | 99.5 | 98.0 | 95.5 | 101 | 106 | 103 | 104 | 105 | 103 | 111 | 94.5 | 89.0 | 105 | 103 | 102 | 103 | 105 | 102 | 98.0 | 102 | 99.5 | 83.0 | 104 | 104 | 103 | 92.0 | 103 | 90.5 |
| 4/27/2018 | 92.0 | 97.0 | 100 | 91.0 | 87.5 | 93.0 | 93.5 | 101 | 94.5 | 90.5 | 96.5 | 93.0 | 76.5 | 92.5 | 87.5 | 95.5 | 96.5 | 94.0 | 94.5 | 89.0 | 94.0 | 96.5 | 82.5 | 95.0 | 93.5 | 95.0 | 82.5 | 94.0 | 86.0 |
| 5/22/2018 | 93.0 | 97.5 | 80.0 | 89.5 | 89.5 | 98.0 | 95.5 | 93.0 | 94.5 | 92.5 | 99.0 | 87.5 | 71.5 | 96.5 | 93.5 | 96.5 | 96.5 | 93.0 | 90.5 | 93.5 | 92.5 | 97.5 | 86.0 | 96.0 | 95.0 | 94.5 | 87.5 | 90.5 | 83.0 |
| 5/21/2018 | 86.0 | 96.0 | 86.0 | 91.5 | 81.5 | 90.5 | 90.5 | 90.5 | 93.0 | 87.0 | 94.0 | 75.5 | 80.0 | 89.5 | 88.0 | 87.5 | 95.0 | 89.0 | 92.0 | 90.0 | 90.0 | 97.0 | 94.0 | 91.5 | 89.0 | 92.5 | 82.0 | 89.5 | 86.0 |
| 6/19/2018 | 93.5 | 93.5 | 86.0 | 94.0 | 85.0 | 95.5 | 96.5 | 95.5 | 95.5 | 93.5 | 95.0 | 92.0 | 89.5 | 90.5 | 93.0 | 95.5 | 96.0 | 94.0 | 95.5 | 93.5 | 94.5 | 99.0 | 98.0 | 96.5 | 94.0 | 101 | 84.5 | 97.0 | 91.0 |
| Mean | 92.7 | 96.7 | 90.0 | 92.3 | 88.9 | 96.6 | 95.8 | 96.8 | 96.5 | 93.3 | 99.1 | 88.5 | 81.3 | 94.8 | 93.0 | 95.4 | 97.4 | 95.0 | 94.9 | 92.8 | 94.6 | 97.9 | 88.7 | 96.6 | 95.1 | 97.2 | 85.7 | 94.8 | 87.3 |
| SD | 4.6 | 2.2 | 8.6 | 2.4 | 7.4 | 6.0 | 4.6 | 5.6 | 4.8 | 6.0 | 6.9 | 7.7 | 7.9 | 6.3 | 6.2 | 5.2 | 3.2 | 6.0 | 4.4 | 3.5 | 4.5 | 1.3 | 6.9 | 4.6 | 5.5 | 4.5 | 4.1 | 5.5 | 3.4 |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Observed Minimum | 86.0 | 93.5 | 80.0 | 89.5 | 81.5 | 90.5 | 90.5 | 90.5 | 93.0 | 87.0 | 94.0 | 75.5 | 71.5 | 89.5 | 87.5 | 87.5 | 95.0 | 89.0 | 90.5 | 89.0 | 90.0 | 96.5 | 82.5 | 91.5 | 89.0 | 92.5 | 82.0 | 89.5 | 83.0 |
| LCL | 73.1 | 50.9 | 74.3 | 62.3 | 75.2 | 64.1 | 75.7 | 61.7 | 71.0 | 72.5 | 76.9 | 45.9 | 73.5 | 62.1 | 70.7 | 76.1 | 74.7 | 67.7 | 68.0 | 75.7 | 76.7 | 79.3 | 79.6 | 79.7 | 75.3 | 69.7 | 65.5 | 75.0 | 79.4 |
| UCL | 115 | 151 | 126 | 130 | 109 | 144 | 115 | 116 | 118 | 116 | 115 | 133 | 118 | 123 | 118 | 113 | 120 | 140 | 134 | 111 | 116 | 114 | 113 | 118 | 111 | 130 | 107 | 114 | 117 |
| Observed Maximum | 99.0 | 99.5 | 100 | 95.5 | 101 | 106 | 103 | 104 | 105 | 103 | 111 | 94.5 | 89.5 | 105 | 103 | 102 | 103 | 105 | 102 | 98 | 102 | 100 | 98.0 | 104 | 104 | 103 | 92.0 | 103 | 91.0 |

LCL = Lower Control Limit : Method Validation Mean minus 3 X SD

UCL = Upper Control Limit : Method Validation Mean plus 3 X SD

One matrix blank was run with each extraction set, no detections were found.

**Table 6.** Quality Control – Multi Residue GC/MS Screen Matrix Spike Percent Recoveries

Analytes: Multi Residue GC/MS Screen
Reporting Limit: 0.05ug/L
Lab: CDFA

QC Matrix: CDPR Ground water
Method: EMON-SM-05-032
Spike Level: 0.100ug/L

| | Percent Recovery (%) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Extraction Date | Alachlor | Clomazone | Dichloran | Dichlorbenil | Disulfoton | Ethoprophos | Ethyl Parathion | Fonofos | Malathion | Methyl Parathion | Phorate | Piperonyl Butoxide | Prometryn | Propanil | Triallate |
| 4/18/2018 | 83.5 | 75.5 | 81.9 | 77.6 | 89.4 | 71.5 | 113.0 | 82.3 | 93.2 | 105.0 | 88.1 | 70.0 | 91.7 | 87.0 | 77.5 |
| 4/27/2018 | 76.4 | 72.6 | 82.0 | 73.5 | 43.0 | 78.8 | 89.9 | 76.4 | 79.6 | 90.8 | 73.7 | 106.0 | 83.6 | 80.7 | 68.9 |
| 5/21/2018 | 109 | 107 | 104 | 108 | 83 | 105 | 111 | 104 | 111 | 115 | 105 | 137 | 124 | 109 | 97 |
| 5/22/2018 | 98.0 | 101 | 127 | 98.4 | 77.8 | 92.1 | 148 | 95.0 | 106 | 136 | 90.0 | 165 | 119.0 | 128 | 94.0 |
| 6/19/2018 | 102 | 96.5 | 104 | 99.1 | 97.1 | 97.4 | 120 | 104 | 105 | 120 | 107 | 107 | 123 | 101 | 94.5 |
| Mean | 93.8 | 90.5 | 99.8 | 91.3 | 78.1 | 89.0 | 116.4 | 92.3 | 99.0 | 113.4 | 92.8 | 117.0 | 108.3 | 101.1 | 86.4 |
| SD | 13.5 | 15.5 | 18.8 | 15.0 | 20.9 | 13.7 | 20.9 | 12.6 | 12.6 | 16.9 | 13.6 | 35.8 | 19.1 | 18.7 | 12.5 |
| | | | | | | | | | | | | | | | |
| Observed Minimum | 76.4 | 72.6 | 81.9 | 73.5 | 43.0 | 71.5 | 89.9 | 76.4 | 79.6 | 90.8 | 73.7 | 70.0 | 83.6 | 80.7 | 68.9 |
| LCL | 54.9 | 42.4 | 51.3 | 34.7 | 34.7 | 52.0 | 55.1 | 48.4 | 51.0 | 54.8 | 61.5 | 32.3 | 46.3 | 58.2 | 52.0 |
| UCL | 140 | 156 | 148 | 149 | 144 | 144 | 151 | 147 | 163 | 150 | 141 | 186 | 156 | 149 | 144 |
| Observed Maximum | 109 | 107 | 127 | 108 | 97 | 105 | 148 | 104 | 111 | 136 | 107 | 165 | 124 | 128 | 97 |

LCL = Lower Control Limit : Method Validation Mean minus 3 X SD

UCL = Upper Control Limit : Method Validation Mean plus 3 X SD

One matrix blank was run with each extraction set, no detections were found.

**Table 7.** Quality Control – Dacthal, MTP, and TPA Matrix Spike Percent Recoveries

| Analytes: Dacthal and Degradates | QC Matrix: CDPR Ground water |
|---|---|
| Reporting Limit: 0.05ug/L | Method: EMON-SM-05-040 |
| Lab: CDFA | Spike Level: 0.200ug/L |

| | Percent Recovery (%) | | |
|---|---|---|---|
| Extraction Date | DCPA | TPA | MTP |
| 4/13/2018 | 66.0 | 99.0 | 97.5 |
| 5/4/2018 | 83.5 | 96.5 | 90.0 |
| 6/1/2018 | 65.5 | 80.0 | 69.0 |
| 6/20/2018 | 76.0 | 96.0 | 79.0 |
| Mean | 72.8 | 92.9 | 83.9 |
| SD | 8.6 | 8.7 | 12.5 |
| | | | |
| Observed Minimum | 65.5 | 80.0 | 69.0 |
| LCL | 57.4 | 48.5 | 73.3 |
| UCL | 84.4 | 104 | 115 |
| Observed Maximum | 83.5 | 99.0 | 97.5 |

LCL = Lower Control Limit : Method Validation Mean minus 3 X SD

UCL = Upper Control Limit : Method Validation Mean plus 3 X SD

One matrix blank was run with each extraction set, no detections were found.

**Table 8.** Quality Control – Triazine, Multi Residue, and Dacthal Blind Spike Percent Recoveries

| Extraction Date | Analyte | Spike Level (ppb) | Result (ppb) | % Recovery | Control limit exceeded |
|---|---|---|---|---|---|
| | Multi Residue Screen | | | | |
| | Diazinon | 0.15 | 0.177 | 118% | Yes |
| | Imidacloprid | 0.2 | 0.198 | 99.0% | No |
| | Oryzalin | 0.25 | 0.242 | 96.8% | No |
| | Alachlor | 0.15 | 0.145 | 96.7% | No |
| 4/13/2018 | Malathion | 0.1 | 0.0872 | 87.2% | No |
| | Carbaryl | 0.25 | 0.217 | 86.8% | No |
| | Dimethoate | 0.15 | 0.146 | 97.3% | No |
| | Fenamiphos | 0.2 | 0.182 | 91.0% | No |
| | Fonofos | 0.15 | 0.175 | 117% | No |
| 5/17/2018 | Prometryn | 0.1 | 0.113 | 113% | No |
| | Atrazine | 0.1 | 0.098 | 98.0% | No |
| 6/19/2018 | Diuron | 0.2 | 0.218 | 109% | No |
| | Triazine Screen | | | | |
| | Bromacil | 0.2 | 0.163 | 81.5% | No |
| | DACT | 0.3 | 0.343 | 114% | No |
| | Norflurazon | 0.25 | 0.209 | 83.6% | No |
| 5/23/2018 | Simazine | 0.15 | 0.13 | 86.7% | No |
| | Dacthal | | | | |
| | DCPA | 0.20 | 0.181 | 90.5% | No |
| | MTP | 0.25 | 0.27 | 108% | No |
| 4/13/2018 | TPA | 0.30 | 0.314 | 105% | No |

Diazinon spike recovery of 118% exceeded Upper Control Limit of 116%