

Summary Report of Pesticide Sampling
Delaware Department of Agriculture
Pesticides Section
2013 Groundwater Monitoring Results

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Hydrologist III

INTRODUCTION

In 1995, the Delaware Department of Agriculture (DDA) designed a shallow groundwater monitoring network with the assistance of the Delaware Geological Survey (DGS). The network currently consists of one hundred and four (104) dedicated monitoring wells located throughout the state south of the Chesapeake and Delaware Canal (C&D Canal). The wells are used primarily to monitor the state's shallow groundwater for pesticides of interest.

DDA pesticide monitoring wells are located primarily on roadsides in state rights-of-way. Wells are screened in the Columbia aquifer. All wells are considered shallow, with the bottom of screen depths less than 40 feet below ground surface. Well depths range from 8.35 feet to 38.70 feet. Most of the wells, however, are significantly shallower than 40 feet. The average completion depth for all 104 currently active monitoring wells is 16.10 feet. The monitoring wells were screened across the water table surface at the time of drilling, as determined by geologic core analysis.

Since the network was initially designed to monitor groundwater for agricultural herbicides, all of the monitoring wells are located below the C&D Canal, where most of the state's agricultural land is located. The wells were originally located such that a well is within 3 miles of all areas in the state below the C&D Canal where significant quantities of agricultural pesticides were applied. This requirement generally excludes land above the C&D Canal, areas within incorporated towns and cities, and areas along the coast where land is largely marsh and wetlands.

Land use throughout the study area has changed significantly in the years since the network's initial inception. Many wells in previously agricultural areas are now in suburban or light industrial land uses. With that shift in land use comes a shift in pesticide usage patterns. The Hydrologist has addressed this by working with the Pesticide Administrator and the EPA Region III Project Leader to select the most appropriate analyte list for sampling, within budgetary constraints. For example, the Hydrologist petitioned for EPA Special Project Funding in 2011 to analyze samples from the entire network using the S150 method, which detects a range of commonly used turfgrass pesticides.

GOAL OF PROGRAM

The DDA Hydrologist conducts annual groundwater sampling activities utilizing the statewide network of shallow monitoring wells. These wells are located throughout the region of the state (the portion of the state located south of the Chesapeake and Delaware Canal) that utilizes groundwater as the sole drinking water source.

The purpose of the DDA's monitoring network is to monitor the state's shallow groundwater for pesticides of interest that are registered for use in the state. The Hydrologist works with the Pesticide Administrator and the EPA Region III Project Leader to determine the optimal strategy for sampling each year. This strategy includes assessing which compounds can be included in laboratory analysis within the limits of budget and other resources. Currently, the analyte list is determined largely by the list of Pesticides of Interest (POIs), delineated in the EPA's Pesticides of Interest National Tracking System (POINTS). In addition to analyzing for POIs, additional compounds can be added to the analyte list after deliberation with the aforementioned parties.

Since 2007, the EPA has been operating a web-based Pesticides of Interest National Tracking System (POINTS). States, tribes, and territories are obliged to evaluate each of the 57 Pesticides of Interest (POI) active ingredients based on the respective level of concern for each POI.

This list of 57 compounds was originally compiled from results from a nationwide survey of FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act) state lead agencies (SLAs). The DDA Pesticide Section is the SLA for Delaware. These 57 compounds were found to be of greatest concern for FIFRA SLAs across the nation. The EPA then tasked each state's FIFRA SLA to evaluate the entire POINTS compound list based each state's respective concerns about the compounds in that state. The DDA Pesticide Section must therefore use a variety of evaluation tools to determine its respective levels of concern about each POI active ingredient. One of these evaluation tools is groundwater monitoring. Because a majority of the state's population (65%) depends on groundwater for drinking water, Delaware emphasizes the value of groundwater monitoring for evaluating the risks of individual pesticides.

The Hydrologist and Pesticide Administrator have determined that alachlor, atrazine, metolachlor, and simazine are Pesticides of Concern (POCs) in Delaware, mainly due to their widespread use in the state and their potential for contamination of the shallow groundwater. As part of POINTS, POCs must be "actively managed," and a large part of this active management conducted by the DDA involves yearly monitoring of these four compounds across the monitoring well network.

SAMPLE METHODOLOGY

During the 2013 sampling season, the Hydrologist obtained groundwater samples for analysis using the EPA 525.2 method. Groundwater sampling activities were conducted in accordance with the Section's Quality Assurance documents, including the Quality Management Plan (2013), Groundwater Standard Operating Procedure (SOP) document (Mensch, 2010), and Groundwater Quality Assurance Project Plan (QAPP) (Mensch, 2013).

Wells are purged using an electric submersible pump run on a Geotech® rechargeable 12 V field battery. Purge water is run through a flow cell where chemical parameters such as pH, electrical conductivity, and temperature are monitored at 5 minute intervals. Once the chemical parameters have stabilized a sample is collected using the laboratory's sample bottle. For most analytical methods previously used, this bottle consists of a 1 liter amber glass bottle with preservatives (added by laboratory personnel prior to acquisition by the Hydrologist). Sample bottles are labeled with the date, location, time of collection, and analytical method to be used. Samples are kept in a dedicated low residue groundwater sample cooler on ice until transfer to a locked low residue refrigerator. The Hydrologist coordinates with the laboratory to ensure that samples are delivered well within the analytical method's holding period.

SAMPLE SCHEDULING:

The DDA Hydrologist sampled the wells between March 27th and May 14th, 2013. This is the typical schedule for pesticide residue sampling, which usually occurs in early spring.

LABORATORY ANALYSIS

Groundwater samples were analyzed using the EPA Drinking Water 525.2 method. This method is used primarily to detect the presence of semivolatile compounds (SOCs) in drinking water, including alachlor, atrazine, metolachlor, and simazine. The Hydrologist submitted groundwater samples for laboratory analysis to QC Laboratories in Southampton, PA. A full analyte list, including respective Minimum Reporting Limits (MRLs), is located for reference in the appendix.

RESULTS

The following compounds were detected in one or more groundwater sample: atrazine, metolachlor, and simazine. None of the other pesticide analytes were detected at or above the respective Minimum Reporting Levels (MRLs), including POC alachlor.

Atrazine was detected in 10.8% of the wells, metolachlor in 2%, and simazine in 2.9%. All of the detections were below DDA's action level of 1.5 ppb (1/2 EPA's Maximum Contamination Level [MCL] of 3.0 ppb), with one exception (DDA ID PCMN-105) described below.

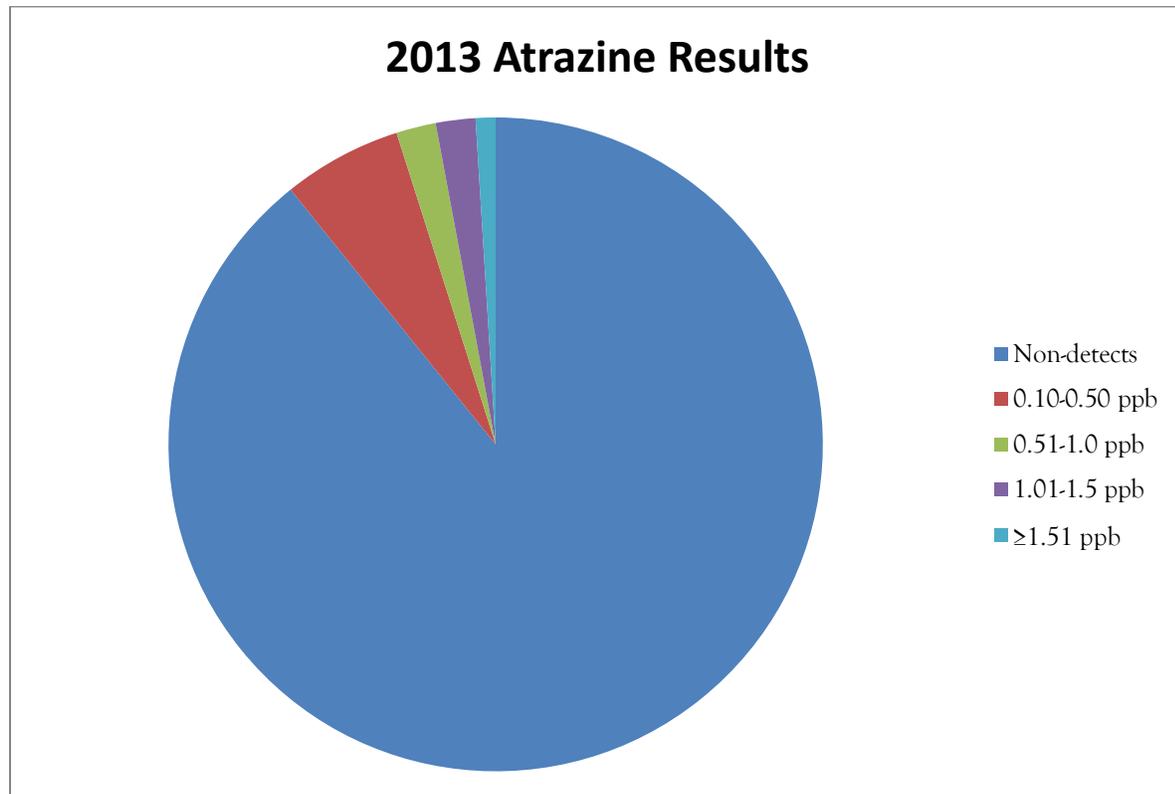
2013 Pesticide Residue Detections in DDA Monitoring Wells (results in µg/L or ppb)

Compound	Number of Detections	Detection Range	Minimum Reporting Limit
Atrazine	11	0.104 – 3.16	0.1
Metolachlor	2	0.191 – 0.383	0.1
Simazine	3	0.669 – 0.970	0.1

As in previous years, atrazine was both the compound most frequently detected and the compound with the highest residue levels.

2013 Atrazine Detections in DDA Monitoring Wells

Detection Range	Number of Wells	Percentage of Total Sampled (n = 102)
Non-detect (< 0.10 ppb)	91	89
0.10 – 0.50 ppb	6	6
0.51 – 1.0 ppb	2	2
1.01 – 1.50 ppb	2	2
≥ 1.51 ppb	1	1



Reporting Limit (RL) = 0.10 ppb Non-detects = Below RL of 0.10 ppb ppb = Parts per Billion

Maximum Contamination Level Exceedance

One well located in a highly agricultural area of New Castle County (DDA ID PCMN-105) had a high concentration of atrazine (3.16 ppb), metolachlor (0.383 ppb), and simazine (0.970 ppb). The atrazine result for this well was well above the mean atrazine residue level in the 10 other wells in the monitoring network that also had atrazine detections (mean level = 0.461 ppb). This well has been the subject of an ongoing investigation involving the DDA, Public Health, and DNREC. This well is being sampled at an increased frequency to monitor the levels of atrazine, metolachlor, and simazine. The levels of atrazine and metolachlor have fallen from those found in the spring of 2011 (5.65 ppb atrazine, 2.20 ppb metolachlor).

The level of atrazine exceeded the EPA's Maximum Contamination Level (MCL) of 3 ppb. Because of this high concentration, a three-part response was initiated in 2011. This response involves (1) resampling the well for the exceedance compound, (2) sampling any potentially affected nearby domestic wells, and (3) initiating an investigation with the DDA Pesticide Inspector. This well was resampled and is now on a high frequency resample schedule. After consulting with the state agency responsible for permitting drinking water wells, the Department of Natural Resources and Environmental Control, a list of drinking water wells was assembled. Homeowners either had their wells sampled or, in the case of homeowner refusal, an informational packet with contact information was given out. This well is currently being sampled at a higher frequency to monitor residue levels.

Appendix

Monitoring Well Results Spring 2013

Analytical Method for Spring 2013

Analytical method used: 525.2 method (run by QC Laboratories,
Southampton, PA, formerly Atlantic Coast Laboratories, New Castle, DE)

EPA 525.2 Method	
Compound	MRL (ppb)
Alachlor	0.1
Atrazine	0.1
Metolachlor	0.1
Simazine	0.1

MRL = Minimum Reporting Limit
Results in parts per billion (ppb)

DDA ID	DGS ID	DNREC ID	Alachlor (ppb)	Atrazine (ppb)	Metolachlor (ppb)	Simazine (ppb)	Date Sampled	
90	Ea44-13	108634	nd	nd	nd	nd	4/15	
92	Eb35-23	108633	nd	nd	nd	nd	4/15	
96	Fa45-07	106882	nd	1.36	nd	0.669	4/15	
98	Fb22-15	106879	nd	0.645	nd	nd	4/15	
102	Fc11-23	106883	nd	nd	nd	nd	4/15	
103	Fc12-26	108632	nd	nd	nd	nd	4/15	
105	Gb11-07	106884	nd	3.16	0.383	0.970	4/9	
107	Gb21-10	106885	nd	nd	nd	nd	4/9	
108	Gb53-02	106890	nd	nd	nd	nd	4/9	
109	Gc44-07	108635	nd	nd	nd	nd	4/17	
110	Hc11-11	106888	nd	nd	nd	nd	4/17	
111	Hc14-15	106889	nd	nd	nd	nd	4/17	
121	Od44-02	90221	nd	nd	nd	nd	4/1	
123	Qi31-03	62670	nd	nd	nd	nd	5/2	
125	Fb54-09	110406	nd	0.239	nd	nd	5/15	
130	Mf45-07	155945	dry					
131	Og11-08	155950	nd	nd	nd	nd	4/4	
132	Oh42-07	155951	nd	nd	nd	nd	4/23	
133	Ph34-15	155953	nd	nd	nd	nd	4/23	
135	Nc41-02	155959	nd	nd	nd	nd	4/16	
136	Od22-04	155961	nd	0.134	nd	nd	4/1	
137	Nd25-12	155967	nd	nd	nd	nd	4/3	
138	Pg51-07	155968	nd	nd	nd	nd	4/16	
139	Qc43-06	155969	nd	nd	nd	nd	5/14	
140	Re13-01	155970	nd	nd	nd	nd	5/13	
141	Rf13-02	155971	nd	0.392	nd	nd	5/13	
142	Qc13-01	155972	nd	nd	nd	nd	4/25	
143	Pd34-03	155973	nd	nd	nd	nd	4/25	
144	Pb15-06	155974	nd	nd	nd	nd	4/23	

145	Rh33-03	155975	dry				
146	Kb32-29	155978	nd	nd	nd	nd	3/27
147	Mc43-06	155980	nd	0.504	0.191	0.774	4/3
148	Lc12-02	155982	nd	nd	nd	nd	3/27
149	Ic43-01	155984	nd	nd	nd	nd	4/8
150	Id14-03	155985	nd	nd	nd	nd	4/8
151	Hd14-02	155986	nd	nd	nd	nd	4/8
153	Ec54-08	166269	nd	nd	nd	nd	4/15
155	Gb45-20	166266	nd	nd	nd	nd	4/9
157	Hd51-12	166265	nd	nd	nd	nd	4/8
159	Jd55-10	166262	nd	nd	nd	nd	3/27
160	Ld33-10	166259	nd	nd	nd	nd	3/27
161	Lb52-07	166258	nd	nd	nd	nd	4/3
162	Mb45-09	166230	nd	nd	nd	nd	4/3
163	Nf52-02	166168	nd	nd	nd	nd	4/1
164	Oc45-08	166199	nd	nd	nd	nd	5/14
165	Nd55-06	166200	nd	nd	nd	nd	4/1
166	Lf55-02	166170	nd	nd	nd	nd	4/22
167	Oi13-06	166167	nd	nd	nd	nd	4/22
168	Ng44-05	166169	nd	nd	nd	nd	4/10
169	Og32-07	166198	nd	nd	nd	nd	4/4
171	Qi13-06	166163	nd	nd	nd	nd	5/2
172	Qh13-05	166166	nd	nd	nd	nd	5/2
173	Qh55-06	166164	nd	nd	nd	nd	5/13
174	Qg32-18	166165	nd	nd	nd	nd	5/13
175	Pg22-06	166189	nd	nd	nd	nd	4/23
176	Pd54-03	166186	nd	nd	nd	nd	4/25
177	Qf31-03	166188	nd	nd	nd	nd	5/13
178	Hb22-17	172331	nd	nd	nd	nd	4/9
179	Ib12-03	172353	nd	nd	nd	nd	4/9
180	Ic21-08	172352	nd	nd	nd	nd	4/9
181	Jb13-13	172354	nd	nd	nd	nd	4/8
182	Lc44-07	172325	nd	nd	nd	nd	3/27
183	Lb23-03	172347	nd	nd	nd	nd	3/27
184	Je34-04	172349	nd	nd	nd	nd	4/8
185	Ie32-02	172350	nd	nd	nd	nd	4/8
187	Jb42-05	172323	nd	nd	nd	nd	4/8
188	Lb15-17	172301	nd	nd	nd	nd	3/27
189	Le24-11	172300	nd	nd	nd	nd	4/10
190	Ke33-22	172318	nd	nd	nd	nd	4/8
191	Jc52-04	172322	nd	nd	nd	nd	3/27
192	Le53-15	172298	nd	nd	nd	nd	4/4
193	Md24-08	172299	nd	nd	nd	nd	4/3
194	Nf24-05	172295	nd	nd	nd	nd	4/1
195	Og15-07	172328	nd	nd	nd	nd	4/10
196	Oi32-18	172294	nd	nd	nd	nd	4/29
197	Qi33-22	172288	nd	nd	nd	nd	5/2

199	Qf23-08	172315	nd	nd	nd	nd	5/13
200	Oe35-03	172317	nd	nd	nd	nd	4/1
201	Pf12-01	172316	nd	nd	nd	nd	4/25
202	Pe12-05	172326	nd	nd	nd	nd	4/25
203	Pf41-02	172327	nd	nd	nd	nd	4/25
204	Rb25-04	172311	nd	nd	nd	nd	5/14
205	Qb35-08	172312	nd	nd	nd	nd	5/14
206	Qd45-01	172304	nd	nd	nd	nd	5/14
207	Qd51-09	172306	nd	nd	nd	nd	5/14
208	Pb35-06	172314	nd	0.128	nd	nd	4/16
209	Ob24-06	172319	nd	nd	nd	nd	4/16
210	Nd31-06	172320	nd	nd	nd	nd	5/14
211	Mf31-03	172297	nd	nd	nd	nd	4/1
212	Kd13-09	176048	nd	0.104	nd	nd	3/27
213	Kc34-05	176049	nd	nd	nd	nd	4/16
214	Me52-03	176050	nd	1.43	nd	nd	4/3
215	Ne23-03	176051	nd	nd	nd	nd	4/1
216	Pc44-07	176053	nd	nd	nd	nd	4/25
217	Qh52-05	176054	nd	nd	nd	nd	5/13
218	Ri22-09	176055	nd	nd	nd	nd	5/13
219	Hc52-06	172351	nd	nd	nd	nd	4/17
220	Qi35-08	103552	nd	nd	nd	nd	5/2
221	Pg45-29	223404	nd	nd	nd	nd	4/23
222	Ng33-15	223403	nd	nd	nd	nd	4/1
223	Kf53-62	223519	nd	0.132	nd	nd	4/10
224	Mc21-24	223520	nd	nd	nd	nd	4/3
225	Lc23-08	223521	nd	nd	nd	nd	3/27
226	Gc13-09	223402	nd	nd	nd	nd	4/17

MRL*

0.1

0.1

0.1

0.1

MRL* = Minimum Reporting Limit

Delaware Department of Agriculture Groundwater Monitoring Program
 Minimum Reporting Limits (MRLS) and Analyte List - EPA 525.2 Method
 2013 Sampling Season

QC Laboratories

Analytical Report

GAS CHROMATOGRAPHY MASS SPECTROMETRY; SEMI-VOLATILES

Analyte	CAS	Analytical Method	MRL (ppb)	MDL (ppb)
Acenaphthylene	208-96-8	EPA 525.2	0.1	0.0130
Alachlor	15972-60-8	EPA 525.2	0.1	0.0340
Anthracene	120-12-7	EPA 525.2	0.1	0.0110
Atrazine	1912-24-9	EPA 525.2	0.1	0.0290
Benzo(a)anthracene	56-55-3	EPA 525.2	0.1	0.0150
Benzo(a)pyrene	50-32-8	EPA 525.2	0.1	0.0210
Benzo(b)fluoranthene	205-99-2	EPA 525.2	0.1	0.0260
Benzo(g,h,i)perylene	191-24-2	EPA 525.2	0.1	0.0420
Benzo(k)fluoranthene	207-08-9	EPA 525.2	0.1	0.0160
Bis(2-ethylhexyl)adipate	103-23-1	EPA 525.2	0.1	0.0230
Bis(2-ethylhexyl)phthalate	117-81-7	EPA 525.2	0.1	0.0680
Butachlor	23184-66-9	EPA 525.2	0.1	0.4100
Butylbenzylphthalate	85-68-7	EPA 525.2	0.1	0.0180
Chrysene	218-01-9	EPA 525.2	0.1	0.0120
Di-n-butylphthalate	84-74-2	EPA 525.2	0.1	0.0370
Di-n-octylphthalate	117-84-0	EPA 525.2	0.1	0.0550
Dibenz(a,h)anthracene	53-70-3	EPA 525.2	0.1	0.0320
Diethylphthalate	84-66-2	EPA 525.2	0.1	0.0240
Dimethylphthalate	131-11-3	EPA 525.2	0.1	0.0230
Fluoranthene	206-44-0	EPA 525.2	0.1	0.0160
Fluorene	86-73-7	EPA 525.2	0.1	0.0200
Hexachlorobenzene	118-74-1	EPA 525.2	0.1	0.0170
Hexachlorocyclopentadiene	77-47-4	EPA 525.2	0.1	0.0180
Indeno(1,2,3-cd)pyrene	193-39-5	EPA 525.2	0.1	0.0320
Metolachlor	51218-45-2	EPA 525.2	0.1	0.0370
Metribuzin	21087-64-9	EPA 525.2	0.1	0.0120
Naphthalene	91-20-3	EPA 525.2	0.1	0.0180
Phenanthrene	85-01-8	EPA 525.2	0.1	0.0140
Pyrene	129-00-0	EPA 525.2	0.1	0.2100
Simazine	122-34-9	EPA 525.2	0.1	0.0680