

IOWA'S WATER

Ambient Monitoring Program

Iowa Community Private Well Study

Limited information is available on drinking water quality in small incorporated Iowa communities served exclusively by private wells. These wells generally provide water to more than 2 but fewer than 25 households. Under the Safe Drinking Water Act (SDWA), regular monitoring of these wells is not required. Many of these communities use private wells that tap shallow, vulnerable aquifers, which may be at risk of contamination from nearby urban and agricultural pollutant sources. During the summer and fall of 2003, the Iowa Community Private Well Study (ICPWS) examined the quality of water from private wells in incorporated communities across Iowa. This study included both a random and focus study design.

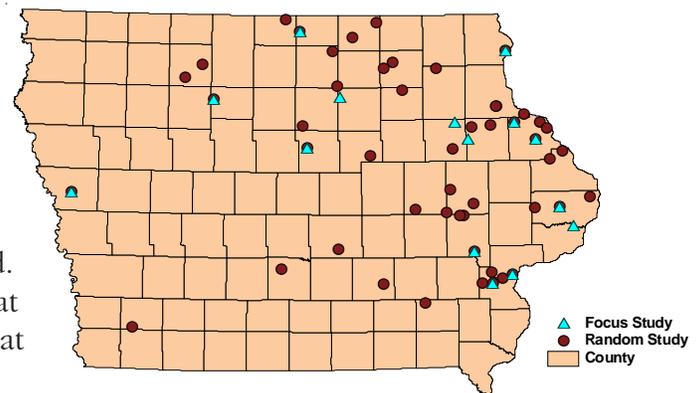


Figure 1. Location of communities sampled.

Random Study

Random Study Design. The ICPWS included a one-time sampling of 103 randomly selected private wells in 50 incorporated Iowa communities without municipal water systems or rural water connections (Figure 1). Due to the prevalence of rural water systems in western and southern Iowa, the regional distribution of study wells was concentrated in the eastern portion of the state (Figure 1). County sanitarians collected water samples and completed a well construction and contaminant site survey of each well sampled. Water samples were analyzed for pesticides, nitrate, ammonia, arsenic, total coliform bacteria, and some industrial chemicals and gasoline constituents.

Random Study Results. Thirty-two percent of the wells had a pesticide detection (Table 1). Atrazine was found in 19% of the wells. Two atrazine degradates, or breakdown products, desethylatrazine (DEA) and desisopropylatrazine (DIA) were detected in 28% and 4% of the wells, respectively, and the pesticide metolachlor was found in 4%. Other common contaminants were nitrate-N (nitrate expressed as nitrogen) at 57%, ammonia (41%), arsenic (26%) and total coliform bacteria (30%). Three wells had arsenic above the

Table 1. Summary of random study results by region (values in percent detection).

Contaminant	East-central (60 wells)	North-central (9 wells)	Northeast (24 wells)	South-central (5 wells)	Southwest (5 wells)	Total across regions (103 wells)
Atrazine	28%	0%	13%	0%	0%	19%
DEA	35%	11%	29%	0%	0%	28%
DIA	7%	0%	0%	0%	0%	4%
Metolachlor	7%	0%	0%	0%	0%	4%
Any pesticide ⁺	42%	11%	29%	0%	0%	32%
Nitrate-N	55%	33%	63%	60%	100%	57%
Ammonia	38%	89%	33%	60%	0%	41%
Total arsenic	28%	56%	17%	0%	20%	26%
Total coliform bacteria	30%	67%	21%	40%	0%	30%

+ Includes acetochlor, alachlor, atrazine, cyanazine, DEA, DIA, metolachlor, prometon

U.S. Environmental Protection Agency’s (U.S. EPA) drinking water standard (0.01 milligrams per liter, mg/L), while 24 wells exceeded the nitrate-N standard (10 mg/L). Since the wells sampled as part of this study are privately owned, they are not required to meet these standards.

Shallow wells had a higher detection frequency of nitrate-N and pesticides, yet a lower detection of arsenic and coliform bacteria (Figure 2). Of the wells sampled, elevated nitrate-N concentrations (>10 mg/L) were more prevalent in sand point wells and in wells that were not cased.

Comparison of ICPWS to SWRL

During 1988 and 1989, 686 private rural wells across Iowa were sampled as part of the Statewide Rural Well Water Study (SWRL). Although the SWRL wells were rural private wells, results from that study can provide perspective for the ICPWS results. Laboratory method detection limits have changed since SWRL, so only ICPWS atrazine compound detections greater than the 1988-89 detection limits are in Table 2.

On a statewide basis, ICPWS wells had a higher detection frequency than SWRL wells for DEA, total atrazine, and nitrate-N. The same was true for wells located in northeast Iowa. ICPWS wells located in east-central Iowa had a higher detection frequency also for atrazine and DIA.

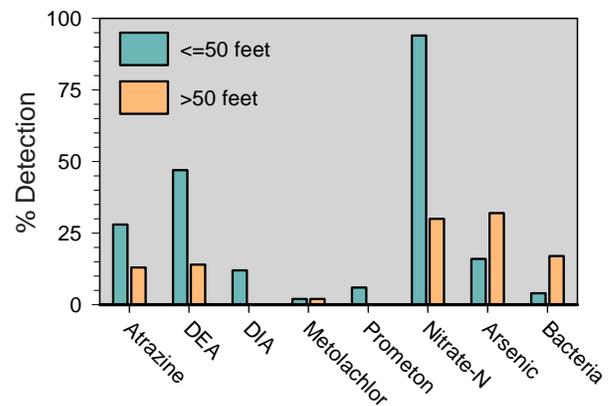


Figure 2. Detection frequency of contaminants – random study.

Table 2. Comparison of ICPWS random study to SWRL results (values in percent detection).

	Community Private Well Study (ICPWS)			Statewide Rural Well Study (SWRL)		
	Statewide % Detections	Northeast % Detections	East-central % Detections	Statewide % Detections	Northeast % Detections	East-central % Detections
Number of Samples	103	24	60	686	88	219
Atrazine *	2.9	0	5	4.4	3.4	4.1
DEA *	18.4	16.7	25	3.5	2.3	3.7
DIA *	2.9	0	5	3.4	1.1	2.7
Total Atrazine ~	19.4	16.7	26.7	8	4.2	7.7
Nitrate-N >10 ppm	23.3	25	23.3	18.3	9.2	11.6
Ammonia-N	40.8	33.3	38.3	50.1	36.4	67.2
Total coliform bacteria	30.1	20.8	30	44.6	20.9	34.3

* using SWRL minimum detection limits: (atrazine: 0.13 ppb; DEA: 0.1 ppb; DIA: 0.1 ppb)

~ total atrazine (atrazine, DEA, DIA)

Focus Study

Focus Study Design. The focus study design consisted of a one-time sampling of 133 selected private wells within 15 incorporated Iowa communities without public water systems (Figure 1). Communities were selected based on the presence and number of potential contaminant sources (i.e., private septic systems, underground storage tanks, active and closed landfills, etc.). A range of six to fourteen wells were sampled in each community. (Note: some wells were sampled for both the focus and random studies.) Water samples were analyzed for total coliform bacteria, nitrate, metals, pesticides, industrial chemicals, and gasoline constituents.

Focus Study Results. Atrazine was the most commonly detected pesticide, as 25% of the study wells had a detection (Table 3). Several other pesticides were also detected. Other compounds detected included nitrate-N (55% of the wells), arsenic (22%), and total coliform bacteria (17%).

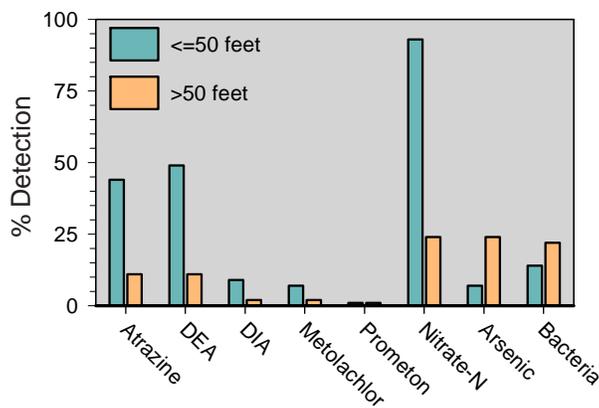


Figure 3. Detection frequency of contaminants – focus study.

Several wells sampled for the focus study exceeded U.S. EPA drinking water standards. Standards exceeded included one well for atrazine (drinking water standard = 0.003 mg/L), 29 wells for nitrate-N, nine wells for arsenic, and two wells for cadmium (0.005 mg/L). All other wells were below established drinking water standards.

Well depth was reported for only 88 wells. Wells less than or equal to 50 feet in depth had a higher frequency of detection for pesticides and

Table 3. Results from focus study.

Contaminant	Percent Detection	# Wells Exceeding DWS*
Nitrate-N	55%	29
Atrazine	25%	1
DEA	27%	--
DIA	5%	--
Arsenic	22%	9
Metolachlor	6%	--
Prometon	6%	--
Chlorthal Dimethyl	5%	--
Cadmium	1.5%	2
Total coliform bacteria	17%	--

* Drinking water standard

-- No standard

nitrate-N, whereas wells greater than 50 feet deep had a higher detection of arsenic and total coliform bacteria (Figure 3).

Conclusions from the ICPWS

- Elevated nitrate-N concentrations continue to be a problem, as >20% of the wells tested had levels greater than 10 mg/L.
 - Occurrence of atrazine and its degradates has increased, but concentrations were lower than the SWRL study.
 - Arsenic was detected in 24% of the wells; concentrations were generally at very low levels.
- Well depth and construction are important factors, as nitrate-N and pesticides were detected more frequently in shallow (≤ 50 feet) than deep (> 50 feet) wells.

Acknowledgements

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For more information on this study, see the CHEEC website at <http://www.cheec.uiowa.edu/>.

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Water Monitoring Program Web Site – wqm.igsb.uiowa.edu



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