

What's in YOUR Well? How safe are private wells in rural Iowa



David Cwiertny

Professor

Department of Civil and Environmental Engineering
Director, Sustainable Water Development Graduate Program
University of Iowa



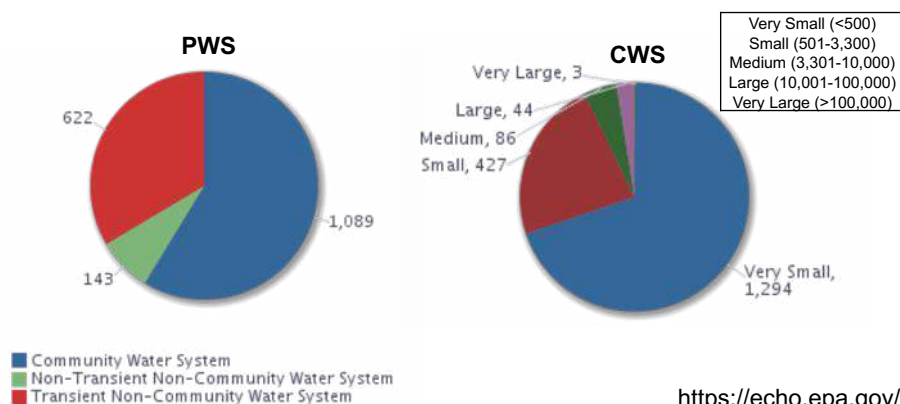
Center for Health Effects of Environmental Contamination

Director, Center for Health Effects of Environmental Contamination
Director, Environmental Policy Research Program
University of Iowa Public Policy Center



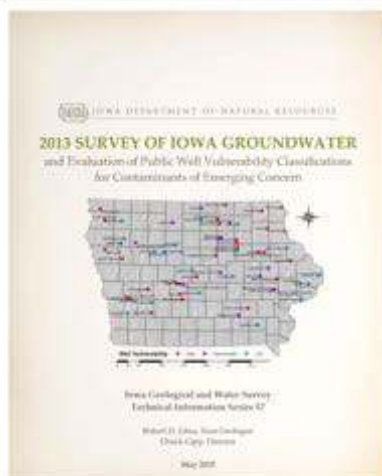
Iowa drinking water by the numbers

- 1854 Public Water Systems (PWS)
- 1089 Community Water Systems (CWS)

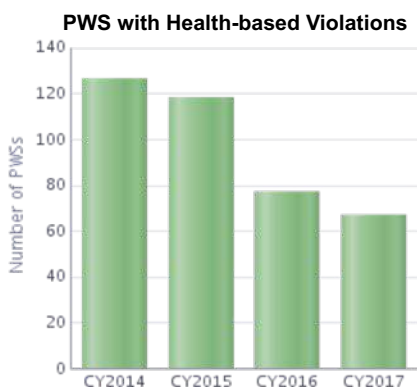


Iowa drinking water sources

- Groundwater supplies drinking water to about 80% of Iowa's 3 million people
- Over 2 million of these people obtain drinking water through regulated PWS
- 300,000 Iowans rely on groundwater for their drinking water obtained from unregulated private wells



Iowa's PWS: Where do we struggle?



Iowa by the numbers (CY 2017):

- 387 PWS with Any Violation
- 67 PWS with Health-based Violation
- 204 Total Health-based Violations

Iowa PWS Health-Based Violations (CY 2017)

Radionuclides	63
Nitrates	34
Surface Water Treatment Rule	32
Revised Total Coliform Rule	19
Arsenic	21
Stage 2 DBP	15
Groundwater Rule	9
Volatile Organic Contaminants	8
Total Coliform Rule	1
Long-term 1 Enhanced Surface Water Treatment Rule	1
Other Inorganic Contaminant	1

<https://echo.epa.gov/>

Are smaller systems disproportionately affected by SDWA violations?

FY2017 (epa.echo.gov)

System Size	#	% CWS	% CWS Any Violation
Very Small (<500)	569	52.6	60.6
Small (501-3,300)	380	35.2	31.8
Medium (3,301-10,000)	85	7.9	3.5
Large (10,001-100,000)	44	4.1	2.9
Very Large (>100,000)	3	0.3	1.2

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Are smaller systems disproportionately affected by SDWA violations?

FY2017 (epa.echo.gov)

System Size	#	% CWS	% CWS Any Violation	% CWS Health-based Violation	% CWS Reporting or Monitoring Violation
Very Small (<500)	569	52.6	60.6	37.1	61.9
Small (501-3,300)	380	35.2	31.8	42.9	31.4
Medium (3,301-10,000)	85	7.9	3.5	8.6	3.8
Large (10,001-100,000)	44	4.1	2.9	8.6	1.9
Very Large (>100,000)	3	0.3	1.2	2.9	1.0

Radium risks and management

Contaminant	In Water As	Maximum Contaminant Level
Radium (Ra)	Bq/L ¹	US EPA (Radium 226 and 228 combined): MCL ² = 5.0 pCi/L MCLG ³ = zero pCi/L WHO ⁴ Guideline: Radium 226 = 1 Bq/L Radium 228 = 0.1 Bq/L Health Canada (Radium 226 only): MAC ⁵ = 0.5 Bq/L (13.5 pCi/L)
Sources of Contaminant	Radioactive decay of uranium and thorium in rocks and soil	
Potential Health Effects	Increased risk of cancer	
Treatment Methods	Cation Exchange Softening Reverse Osmosis Distillation Lime Softening	

<https://www.wqa.org/learn-about-water/common-contaminants/radium>

Nitrate regulation of 10 mg/L set for methemoglobinemia (blue-baby syndrome)

- Nitrate transforms to nitrite in body, reacts with hemoglobin, reduces ability of blood to carry oxygen
- Can lead to trouble breathing, vomiting, anoxia
- Rarely diagnosed in U.S.
- ~2000 cases diagnosed worldwide from 1945-1970
- Most recent Iowa case was in late 1970s / early 1980s



Is 10 mg/L low enough?



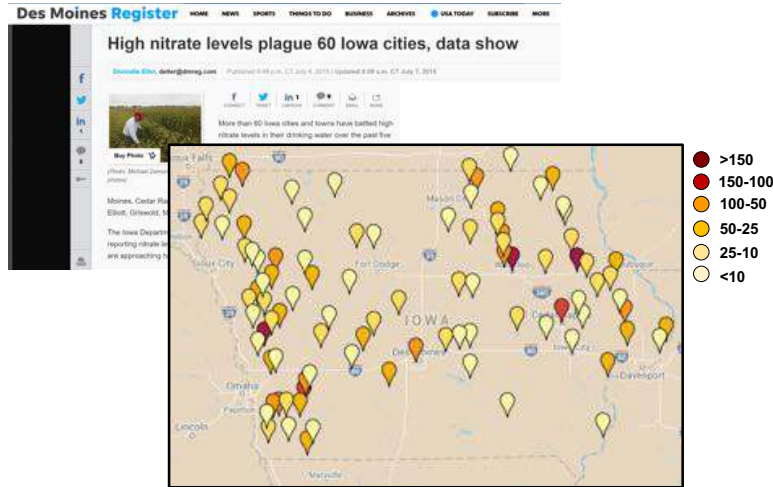
Cancer Risks (Iowa Women's Health Study)

- Bladder cancer
 - 1.6× risk at **>5 mg/L** for ≥4 years (Jones 2016)
- Ovarian cancer
 - 2.0× risk at **>3.0 mg/L** for ≥11 years (Inoue-Choi 2015)
- Thyroid cancer
 - 2.6× risk at **>5 mg/L** for ≥5 years (Ward 2010)

Reproductive Health (National Birth Defects Prevention Study)

- Iowa-Texas Study results (Brender 2013)
 - Spina bifida: 2× more likely to ingest **≥ 5 mg** of nitrate daily from drinking water than control mothers
 - Limb deficiencies: 1.8× more likely to ingest **≥ 5.42 mg** of nitrate daily
 - Cleft palate: 1.9× more likely to ingest **≥ 5.42 mg** of nitrate daily

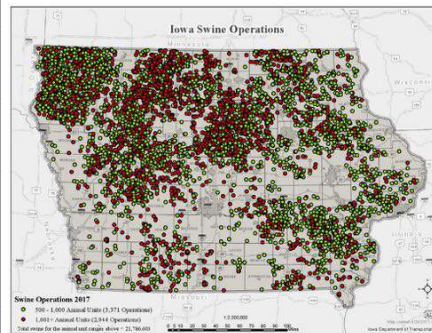
Nitrate is regulated by the EPA in drinking water (at 10 mg/L or ppm)



Instances (see key) of >5 mg/L NO₃⁻ between 2009-2014 in municipal IA water supplies (e.g., Woodbine Water Dept. had a max 189 reports)

Pathogens and SDWA (and CAFOs)

Select Regulated Microorganisms	Sources of Contaminant in Drinking Water
<i>Cryptosporidium</i>	Human and animal fecal waste
<i>Giardia lamblia</i>	Human and animal fecal waste
Total Coliforms (including fecal coliform and <i>E. Coli</i>)	Coliforms are naturally present in the environment; as well as feces; fecal coliforms and <i>E. coli</i> only come from human and animal fecal waste.
Viruses (enteric)	Human and animal fecal waste



Pesticides, pesticides, pesticides

- **Atrazine:** corn herbicide
 - Endocrine disruptor, possible carcinogen
 - EPA drinking water standard is 3 ppb
- Southern Iowa study (Munger 1997)
 - Risk of IUGR associated with atrazine, cyanazine
- Iowa Women's Health Study (Inoue-Choi 2016)
 - Atrazine not associated with ovarian cancer risk
- National Birth Defects Prevention Study (Winston 2016)
 - Atrazine not associated with risk for hypospadias



CHEEC Center for Health Effects of Environmental Contamination

Focus on private wells (not under SDWA)

- Over 15 million U.S. households (~15% of Americans) rely on private water wells for drinking water.
- The EPA does not regulate private drinking water wells.
- Many states and towns do not require sampling of private wells after installation.
- It is the **responsibility of the homeowner** to maintain the safety of their water.



<https://www.epa.gov/privatewells>

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Danger lurks in Iowa's well water, testing shows

[Drewella Eber](#), edber@dmreg.com Published 11:18 a.m. CT Aug. 28, 2016 | Updated 7:21 p.m. CT Aug. 27, 2016

The New York Times

Rural America's Own Private Flint: Polluted Water Too Dangerous to Drink

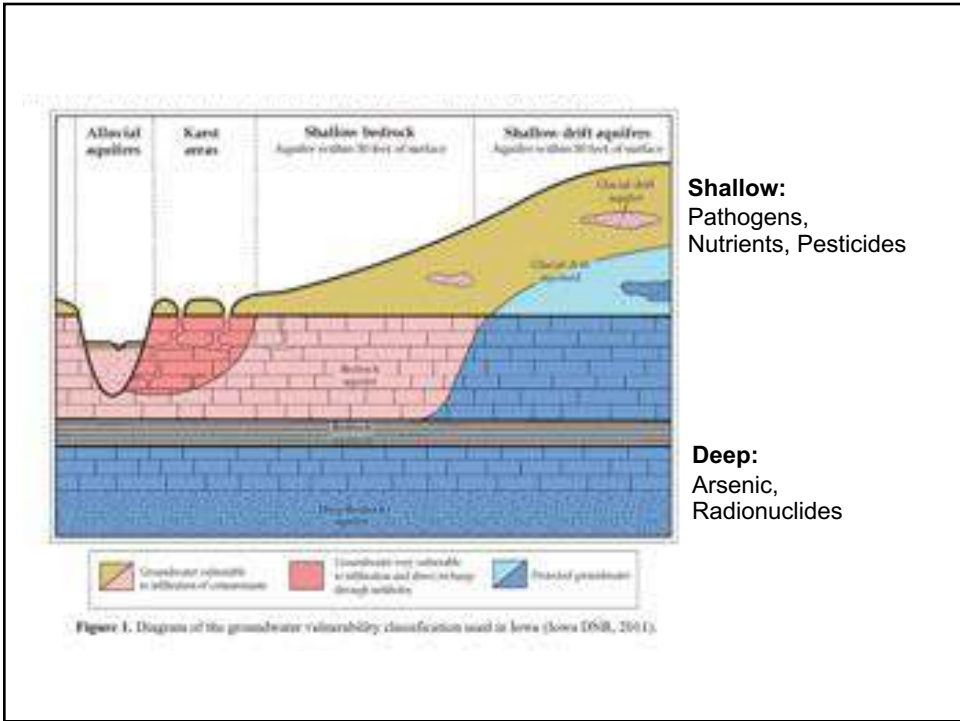


Flint, a common byproduct of coal-mining operations, has been linked to an array of serious health risks. [Source: Associated Press and New York Times](#)

By Jack Healy
Nov. 2, 2014

ARMENIA, Wis. — The groundwater that once ran red and clear from

"With nearly 300,00 Iowans who rely on private wells, "there could be thousands of people across the state who are in the same boat and don't even know it," said Brian Hanft, environmental services manager at Cerro Gordo Health Department.



Iowa Statewide Rural Well Water Survey Phase 2 (SWRL2)

5/2006 – 12/2008
473 private wells
89 counties

- **Bacteria:** 43% had total coliform bacteria, 19% had enterococci, 11% had *E. coli*
- **Nitrate:** 49% had nitrate; 12% had ≥ 10 mg/L (MCL)
- **Arsenic:** 48% had arsenic; 8% had ≥ 0.01 mg/L (MCL)
- **Pesticides:** 8% had atrazine at very low concentrations; 2% had metolachlor; acetochlor, alachlor and trifluralin were detected in <1% of wells
- **Herbicide degradates:** 11% had desethylatrazine, 11% had acetochlor ESA (ethane sulfonic acid), 27% had alachlor ESA, 33% had metolachlor ESA, and 8% had metolachlor OXA (oxanilic acid)

Statewide results on associations between contaminants and well survey variables:

- Shallower wells (<100 feet deep) more:
 - total coliform bacteria detections
 - herbicide degradate detections
 - nitrate concentrations
- Older wells (constructed before 1991) had more:
 - total coliform bacteria detections
 - herbicide degradate detections
- Total coliform bacteria, enterococci and *E.coli* detections more common in the NW, SW and SC Iowa
- Higher nitrate concentrations (≥ 10 mg/L nitrate-N) were more common in NW and SW Iowa

Coming Soon: Northeast Iowa well water survey

- **Aim 1:** Analyze Private Wells at 50 Agricultural Health Study Sites in Northeast Iowa
Nutrient analysis (Nitrate+Nitrite as N, Ammonia as N, Total Kjeldahl Nitrogen, Orthophosphate as P, Total Phosphate as P), neonicotinoids + degradates, glyphosate + AMPA, pesticide method [227 pesticides + degradates], cations and trace elements [Cr redox species, Pb and As], Perfluorinated alkylated substances, broad spectrum antibiotics method, hormonally active compounds (e.g. hormones, hormone conjugates, phytoestrogens, mycotoxins), Trace elements, 110 pharmaceuticals, broad spectrum microbial analysis, and non-target analysis
- **Aim 2:** Perform Urinary Biomonitoring for 50 Individuals at 50 Agricultural Health Study Sites
- Subjects' farms located in one of 10 Iowa counties (Buchanan, Cedar, Clayton, Delaware, Dubuque, Fayette, Jackson, Johnson, Jones or Linn)
- Collaborators: USGS, SHL, National Cancer Institute, Agricultural Health Study, CHEEC, UI College of Public Health, UI College of Engineering
- Sampling November-December 2018



Options for monitoring private wells: Grants to Counties Program

IAC 6/3/16

Public Health(641)

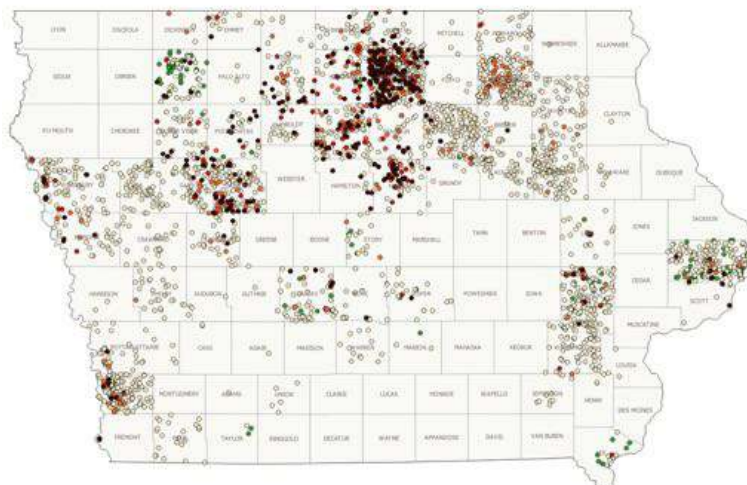
Ch 26, p1

CHAPTER 26 PRIVATE WELL TESTING, RECONSTRUCTION, AND PLUGGING--GRANTS TO COUNTIES

(IAC 6/3/16, 641-26.1-1)

641--26.1(138) Applicability. These rules apply to administration of the grants to counties program by the department in accordance with Iowa Code sections 135.31(2b) and 459C.31(2) through (4) for the purpose of testing private water wells, reconstructing private water wells, and the proper plugging of abandoned private water wells (including systems that present a contamination risk to groundwater) within the jurisdiction of each county board of health.
(IAC 6/3/16, 641-26.1-138)

Arsenic in Iowa private wells through GTC



- A **yellow dot** indicates arsenic was detected in well water near this location, but less than 5 micrograms per liter (or $\mu\text{g/L}$) in concentration - a fairly low risk.
- An **orange dot** indicates arsenic was detected in well water near this location and it's in the range of 5 - 8.9 $\mu\text{g/L}$ - this is a mid to high arsenic concentration - but not above the MCL
- A **red dot** indicates arsenic was detected in well water near this location with a concentration of 9 - 10 $\mu\text{g/L}$ - this level is near or at the recommended MCL
- A **black dot** indicates that arsenic was detected in well water near this location and its level is above the MCL of 10 $\mu\text{g/L}$.

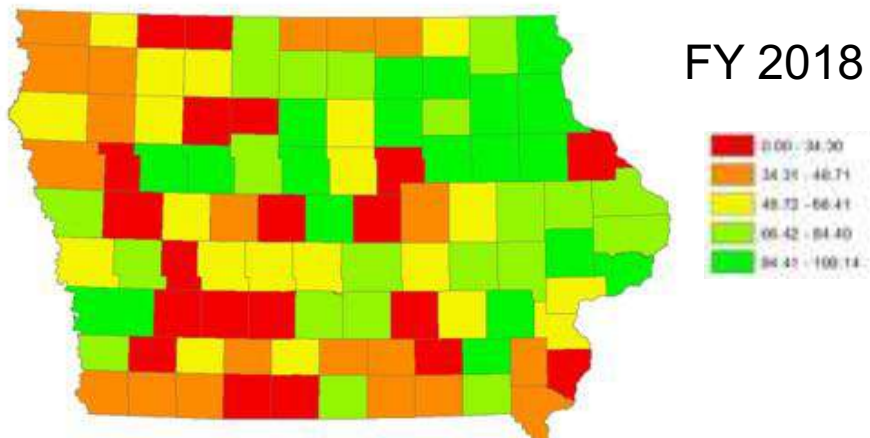


Herbicide parent compounds: Acetochlor, Alachlor, Ametryn, Atrazine, Butachlor, Butylate, Cyanazine, Dimethenamid, EPTC, Glyphosate, Metolachlor, Metribuzin, Prometon, Propachlor, Propazine, Sencine, Trifluralin.
Herbicide degrade compounds: Acetochlor ESA, Acetochlor OXA, Alachlor ESA, Alachlor OXA, Desmethy Atrazine, Desisopropyl Atrazine, Dimethenamid ESA, Dimethenamid OXA, AMPA (Glyphosate degradation), Metolachlor ESA, Metolachlor OXA.

Compound	Total Wells Tested	Total with Quantifiable Concentration	Total with Concentration above MCL*	% with Detected Concentration
Total Coliform Bacteria	280	108	108	39%
E. coli	252	9	9	4%
Nitrate as N	273	145	31	11%
Nitrite as N	281	9	1	1%
Total Arsenic	272	94	9	3%
Neonitroimidazole†	280	4	4	1%
Atrazine ESA†	195	27	27	14%
Atrazine OXA†	195	4	4	2%
Alachlor ESA†	195	39	31	16%
Alachlor OXA†	195	4	4	2%
Glyphosate	100	1	0	1%
Metolachlor†	195	5	5	3%
Metolachlor ESA†	195	47	47	24%
Metolachlor OXA†	195	10	10	5%

* MCL, Maximum Contaminant Level: The highest level of a contaminant that is allowed in drinking water. MCLs are enforceable standards.
 † Compound does not have an established Maximum Contaminant Level set by the EPA. Additional information may be available in the EPA's 2013 Edition of the Drinking Water Standards and Health Advisories. Due to unknown health effects, unquantifiable detections are noted as concentrations of the MCL.

Percentage of funds spent through Grants to Counties program



*ADLM Counties Environmental Public Health: Appanoose, Davis, Lucas and Monroe



Rural Water System Service Territory Map



Thanks for listening!

David Cwiertny

4655 Seamans Center

david-cwiertny@uiowa.edu

319-335-1401

@dcwiertny

