

ARSENIC IN RESIDENTIAL DRINKING WATER SUPPLIES

Presented to the Michigan Environmental Health
Association



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A CONVERSATION WITH A HOMEOWNER ON MARCH 16, 2010

“Sir, you don’t seem to understand. My doctor asked me if my kids or I are having any tingling in our face and hands, and he asked if my kids have grown any warts.”



HOUSE #	WELL DEPTH	AS RESULT (ppb)
1	56'	ND
2	157'	110
3	65'	0.66
4	88'	N/A
5	161'	170
6	93'	N/A
7	90'	N/A
8	83'	0.82
9	?	N/A
10	60'	0.2

1 = Arsenic Below 10 ppb
2 = Arsenic Above 10 ppb
4 = No Sample Data

High
arsenic
well
record

10485
Mountain View

2	FORMATION DESC	Thickness of Stratum	Depth to Bottom of Stratum
	BROWN SILTY CLAY	12	12
	BROWN SAND	10	22
	GRAY CLAY	3	30
	GRAY SILTY CLAY	10	40
	GRAY SAND	8	48
	HARD GRAY CLAY	33	81
	GRAY SAND AND GRAVEL	3	84
	HARD GRAY CLAY	19	103
	GRAY CLAY AND GRAVEL	44	147
	GRAVEL AND SANDSTONE	3	150
	SANDSTONE AND <u>SHALE</u>	3	153
	GRAVEL	3	156
	SANDSTONE AND GRAVEL	3	159
	GRAY CLAY	2	161

13 1930

HITTING A HOME RUN

In 2008, Detroit Tiger Brandon Inge purchased a home in Washtenaw County.

At time of sale, the home tested with 19 ppb arsenic.

The Inge's installed a Reverse Osmosis water system.

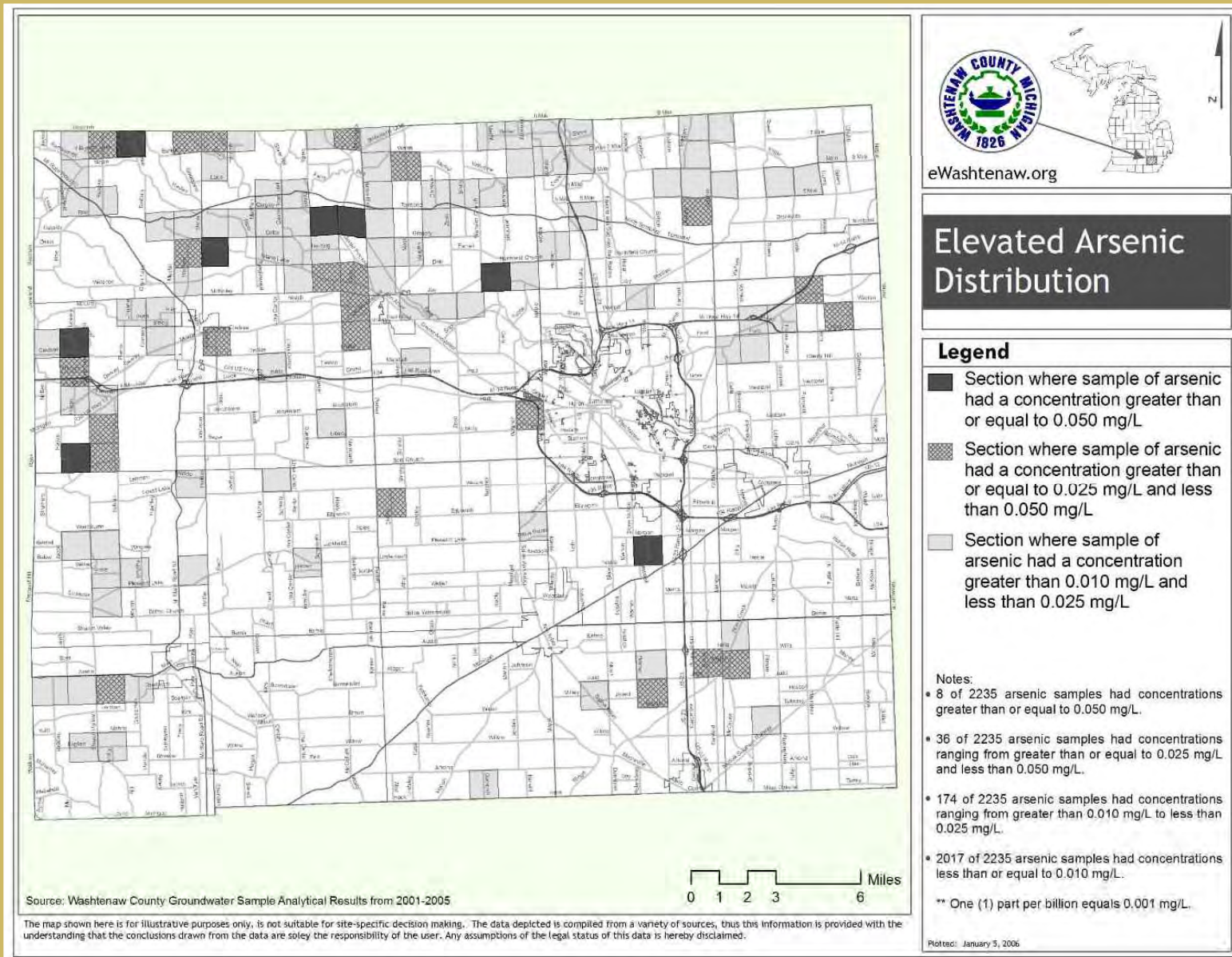
In 2009 Brandon Inge hits 27 home runs!

Washtenaw County Approaches

- All new/replacement wells are sampled for coliform bacteria, nitrates, and arsenic.
- All homes at time of sale are sampled for coliform bacteria, nitrates, and arsenic.
- Treatment is allowed for levels between 11ppb and 49pbb.
- A new well must be drilled or bottled water utilized for wells that test at 50 ppb or greater*.

* If a homeowner submits an arsenic sample on their own without any regulatory prompting, the Dept. has not taken a hard line regulatory stance.

Prevalence of Arsenic in the groundwater with in Washtenaw County (2001-2005 Data)



Elevated Arsenic Distribution

- Legend**
- Section where sample of arsenic had a concentration greater than or equal to 0.050 mg/L
 - ▨ Section where sample of arsenic had a concentration greater than or equal to 0.025 mg/L and less than 0.050 mg/L
 - Section where sample of arsenic had a concentration greater than 0.010 mg/L and less than 0.025 mg/L

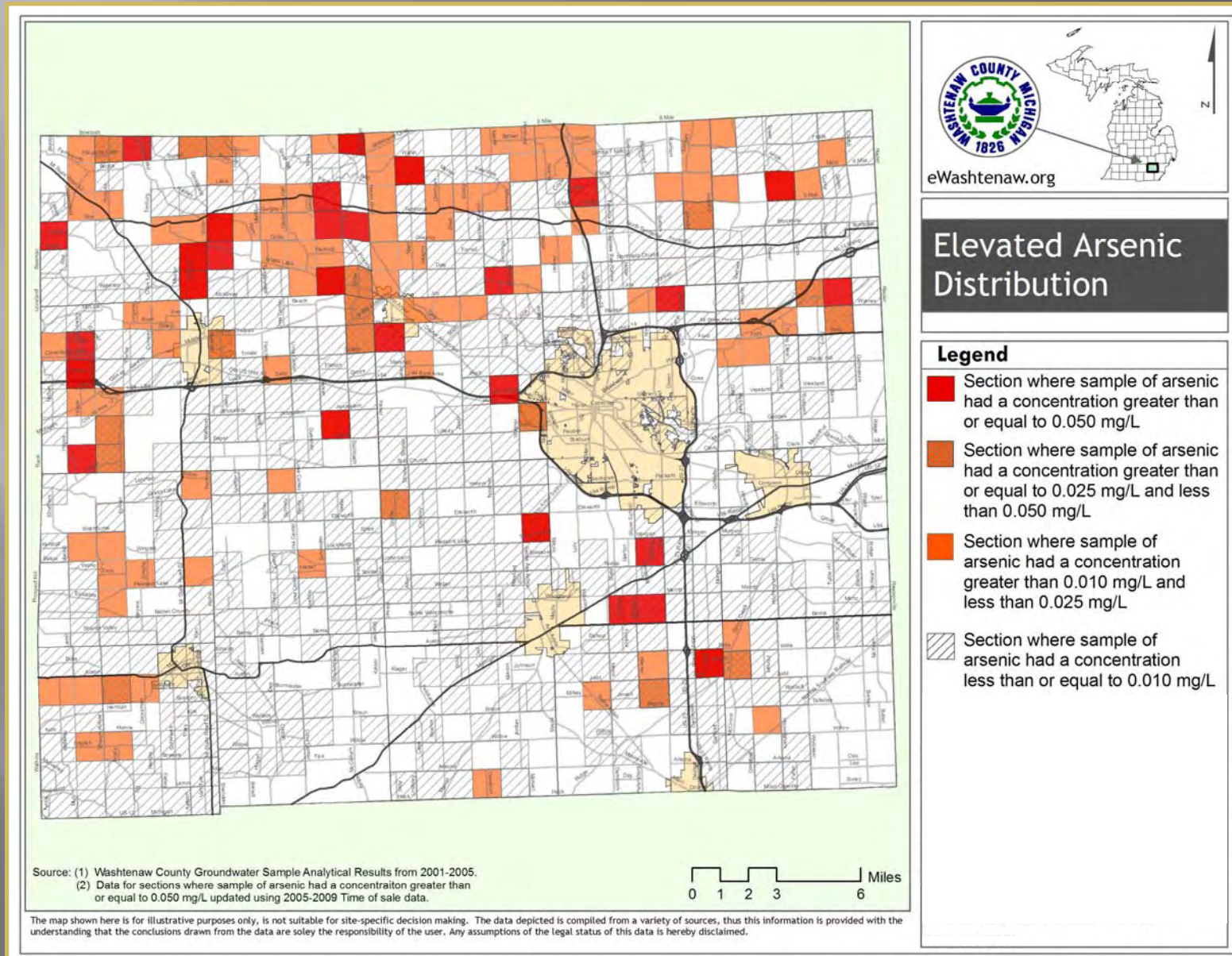
- Notes:
- 8 of 2235 arsenic samples had concentrations greater than or equal to 0.050 mg/L.
 - 36 of 2235 arsenic samples had concentrations ranging from greater than or equal to 0.025 mg/L and less than 0.050 mg/L.
 - 174 of 2235 arsenic samples had concentrations ranging from greater than 0.010 mg/L to less than 0.025 mg/L.
 - 2017 of 2235 arsenic samples had concentrations less than or equal to 0.010 mg/L.
- ** One (1) part per billion equals 0.001 mg/L.

Source: Washtenaw County Groundwater Sample Analytical Results from 2001-2005

The map shown here is for illustrative purposes only, is not suitable for site-specific decision making. The data depicted is compiled from a variety of sources, thus this information is provided with the understanding that the conclusions drawn from the data are solely the responsibility of the user. Any assumptions of the legal status of this data is hereby disclaimed.

Plotted: January 5, 2006

Prevalence of Arsenic in the groundwater with in Washtenaw County (2005-2009 Data)



560 PPB

Our highest arsenic level to date.

Found in a new well drilled into a relatively shallow aquifer in a subdivision built around a lake created from sand and gravel mining (area was not originally mapped as an arsenic area).

Residential Arsenic in Washtenaw County by the numbers

- ▣ 8976 Arsenic Samples analyzed
- ▣ 7090 homes tested for Arsenic
- ▣ 90.3% homes tested at 10ppb or below
- ▣ 9.2% homes tested at 11 to 49ppb
- ▣ 0.5% homes tested at 50 or greater

A note on sample results

- WCEHD allows averaging the last three samples collected – this is frequently used if the initial sample is 11-15 ppb.
- At time of sale - if the home has a treatment device that has the ability to remove arsenic - both an untreated source water sample and a treated drinking water sample are to be collected.
- WCEHD has encountered variances in results in sample results. **Supplies with higher levels show greater variances.**
- Arsenic results have been higher for vacant homes. **41.3% of homes that had an arsenic above 50 ppb were able to reduce the level to below 50 ppb through purging alone*.**

** In a few instances we recommended that the pressure tank be replaced and the supply purged – this resulted in lowering the arsenic to <50 ppb and to the point we were comfortable with treatment.*

STATISTICS OF INTEREST

- In 2009: 7.7% of newly drilled wells were required to have arsenic treatment.
- In 2009: 6.7% of the Homes inspected at time of sale installed Arsenic removal devices to comply with the Property Transfer Regulation.
- In 2008: 7.7% of newly drilled wells were required to have arsenic treatment.
- In 2008: 6.0% of the Homes inspected at time of sale installed Arsenic removal devices to comply with the Property Transfer Regulation.

STATISTICS OF INTEREST

Since 2005 29 homes have tested with arsenic above 50 ppb. This resulted in:

14 New wells being drilled (5 still required treatment)

12 Were able to reduce the level to below 50 ppb just through purging!!

3 Homeowners have NOT taken corrective action to date☹

TYPICAL COSTS

Cost to sample a well for arsenic:	\$17
Cost to install a reverse osmosis water treatment system:	\$600-800
Cost to drill a new well:	\$4500
Cost of drinking safe water:	<u>Priceless</u>

Arsenic Treatment

Reverse Osmosis

- Reverse Osmosis was utilized at **91%** of the homes where arsenic removal was required.
- Reverse Osmosis systems have worked better than expected providing a **90.3%** removal rate after installation. 😊
- Point of Use systems were utilized **97%** of the time.
- The ability of an RO system to remove arsenic when the source water was below 25 PPB was the same as when the source water was 26-49 ppb.

IMPORTANT QUESTIONS?

- How will these RO Units work in the long term?
- What is the membrane life of these units?
- Will homeowners sample regularly to assure proper function?
- Is there a possibility that if these systems are not maintained that they may concentrate arsenic in treated drinking water?

Homeowner follow-up

- ▣ In 2008, owners of water supplies that had arsenic issues were mailed a reminder to test their water – only 5% of homeowners responded to this letter by submitting an arsenic sample to the Health Department. 😞

Arsenic Treatment

Media Based

- Media based treatment systems demonstrated a 95% removal rate. 😊
- Media systems are installed both as POU and as whole house treatment systems.
- A sufficient number of systems have not been installed over a sufficient time period to provide data on the length of media life.

Summary of arsenic removal Devices Installed is the result of a Time of Sale Inspection in 2009

# of systems	Brand/make of system	Type Of system	POU
11	Whirlpool WEHR 25	RO	YES
5	Quicksilver	RO	YES
3	Avanta Pure APPRO 50	RO	YES
3	Spring soft SS #35	RO	YES
3	Kenetico	RO	YES
2	Renolds	RO	YES
2	Adedge	MEDIA	YES
2	Culligan Aqua Clean	RO	YES
2	GE Smartwater	RO	YES
2	Blue Max	Media	NO
1	American Aqua	RO	YES
1	Microline TCF-435RO	RO	YES
1	Omni Pure #CL-10	RO	YES
1	Michigan Water service	RO	YES

Summary of arsenic removal Devices Installed is the result of a Time of Sale Inspection in 2008

# of systems	Brand/make of system	Type Of system	POU
4	Whirlpool WEHR 25	RO	YES
4	Renolds	RO	YES
3	GE Smartwater	RO	YES
3	Avanta Pure APPRO 50	RO	YES
2	Kenetico	RO	YES
2	Adedge	MEDIA	YES
2	American Aqua	RO	YES
1	Quicksilver	RO	YES
1	Culligan Aqua Clean	RO	YES
1	Blue Max	Media	NO
1	Flowmatic 50	RO	YES
1	Nelson 5 stage 132	RO	YES
1	Dow absorbia GTO	MEDIA	YES
1	Watermax 3500	RO	YES
1	Watts RO-Pure	RO	YES

WHAT HAVE WE LEARNED?

Implementing arsenic testing in the residential well program has gone very well and for the most part has been well received by the public 😊

WHAT HAVE WE LEARNED?

On the permitting side, in many instances we are recommending the use of “first aquifer systems” and not drilling through usable aquifers to obtain a deeper protected aquifer.

WHAT HAVE WE LEARNED?

The overall prevalence of arsenic has been what we expected. However, several of the arsenic “hot spots” that have been identified are in areas that we would not have predicted.

From 2005 to 2009, 20 additional sections were identified where a sample of arsenic had a concentration greater than or equal to 50 ppb.

WHAT HAVE WE LEARNED?

Reverse osmosis treatment has worked better than expected, especially treating water in the 25-49 ppb range 😊

WHAT HAVE WE LEARNED?

Only a small percentage of homes that have arsenic treatment are testing for arsenic on a regular basis to ensure that their removal systems are working properly ☹

Additional education and possible regulatory presence is needed in this area of the program.

WHAT HAVE WE LEARNED?

Low level arsenic contamination:

Little variance in results

Not affected by vacancy rates

Higher level of arsenic contamination (>25 ppb):

Results can be highly variable

Statistical correlation between very high arsenic levels and home vacancy

What is next for us?

- **We continue to feel that the association between arsenic levels and iron levels needs further analysis.**
- **Determining the long term effectiveness of treatment is a priority!!**

QUESTIONS?

FEEL FROM TO CALL US AT (734) 222-3800
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