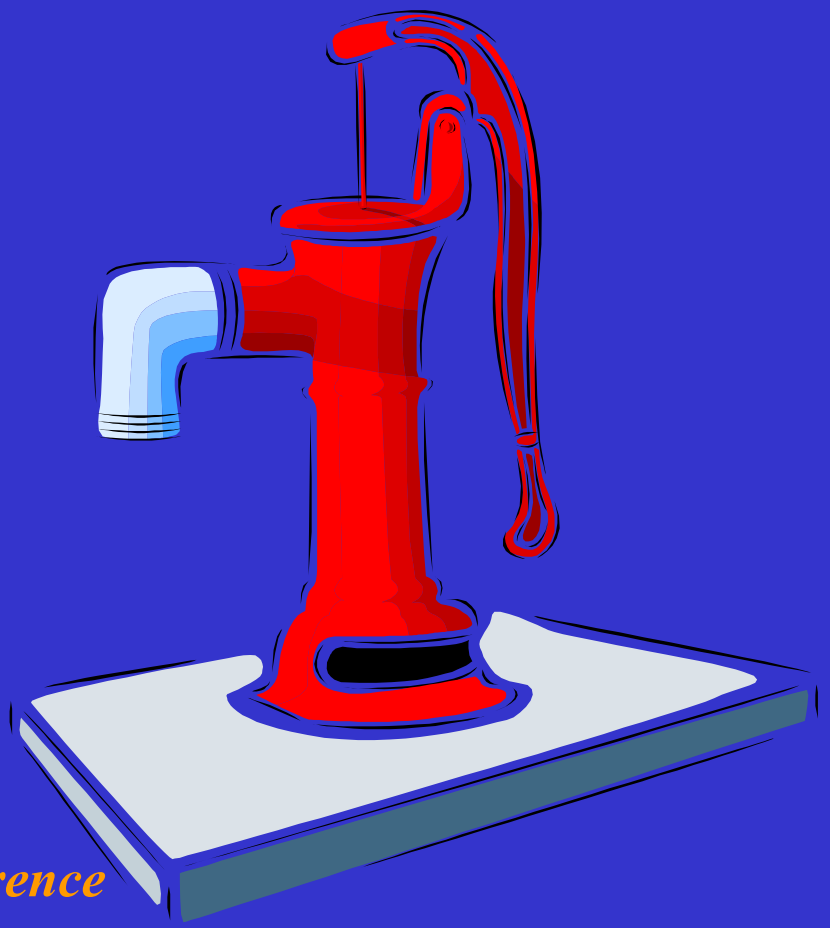
Arsenic In Drinking Water

WISCONSIN STATE LABORATORY OF HYGIENE



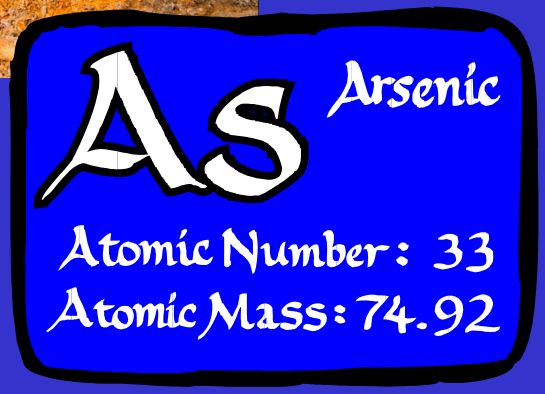
WISCONSIN DEPT. OF NATURAL RESOURCES

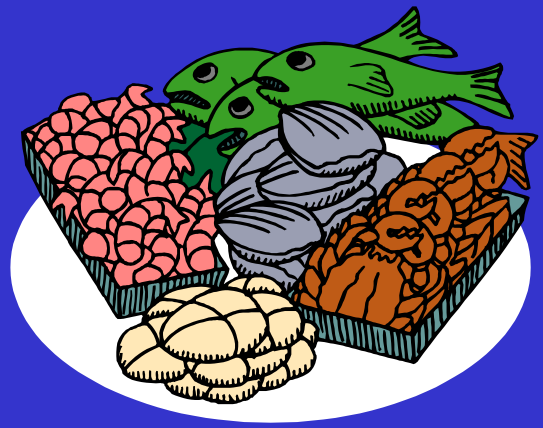
Wisconsin Water Well Association Conference

January 16, 2002

Where is arsenic found?

- Bedrock
- Soil
- Groundwater
- Surface waters
- Food

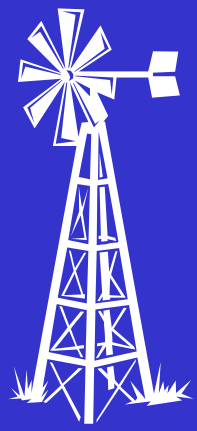




How are we exposed to arsenic?

- Smoke from wood, coal, tobacco products
- Dust from some industrial processes
- Drinking water that contains elevated levels of arsenic

Inorganic forms of arsenic are the most toxic.



Food contains traces of organic arsenic which is relatively non-toxic

Why test for arsenic?

- High levels of inorganic arsenic, the most toxic form, have been found throughout Wisconsin
- Naturally occurring high levels are mostly found in Outagamie, Winnebago and Brown Counties. However, other isolated areas of Wisconsin also have high levels.
- Levels of arsenic in impacted wells can increase over time.

What level of arsenic is safe?

- Both the US Environmental Protection Agency and the World Health Organization have set the standard at 10 µg/l.

Here is the cancer risk:

0.5 ppb	-	1 in 10,000
1 ppb	-	1 in 5,000
3 ppb	-	1 in 1,000
5 ppb	-	1.5 in 1,000
10 ppb	-	>1 in 333
20 ppb	-	1 in 143

National Academy of Sciences

http://www4.nationalacademies.org/news.nsf/fc340309c47a1e43852567460067595e/c2f3467f548f460c85256ac4006d092a?OpenDocument

How can arsenic affect health?

- ✓ Increased risk of skin cancer
- ✓ Increased risk of internal cancers (bladder, prostate, lung and other sites)
- ✓ Thick, rough skin on hands and feet
- ✓ Unusual skin pigmentation (dappling of dark brown or white splotches)
- ✓ Numbness in the hands and feet

Other arsenic health effects

- ✓ Circulatory disorders
- ✓ Tremors
- ✓ Stomach pain, nausea, diarrhea
- ✓ Diabetes (not confirmed)

Example of the health effects of exposure to high levels of arsenic in drinking water

This picture shows signs of hyperkeratosis on the palms of a villager in Bangladesh resulting from arsenic contaminated water.

http://www.lehigh.edu/~aks0/arsenic.html

Can people recover from exposure to arsenic?

- Once exposure has happened it is not reversible.
- Public Health Officials stress that prevention is the best approach.

Can I wash with water above 10 µg/l arsenic?

Non consumptive uses such as showering and washing dishes are not expected to be a significant source of arsenic exposure.

Are there environmental problems?

Yes - Arsenic has been identified as a public health concern especially in:

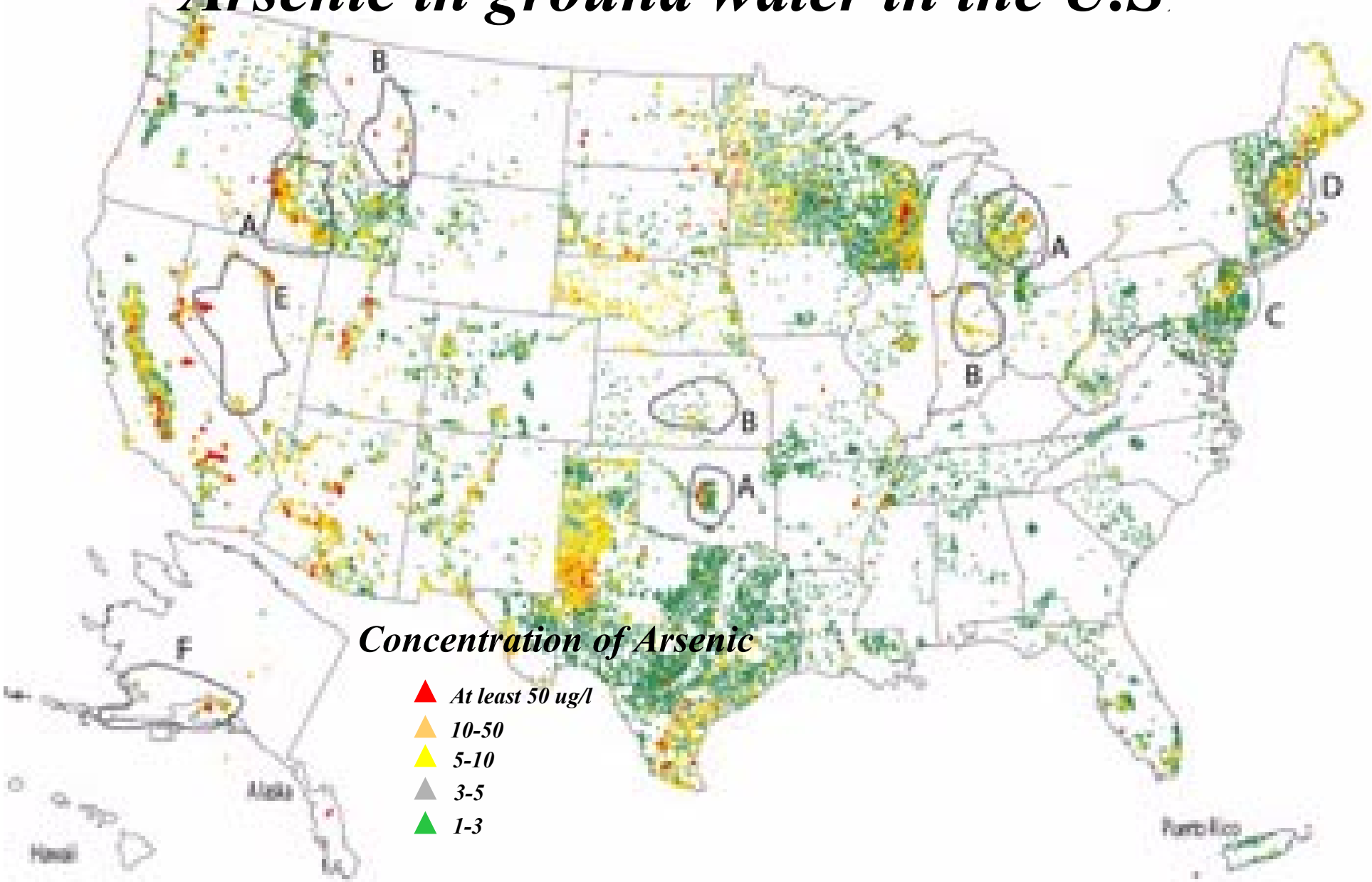
- ☞ Bangladesh-Very serious problem
- ☞ Malaysian-Also a serious public health threat. Bau Lake region
- ☞ Vietnam - Red River delta
- ☞ United States

  Oregon, New Mexico, New Hampshire, Michigan
- ☞ Wisconsin

  Lower Fox River Valley, S.E. Wisconsin & other isolated areas.

Wisconsin has had the highest detect in the world in a drinking water supply well at 15,000 ppb.

Arsenic in ground water in the U.S

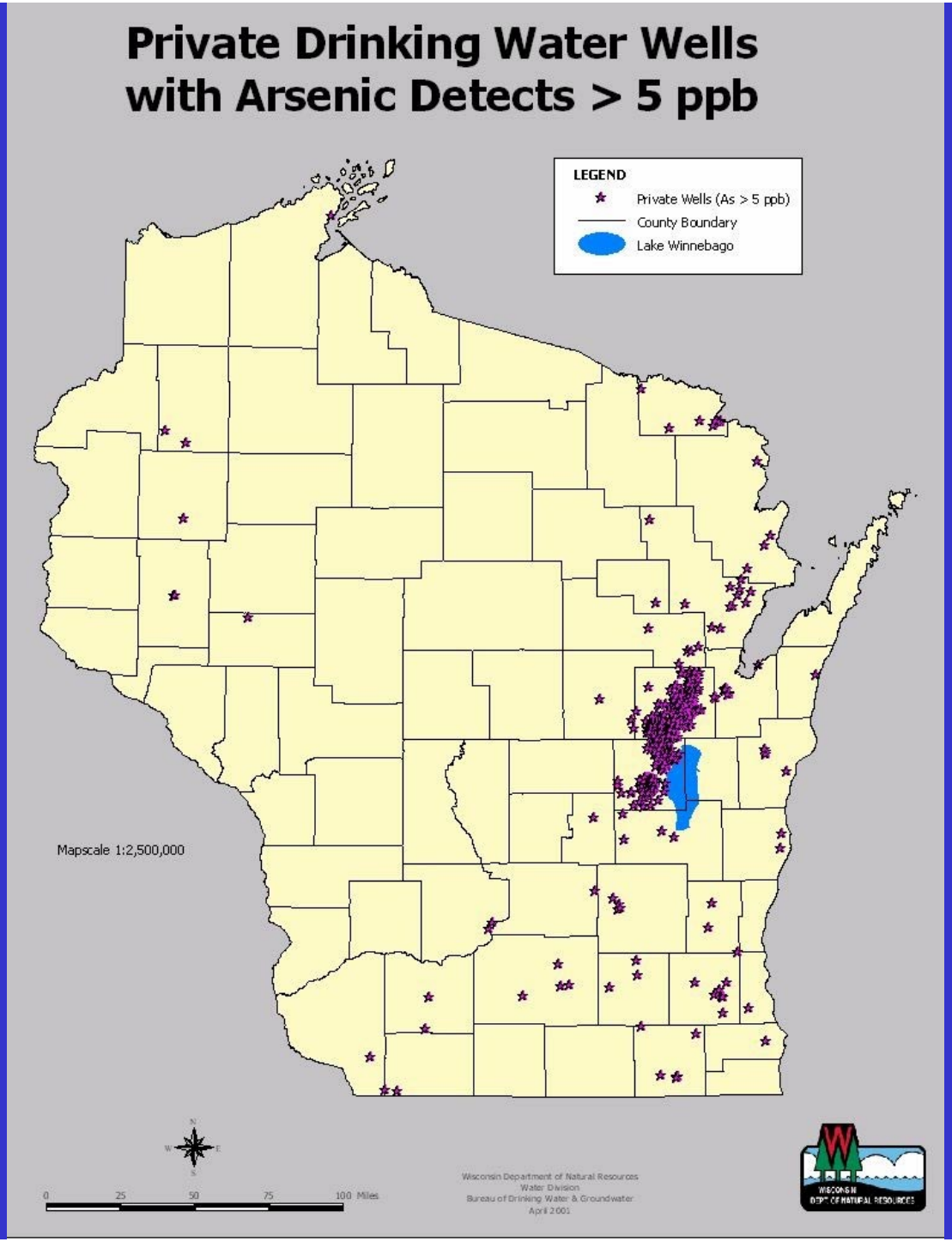


http://www.agiweb.org/geotimes/nov01/feature_Asmap.html?sid=de351467000e4227065ab930f6dabf16

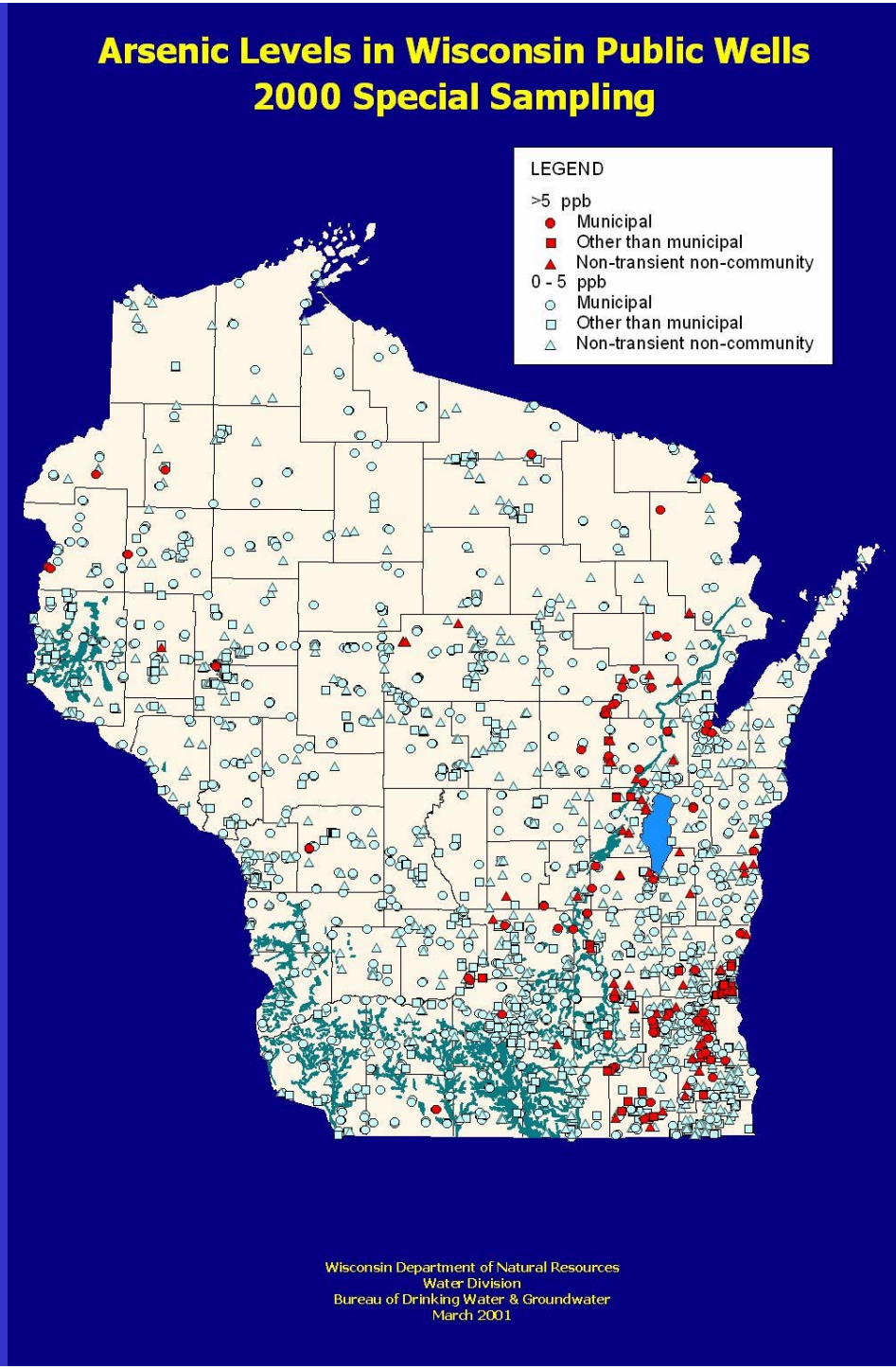
Is arsenic a problem in Wisconsin?

- As many as 30,000 private wells in northeastern Wisconsin could contain arsenic levels in excess of 5 µg/l.
- Based on sampling results from public water systems, 73 wells serving the public exceed 10 µg/l.
- Arsenic levels between 5-10 µg/l warrant concern as there is a risk these levels may increase over time.

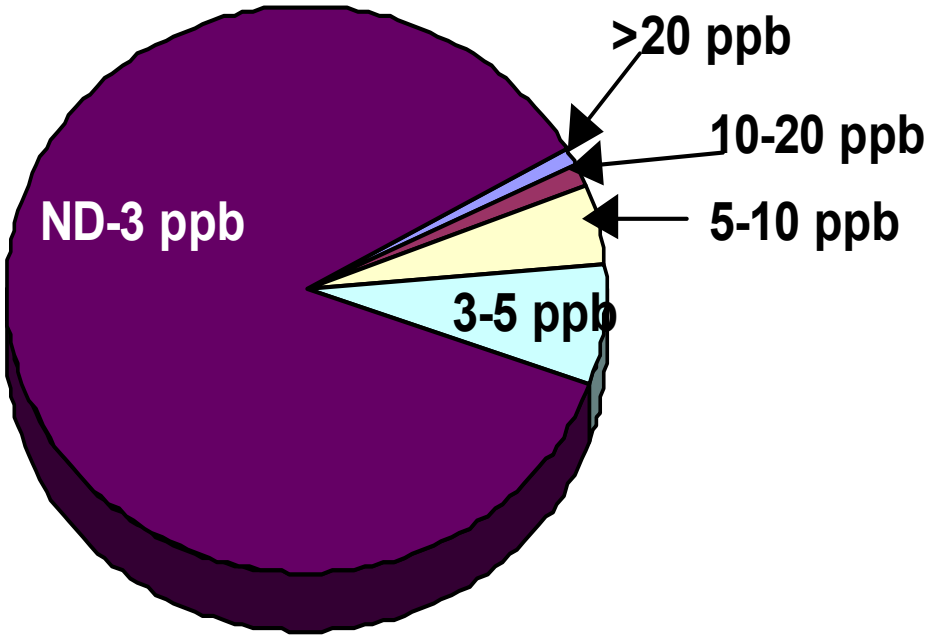
An "Arsenic Advisory Area" was established by the Dept. of Natural Resources (DNR) in the early 1990s. This area includes a strip of land about ten miles wide extending, in a northeasterly trend, from a location just southwest of Oshkosh, to a location just west of Green Bay.



Public Water Supply wells are also at risk to contamination of Arsenic



Arsenic in Wisconsin Public Water Supply Wells 2000 Survey



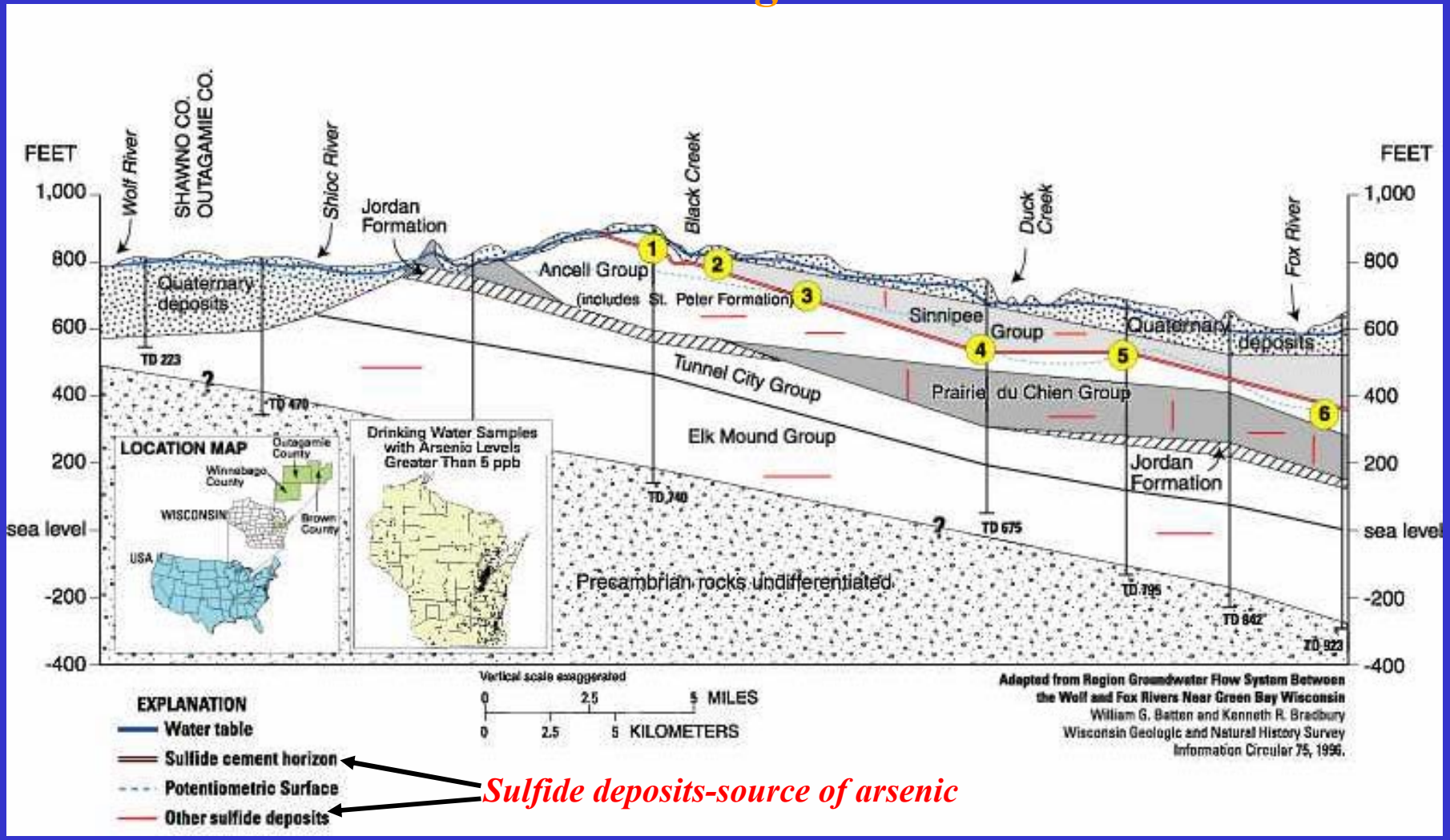
3182 wells tested

Source: http://www.dnr.state.wi.us/org/water/dwg/arsenic/index.htm

How does arsenic make it's way into wells?

- Sulfide bearing minerals such as iron pyrite can contain arsenic
- Arsenic can be released when sulfide bearing minerals are exposed to air within open boreholes of wells.
- Disinfecting wells with bleach may accelerate the released of arsenic in wells that penetrate bedrock containing the sulfide minerals.

Illustration of well bored through bedrock containing arsenic bearing minerals



Sulfide deposits-source of arsenic

Taken from: **A Study of Well Construction for Arsenic Contamination in Northeast Wisconsin**

Authors: Elizabeth Heinen, Annette Weissbach, Keld Lauridsen

How much of a problem is arsenic in Wisconsin?

- Arsenic levels of up to **15,000 µg/l** have been detected in Wisconsin. (1500 times higher than the federal standard of 10 ppb). Many wells with elevated arsenic also have high levels of Nickel, Cadmium, Chromium, Aluminum and Cobalt.
- Several individuals have suffered from the effects of arsenic exposure (e.g., black fingernails, fatigue, and numbness in extremities).
- Increased risk of cancer is currently being studied.

How often should I test my water for arsenic?

- If you have a private well in Winnebago, Outagamie or Brown Counties, test your water periodically for arsenic.
  - ⇨ If arsenic is detected initially, you may want to test your water at least annually.
- ☹ Be aware that arsenic concentration in a well can ***change over time***.

How can I find out if my water contains arsenic?

- Have your water tested by a certified laboratory.
- Visit the DNR web site to obtain a list of certified laboratories.
  - ✓ ***http://www.dnr.state.wi.us/org/es/science/lc/search/***

Can the State Laboratory of Hygiene (SLH) test my water for arsenic?

- Because of public health concerns, the SLH can provide arsenic testing for private homeowners.

- The SLH can also direct those who need assistance to the appropriate local public health agencies or to the Department of Health and Family Services, Bureau of Environmental Health (608-266-0923).

What should I look for when selecting a lab to do my arsenic testing?

- We recommend the lab be certified to do arsenic testing in drinking water.
- At a minimum the lab must use an appropriate method for arsenic testing.

  Caution: Some methods are simply not sensitive enough!!!

  We recommend a detection limit of 1 ppb or below.

NO!

ICP EPA Method 200.7, Not Approved, Detection Limit is only about 50 µg/l

(that's 5 times the health standard)

OK!

AA Furnace, EPA Method 200.9, Approved, Detection Limit 0.5 µg/l

OK!

ICP-MS, EPA Method 200.8,
Approved, Detection Limit 1.4 µg/l

What should I do if arsenic is detected in my well?

- ✓ If the arsenic level in your well is above 10 µg/l (the federal standard) , ***stop*** drinking the water and use bottled water or water from another "safe" source (e.g., a public water supply known to have low arsenic levels).

- ✓ If your water is above 5 µg/l, or if you live in the existing arsenic advisory area, public health officials recommend annual testing.

Are there approved water treatment devices?

- Yes, there are approved point of use and point of entry treatment systems.

- Contact the Department of Commerce, Safety and Buildings Division, Glen Schlueter at:
  - ✉ gschlueter@commerce.state.wi.us
  - ☎ (608) 267-1401
  - On-line at:

    http://www.dnr.state.wi.us/org/water/dwg/arsenic/AsTreatment.pdf

Where can I go to get other information about removing arsenic from drinking water?

- Visit the following web sites for additional information about arsenic removal:
  - ehpnet1.niehs.nih.gov/docs/1998/106-11/innovations.html
  - www.who.int/water_sanitation_health/Arsenic/ArsenicUNReptoc.htm
  - www.waternet.com/article.asp?IndexID=6631203
  - www.dnr.state.wi.us/org/water/dwg/arsenic/

What is the State doing about this problem?

Research Projects include:

- Alternative disinfection of wells

  Oxidation during disinfection may accelerate arsenic release

- Arsenic Replacement Wells

  - Proper well construction will help reduce the risk of contamination from arsenic bearing rock formations.
  - See www.dnr.state.wi.us/org/water/dwg/arsenic/Recommend.htm for recommendations.

http://www.dnr.state.wi.us/org/water/dwg/arsenic/Studies.htm

How can I help?

- The DNR and Dept. of Health and Family Services (DHFS) need well water data to identify arsenic contamination areas and to determine the extent of the problem.
- Well drillers, pump installers and private homeowners can help by testing private wells for arsenic at the State Laboratory of Hygiene (SLH), commercial, or local health department laboratories.
- The SLH provides electronic summaries of all water tests to the DNR and DHFS as part of it's public health mission.

How will testing help?

- The DNR and DHFS use the well data to assess drinking water quality state wide and to alert the public of potential problems.
- The DNR has developed an on-line data system to acquire drinking water quality data from other laboratories.
- If a commercial laboratory tests your water, ask them to share that data with the DNR.
- By gathering more data, the State can better protect the public health.

Where can I go to get more information about the arsenic in water?

- ✓ Contact your Local Public Health Department.
- ✓ Contact the State Division of Public Health at 608-266-0923 or at: www.dhfs.state.wi.us/dph_beh/Env_Health_Resources/Water/index.htm#Arsenic_in_Drinking
- ✓ Visit the DNR web site for assistance at the following address: www.dnr.state.wi.us/org/water/dwg/arsenic or contact a Water Supply Specialist at your local DNR Office.
- ✓ Harvard University School of Public Health at: http://phys4.harvard.edu/~wilson/arsenic_project_introduction.html
- ✓ National Academy Press website at: http://books.nap.edu/nap-cgi/srchnax.cgi?term=arsenic

Acknowledgements

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