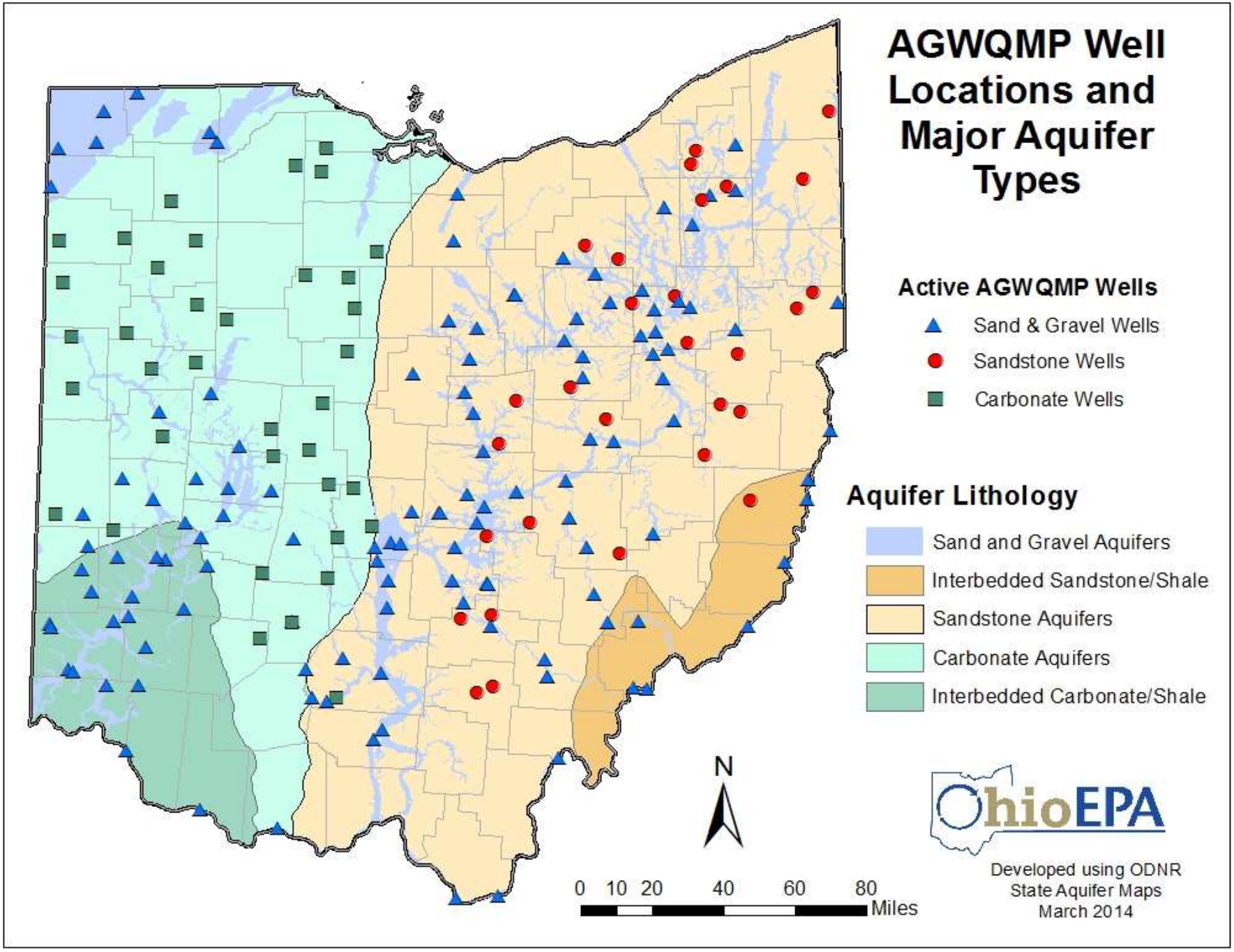
Ground Water Quality
AGWQMP
Fact Sheets and Technical Reports

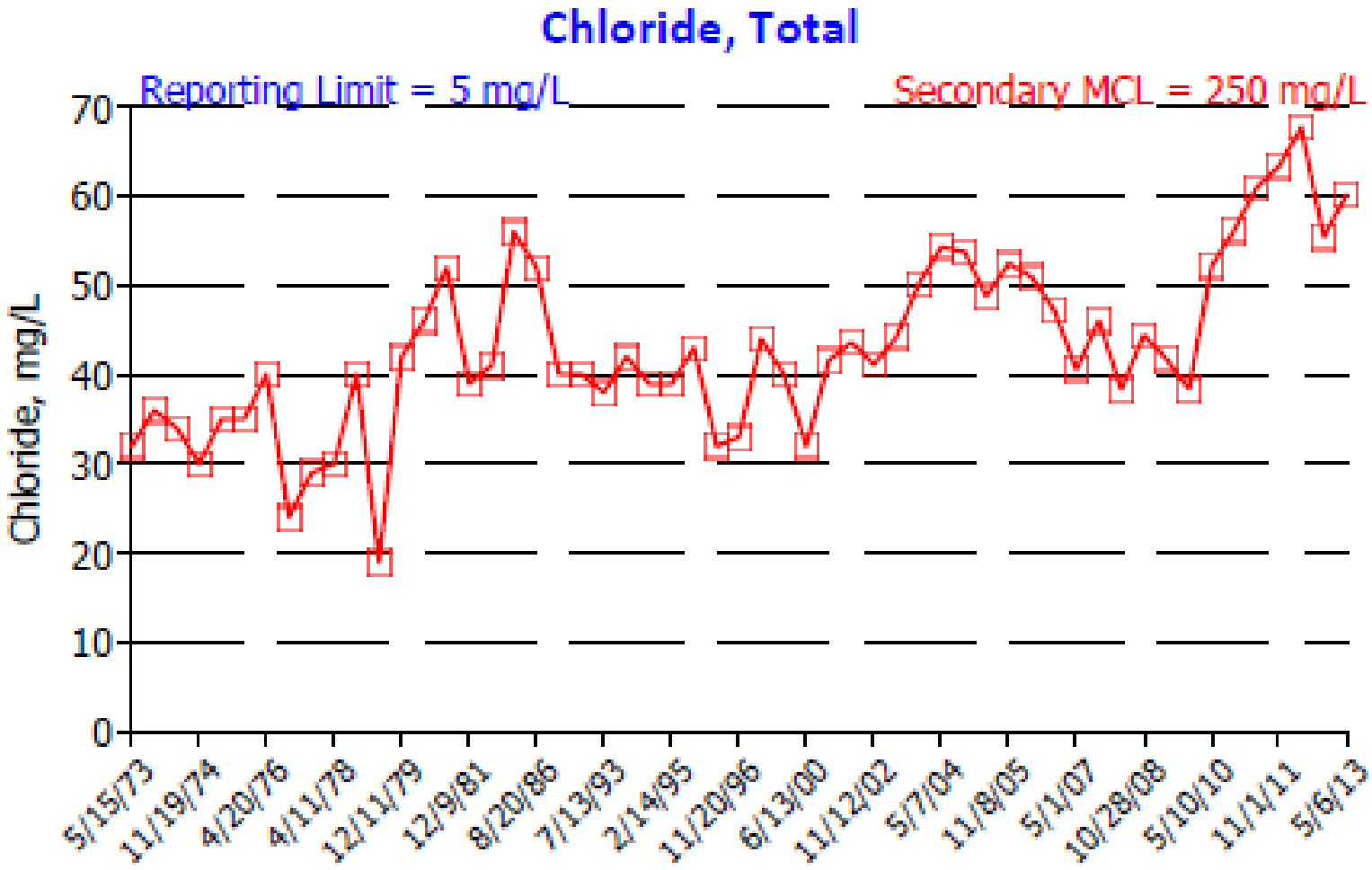
Chris Kenah
Ohio EPA, DDAGW

Ohio Water Resources Council
Water Resource Monitoring Meeting
March 21, 2014


AGWQMP Well Locations and Major Aquifer Types
Active AGWQMP Wells
Sand & Gravel Wells
Sandstone Wells
Carbonate Wells
Aquifer Lithology
Sand and Gravel Aquifers
Interbedded Sandstone/Shale
Sandstone Aquifers
Carbonate Aquifers
Interbedded Carbonate/Shale
N
0 10 20 40 60 80
Miles
OhioEPA
Developed using ODNR State Aquifer Maps March 2014

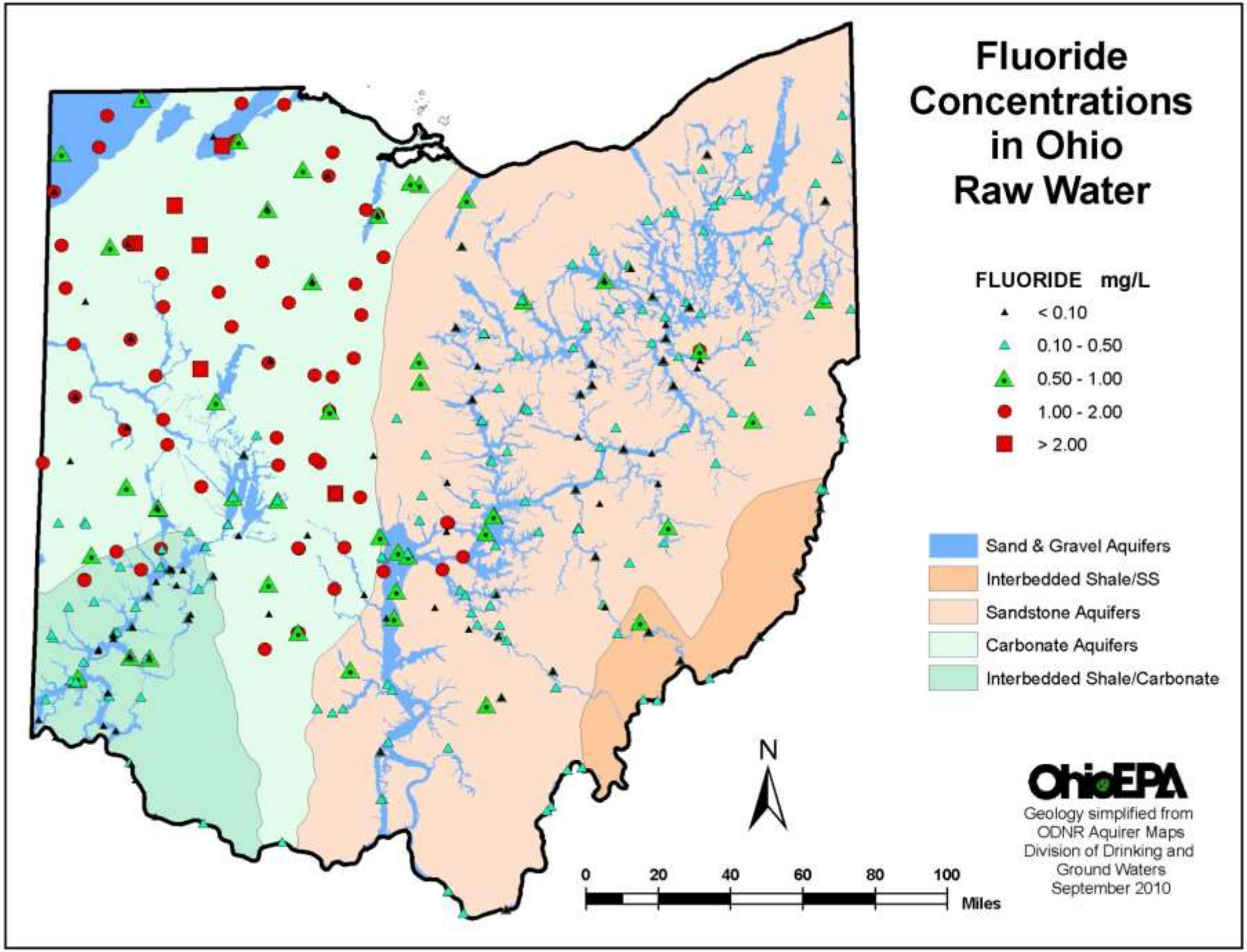
Ambient GW Quality Monitoring Program

- We have a lot of water quality data;
- Using it to characterize Ohio's ground water;
- Two approaches:
  - Use the times series to identify long term water quality trends;
  - Develop Fact Sheets and Technical Reports for specific parameters.


Chloride, Total
Reporting Limit = 5 mg/L
Secondary MCL = 250 mg/L
Chloride, mg/L
70
60
50
40
30
20
10
0
5/15/73
11/19/74
4/20/76
4/11/78
12/11/79
12/9/81
8/20/86
7/13/93
2/14/95
11/20/96
6/13/00
11/12/02
5/7/04
11/8/05
5/1/07
10/28/08
5/10/10
11/1/11
5/6/13

Fact Sheets and Technical Reports

- Fluoride
- Aquifer and Ground Water Quality
  - In conjunction with “Know Your Well Water”
    - Click on “Know Your Well Water” tab on: http://ohiowatershed.osu.edu
- Oxidation–Reduction
- Radionuclides


Fluoride Concentrations in Ohio Raw Water
FLUORIDE mg/L
< 0.10
0.10 - 0.50
0.50 - 1.00
1.00 - 2.00
> 2.00
Sand & Gravel Aquifers
Interbedded Shale/SS
Sandstone Aquifers
Carbonate Aquifers
Interbedded Shale/Carbonate
N
0 20 40 60 80 100
Miles
OhioEPA
Geology simplified from ODNR Aquirer Maps
Division of Drinking and Ground Waters
September 2010

March 2012

Fact Sheet 2012-01

Series on Ohio's Ground Water Quality

OhioEPA

Fluoride in Ohio's Ground Water

Fluoride is the naturally-occurring stable form of the gaseous element fluorine (F). Fluoride is among the top 15 most abundant components of the Earth's crust and is naturally found in very small amounts in most aquifers. An aquifer is an underground unit of saturated earth materials that can provide usable quantities of ground water to a well.

How does fluoride get into Ohio's ground water?

As water flows through earth materials, some of the rocks and minerals it contacts are dissolved and fluoride is naturally released into the water. Most ground waters in Ohio naturally contain less than one milligram per liter (mg/L) of fluoride (1 mg/L is 1 part per million; or one cent in a million pennies). A number of human activities can also increase fluoride concentrations in soil and water, including glass, steel, and phosphate fertilizer production. In addition, agricultu run-off, infiltration of fertilizers, and discharges from septic or sewage tre facilities that process fluoridated add inorganic fluorides to the envir

Where will you find elevated fluoride

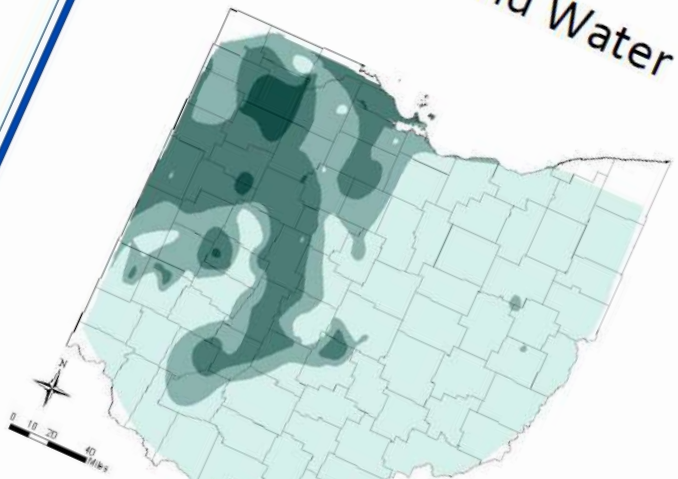
The limestone aquifers in western Ohio ha figure above. Limestone aquifers contain the releases fluoride into ground water in the limes the state may contain some fluoride-bearing carbo concentrations in some sand and gravel aquifers falls limestone aquifers and the lower concentrations in the

What are safe levels of fluoride in drinking water?

The U.S. Environmental Protection Agency's maximum contam

OhioEPA

Fluoride in Ohio's Ground Water



Division of Drinking and Ground Waters

Technical Series on Ground Water Quality

February 2012

FACT SHEET

Division of Drinking and Ground Waters
February 2014

OhioEPA

Major Aquifers and Ground Water Quality in Ohio

Ohio has abundant ground water resources, but the amount available at a given location depends on local geology and well construction. Water quality also varies from place to place and over time, depending on the local geology, sensitivity and land use.

This fact sheet identifies the types of geologic materials that provide water to wells, discusses factors that influence water quality, and provides typical water quality test results.

Where does my well water come from?

Ground water is replenished by rain and melted snow infiltrating through the soil column. Average precipitation in Ohio ranges between 30 to 44 inches a year. Much of the water entering the soil is used by plants. A small amount is held in the soil, and the rest (3 to 16 inches per year) moves downward (called recharge). Any zone of saturated earth materials that is capable of providing useable quantities of water to a well is called an aquifer. The surface of the first or shallowest saturated zone or aquifer is called the water table. The amount of ground water that can flow through soils or rock depends on the size of the spaces in the earth material and how well they are connected. In most aquifers, ground water moves slowly (typically 10 to 1,000 feet per year).

Are all aquifers the same?

No. Ohio has three major aquifer types, as illustrated in Figure 1, including:

- sand and gravel deposits (blue);
- sandstone bedrock (beige); and
- carbonate bedrock, (light green).

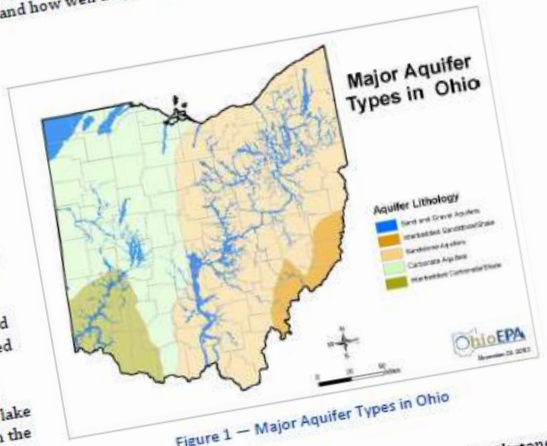


Figure 1 — Major Aquifer Types in Ohio

The sand and gravel aquifers consist of loose (unconsolidated) sand and gravel units with fine grained interbedded material like silts and clay or till. Most of these aquifers occur in old river valleys that have been filled with unconsolidated material and are frequently referred to as buried valley aquifers. In northwest Ohio, the unconsolidated aquifers (patches of blue) are sheets of sand and gravel deposited in glacial lake environments, Water production (yield) from the coarse-grained and thick sand and gravel aquifers range up to 500 to 1,000 gallons per minute (gpm), but are generally much lower.

The sandstone bedrock aquifers are consolidated (cemented) rock layers, interbedded (like a layer cake) with siltstones and shales. A well may receive water from multiple sandstone layers. Thicker sandstones can yield 25—100 gpm, but 25 gpm is good. Many wells in the southeast portion of Ohio produce 5 gpm and less. Where shale dominates, like the sediments (brown) in southeast Ohio, yields are low.

Technical Series

DRAFT

1/28/2014

Major Aquifers in Ohio and Associated Water Quality

Abstract

aquifers are described and ground water quality data is presented that characterizes them.
ented provides ranges of constituent concentrations typical of the major aquifers across
a are representative of source water utilized by public water systems (raw or untreated
a are not pristine, since a number of the AGWQMP wells are impacted by elevated
organic parameters sourced from surface activities. The inherent variability in
re must be taken when extrapolating point data beyond the collection site.
compiled in this report is the best summary available for the general water
ers, and is presented to help evaluate water quality in local aquifers.

Introduction

major aquifers;
ter quality within aquifer types; and
tive of the major aquifers.

water quality evaluations by providing ranges of
ifers across Ohio for comparison. The water
Ambient Ground Water Quality Monitoring

ers

precipitation ranges between 30 to 44
healthy stream flows. Infiltration
nd keeps the streams flowing.

1 (modified from ODNR
istributed as thin bands
tone and shale in the
tern half. The
ells except where

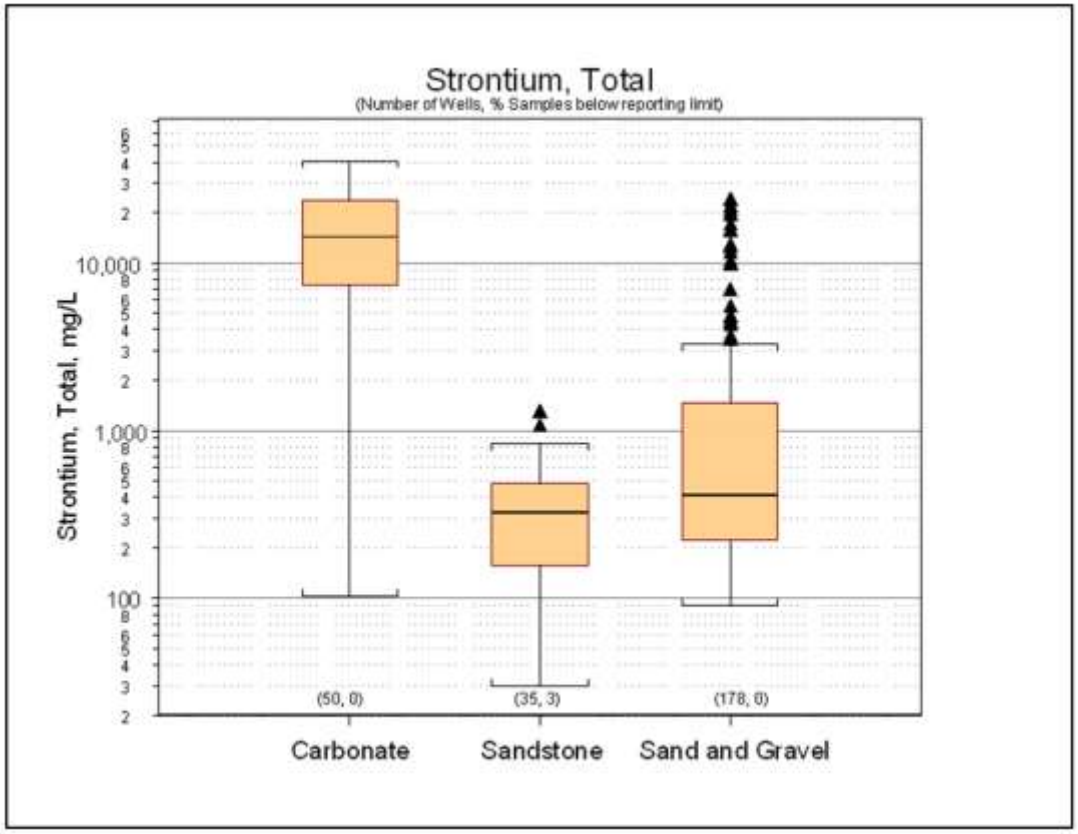
hio's
al and
cial drift by
s are found
ream channels such

DRAFT

µg/L	µg/L	Carbonate	71.8	11	<10	4090	265	7

NUTRIENTS

MCL/ SMCL	Parameter and Units	Major Aquifer	Mean Value	Median Value	Minimum Value * £	Maximum Value	Standard Deviation	Numl Sam
	Ammonia mg/L	Sand and Gravel	0.22	0.08	0	3.41	0.36	34
		Sandstone	0.37	0.17	0	2.30	0.49	7
		Carbonate	0.41	0.35	0	5.93	0.50	8
	Chemical Oxygen Demand mg/L	Sand and Gravel	13.3	<10	<2.0	200	9.25	33
		Sandstone	13.4	<10	<6.0	172	8.43	7
		Carbonate	14.0	<10	<10	371	16.1	8
10 mg/L	Nitrite & Nitrate NO2 +NO3 as N mg/L							33
	Phosphorus mg/L							31
	Total Kjeldahl N mg/L							23



Fact Sheets and Technical Reports

- Fluoride
- Aquifer and Ground Water Quality
  - In conjunction with “Know Your Well Water”
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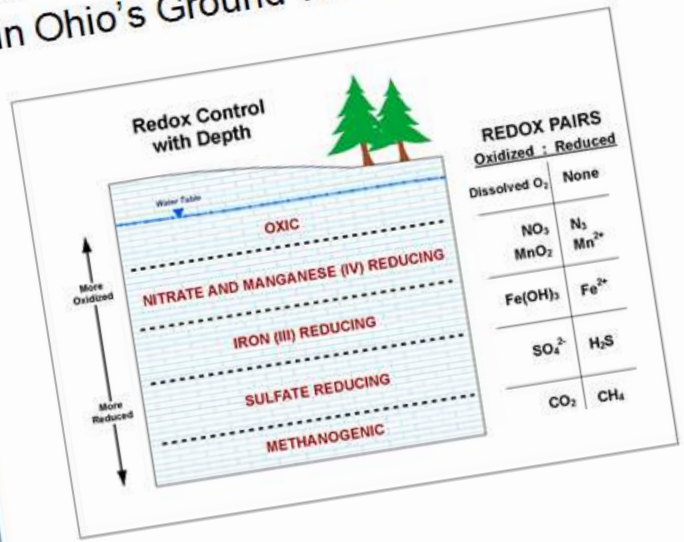
- Oxidation–Reduction
- Radionuclides

January 2014

OhioEPA

Division of Drinking and Ground Waters
Technical Series on Ground Water Quality

Reduction-Oxidation (Redox) Control in Ohio's Ground Water Quality



John R. Kasich, Governor
Mary Taylor, Lt. Governor
Craig W. Butler, Director

DRAFT

October 2013

Fact Sheet 2013-01

Series on Ohio's Ground Water Quality

OhioEPA

Radionuclides in Ohio's Ground Water

What are radionuclides?

Radionuclides are elements with unstable atoms. When these unstable atoms decay, they release energy (radiation) in alpha or beta particles and gamma rays. Energy is continually released until a stable, non-radioactive substance is formed. Most radionuclides occur naturally, but some come from man-made sources. The most common radionuclides found in ground water are decay products of uranium and thorium and include radium and radon.

How do radionuclides get into Ohio's ground water?

Most of the radionuclides found in Ohio's ground water occur naturally from the weathering and dissolution of rocks and minerals. The amount and type of radiation released during the decay process depends on the radionuclides present.

Radioactive materials are also used in medical diagnostics and treatments, electricity production, commercial products, research and nuclear weapons. Human activities, such as disposal of radioactive wastes, may increase the levels of radioactive materials found locally in ground water.

How are radionuclides measured?

Gross alpha and gross beta particle activity are measures of the total radioactivity produced during a
are measured in picocuries per liter (pCi/L). If a sample shows high gross alpha or gross beta, addi
analysis is required to identify the specific radiation source. Analysis is also completed for indivi
radionuclides like radium-228, which is a decay product of thorium.

Where will you find elevated radionuclides in Ohio's ground water?

Ohio's public water systems are required to sample for radionuclides in ground water. The figure on the right shows that gross alpha in ground water is generally low across Ohio. This is expected because uranium and thorium, typically found in igneous (volcanic or plutonic) rocks, are found in low levels in Ohio's major aquifers.

The highest levels of gross alpha can be found in the carbonate bedrock of northwestern Ohio. Because organic matter was more abundant in the carbonate sediments when the bedrock was being formed, the uranium was concentrated and incorporated into the bedrock. These levels are still relatively low and not of concern. Radium-226 follows the same general pattern as gross alpha because its source material is also uranium.

Black shales, such as the Ohio and Olentangy shale yield much water. Consequently, little public wa

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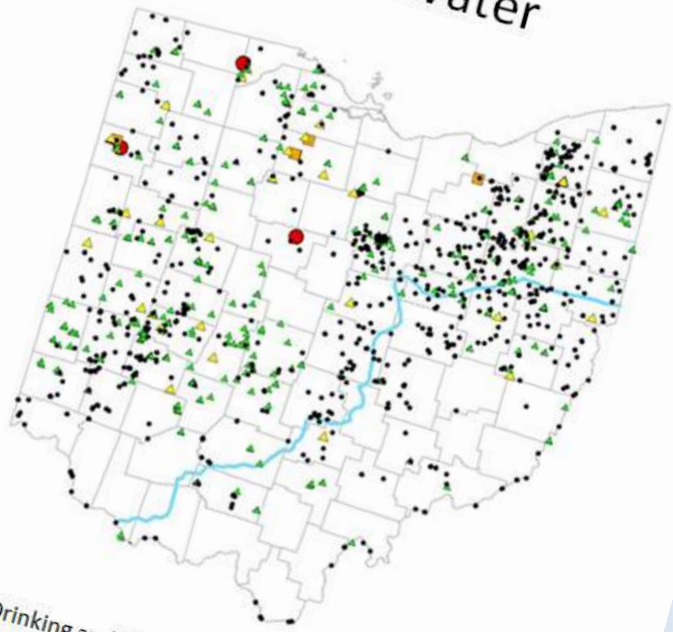
Radionuclides in Ohio's Ground Water



Division of Drinking and Ground Waters
Technical Series on Ground Water Quality
October 2013

Monitoring Data – Needs to be Used

- Value of data is documented by its use;
- Use of data helps inform the public;
- Provides the basis to help make policy decisions and individual decisions;

Radionuclide Fact Sheet and Technical Report under review in Ohio EPA Directors Office?

Acknowledgements

- Linda Slattery, Mike Slattery, and Jeff Patzke have prepared/helped prepare documents;
- Ohio EPA district staff collect AGWQMP samples;
- PWS operators – Their cooperation is critical for AGWQMP efforts.

Ohio EPA
Division of Drinking and Ground Waters
Ground Water Quality Characterization Program

http://www.epa.state.oh.us/ddagw/gwqcp.aspx