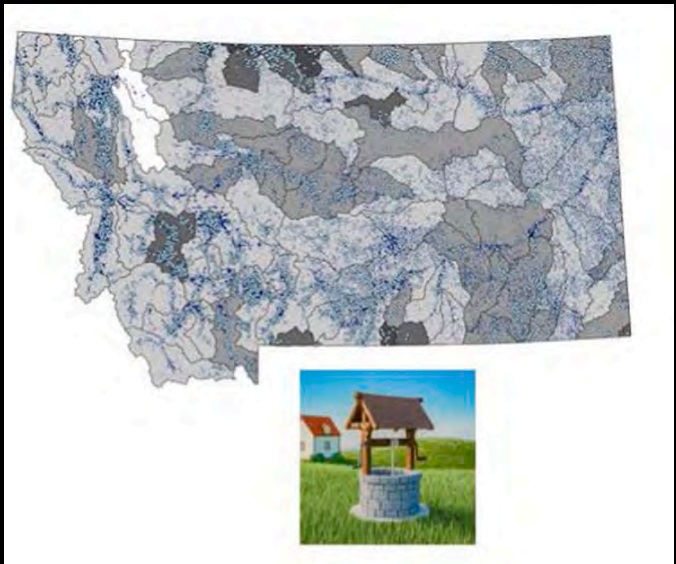
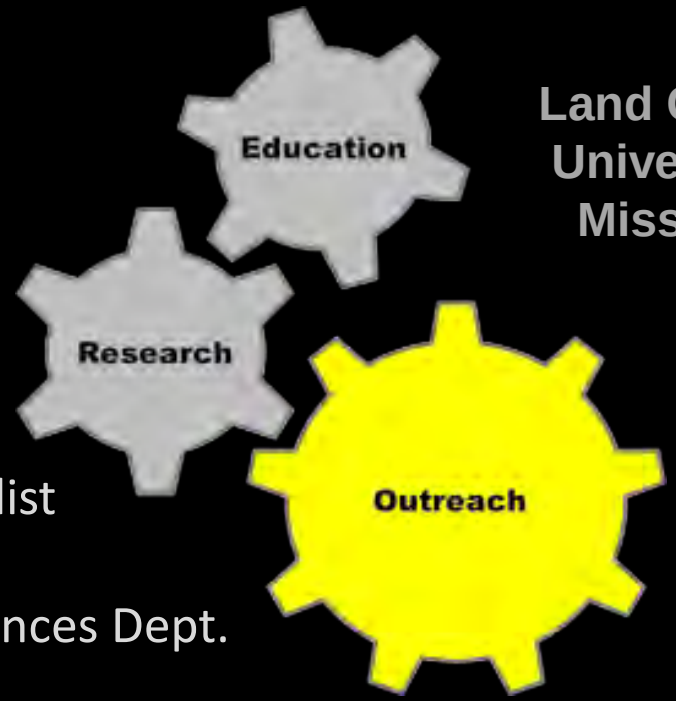
Health risks from consuming Montana groundwater, 20 years of private well testing, and new programming





Land Grant University Mission

Dr. Adam Sigler
Extension Water Quality Specialist
Assistant Professor
Land Resources and Environmental Sciences Dept.
Montana State University

Talk coauthors: Mari Eggers, Nicklas Kiekover, Gabrielle Jawer, Hendrick Moore

MONTANA STATE UNIVERSITY EXTENSION

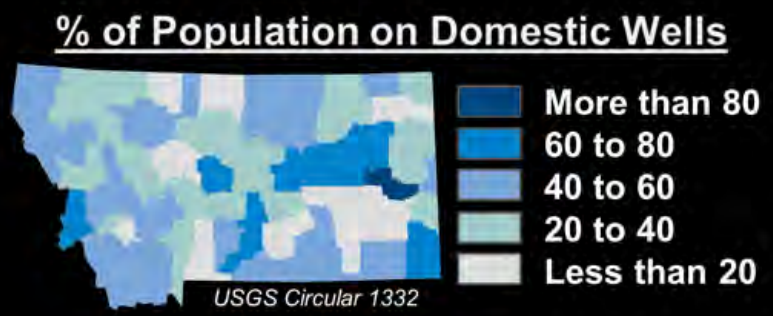
Montana AWRA
October 10th, 2025

Funders
MSU Extension
Montana Institute on Ecosystems
Montana Water Center

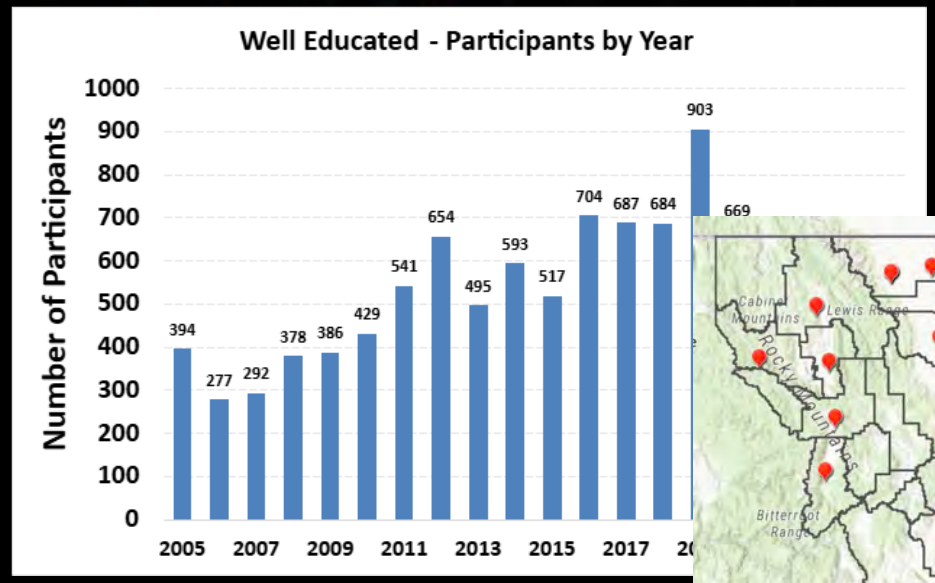
Well Educated

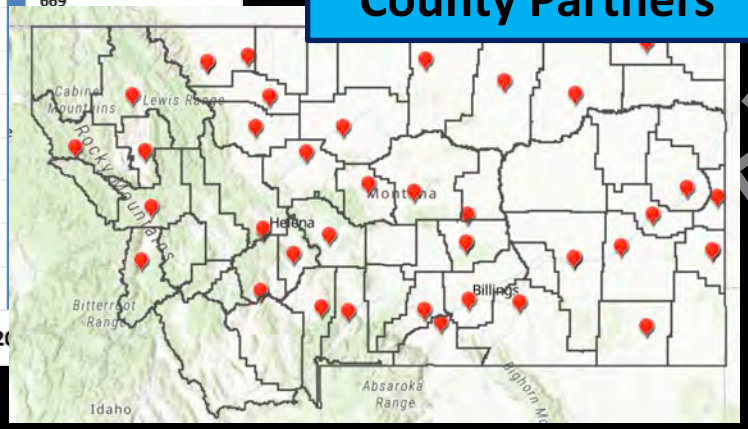
Program Goals

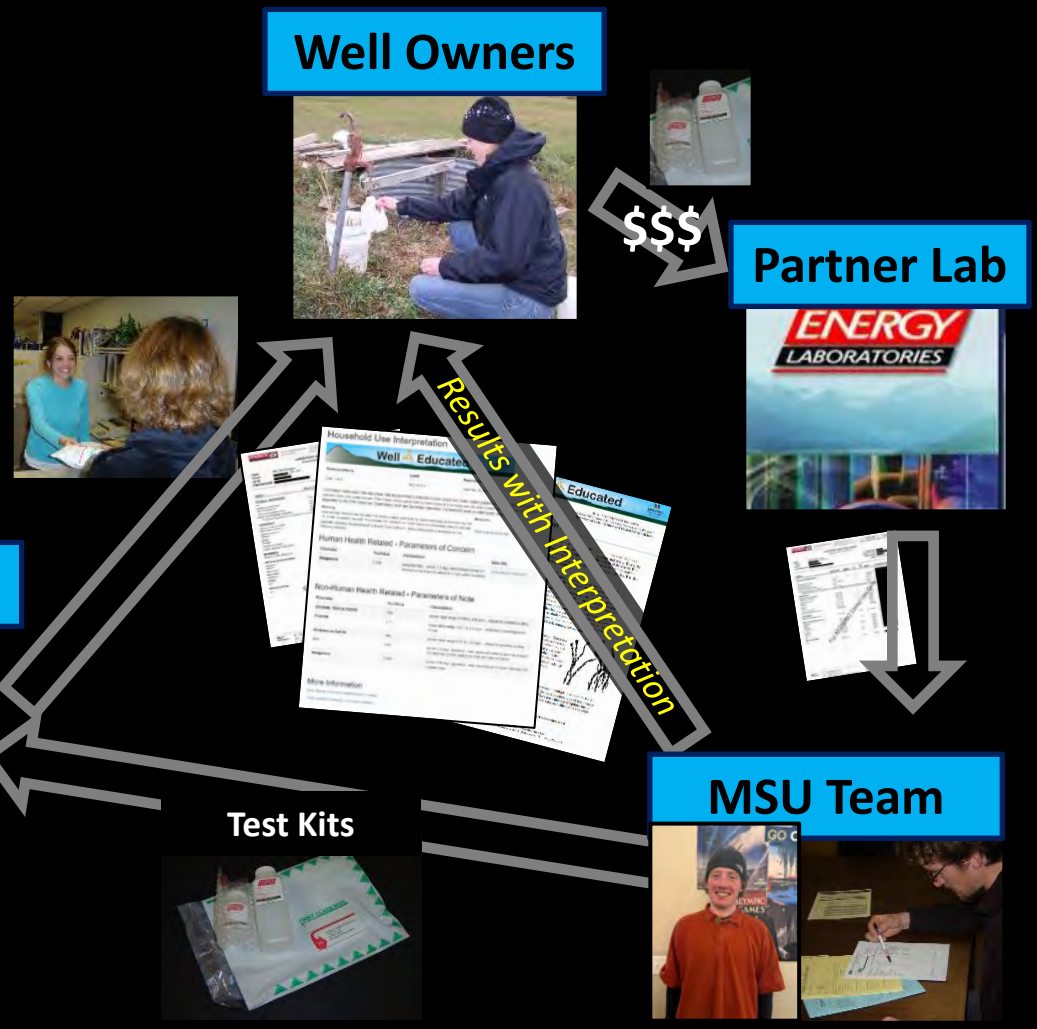
1. Well owner education: water suitability and groundwater protection
2. Centralized data resource: research and education



1/3 of Montana residents get home water from private wells







Mari Eggers, MSU

Adam Sigler, MSU

Nicklas Kiekover, MSU

Albert Parker, MSU

Bob Peterson, MSU

John LaFave, MBMG

Paul Bradley, USGS

Kelly Smalling, USGS

Environmental Pollution 369 (2025) 125810

Contents lists available at ScienceDirect

Environmental Pollution

journal homepage: www.elsevier.com/locate/envpol

Statewide cumulative human health risk assessment of inorganics-contaminated groundwater wells, Montana, USA☆

Margaret J. Eggers [a,b,*], W. Adam Sigler [b], Nicklas Kiekover [b], Paul M. Bradley [c], Kelly L. Smalling [d], Albert Parker [e], Robert K.D. Peterson [b], John I. LaFave [f]

[a] Microbiology and Cell Biology/Land Resources and Environmental Science Department, Montana State University, PO Box 173120, Bozeman, MT, 59717, United States
[b] Land Resources and Environmental Sciences Department, PO Box 173120, Montana State University, Bozeman, MT, 59717, United States
[c] U.S. Geological Survey, South Atlantic Water Science Center, Columbia, SC, 29210, United States
[d] U.S. Geological Survey, New Jersey Water Science Center, Lawrenceville, NJ, 08648, United States
[e] Center for Biofilm Engineering, Department of Mechanical Sciences, Montana State University, Bozeman, MT, United States
[f] Research Division, Montana Bureau of Mines and Geology, Butte, MT, United States

ARTICLE INFO

Keywords:
Private wells
Cumulative risk assessment
Groundwater
Geospatial analysis
Heavy metals
Human health
Inorganic contaminants
Montana

ABSTRACT

Across the United States, rural residents rely on unregulated and generally unmonitored private wells for drinking water, which may pose serious health risks due to unrecognized contaminants. We assessed the nature, degree, and spatial distribution of cumulative health risks from inorganic contaminants in groundwater. Our analysis included nearly 84,000 data points from 6500+ wells, across 51 of Montana's 98 watersheds, using a public groundwater database. We compared a drinking water screening level cumulative risk assessment (CRA) for inorganics based on the U.S. Environmental Protection Agency (EPA) protective health thresholds (Maximum Contaminant Level Goals, Health Advisories [MCLG-HAs]) to a CRA based on EPA public supply enforceable Maximum Contaminant Levels (MCLs). Based on median concentrations of 19 inorganics (antimony, arsenic, barium, beryllium, boron, cadmium, chromium, copper, fluoride, manganese, molybdenum, nickel, nitrate, lead, selenium, strontium, thallium, uranium, zinc), 75% of watersheds had MCLG-HA-based cumulative risk values > 1.0; arsenic and uranium contributed the most risk, followed by strontium, fluoride, manganese and boron. Hence, this screening level (Tier I) CRA indicated widespread potential for unrecognized human health risk to private well users from inorganic contaminants considering both carcinogenic and non-carcinogenic risks. Sensitivity analysis showed that benchmarks applied (MCLG-HAs versus MCLs) exerted the largest control on results. Our findings identify priority regions for Tier 2 risk assessments to elucidate local sources and distributions of geogenic versus anthropomorphic contaminants. Our study is the first statewide assessment of cumulative health risk from groundwater that we are aware of, and results support increased statewide drinking water education and testing to reduce human health risks from contaminated private well water.

1. Introduction

Across the United States (U.S.), approximately 43 million people – about 15% of the U.S. population – lack access to public water services and rely instead on private wells (Dieter and Maupin, 2017; Dieter et al., 2018; Fox et al., 2016). Public supply drinking water contaminants are federally regulated under the Safe Drinking Water Act (SDWA) National Primary Drinking Water Regulations (U.S. Environmental Protection Agency, 2024a), but no federal laws govern private well water quality. Most states do not regulate water quality in private wells, beyond establishing standards for location and construction of new wells (National Ground Water Association, 2021). This lack of regulation is a public health concern because groundwater can contain a range of naturally occurring and anthropogenic toxics, including metals, metalloids, nitrate, fluoride, pesticides, polycyclic aromatic hydrocarbons, per- and polyfluoroalkyl substances (PFAS), and many other organic compounds (Bradley et al., 2018a; Bradley et al., 2021a; Bradley et al., 2021b; Bradley et al., 2022; DeSimone, 2009; DeSimone et al., 2015;

by Sarah Harmon.

Department, PO Box 173120, Montana State University, Bozeman, MT, 59717, United States.

Human health risk from contaminants in water

US Safe Drinking Water Act

Maximum Contaminant Levels (MCLs)

health risk vs economic compromise

Legally binding for public water supplies, not for private wells

Maximum Contaminant Level Goals (MCLGs)

Strictly health based

Concentration **BELOW** the threshold is **OK**
Concentration **ABOVE** the threshold is **NOT OK**

Cumulative Risk Approach

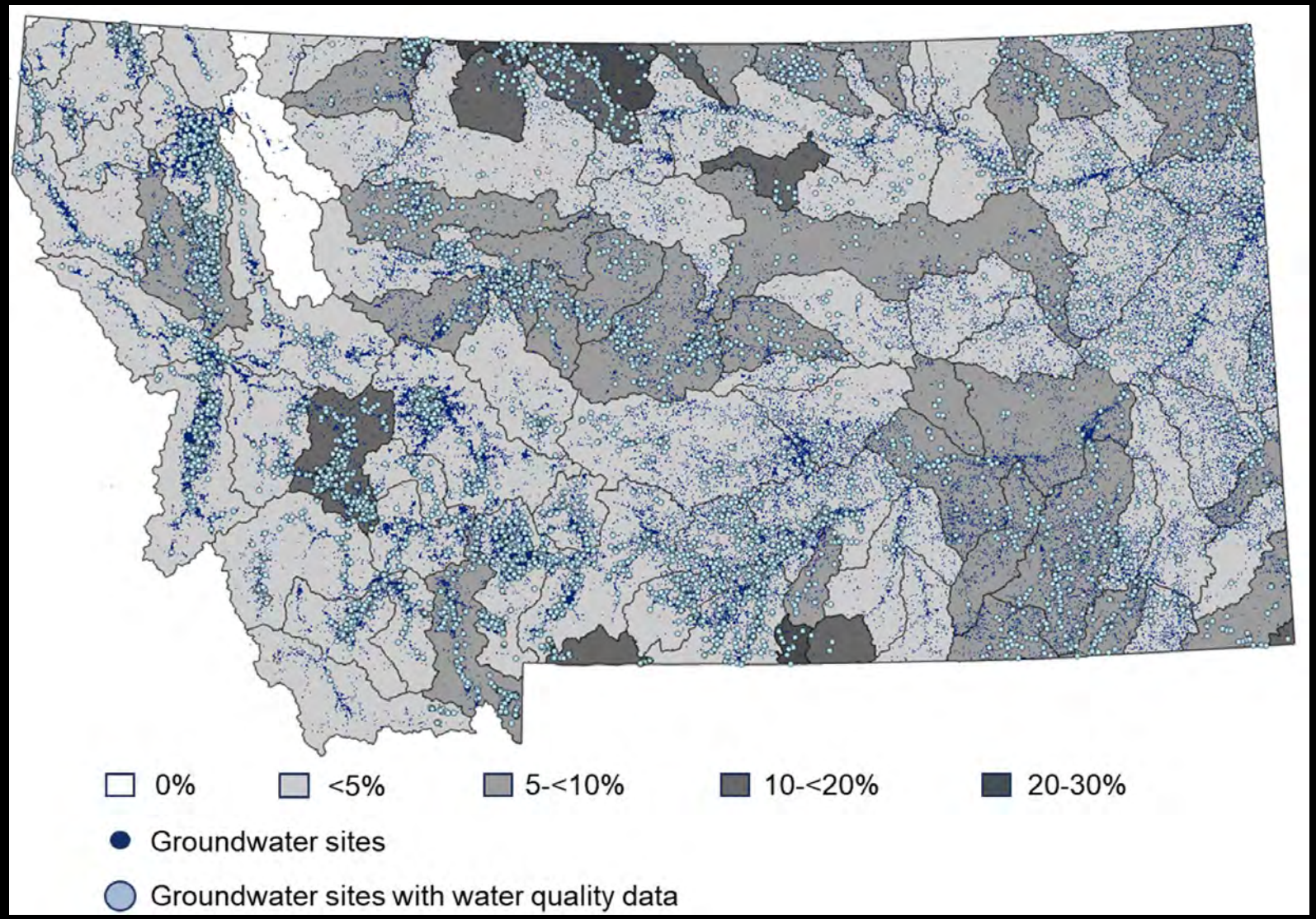
$$\textbf{Hazard Quotient} = \frac{\text{Observed Concentration}}{\text{Health Threshold}}$$

Cumulative Risk = Sum of hazard quotients for all analytes

Data and Methods

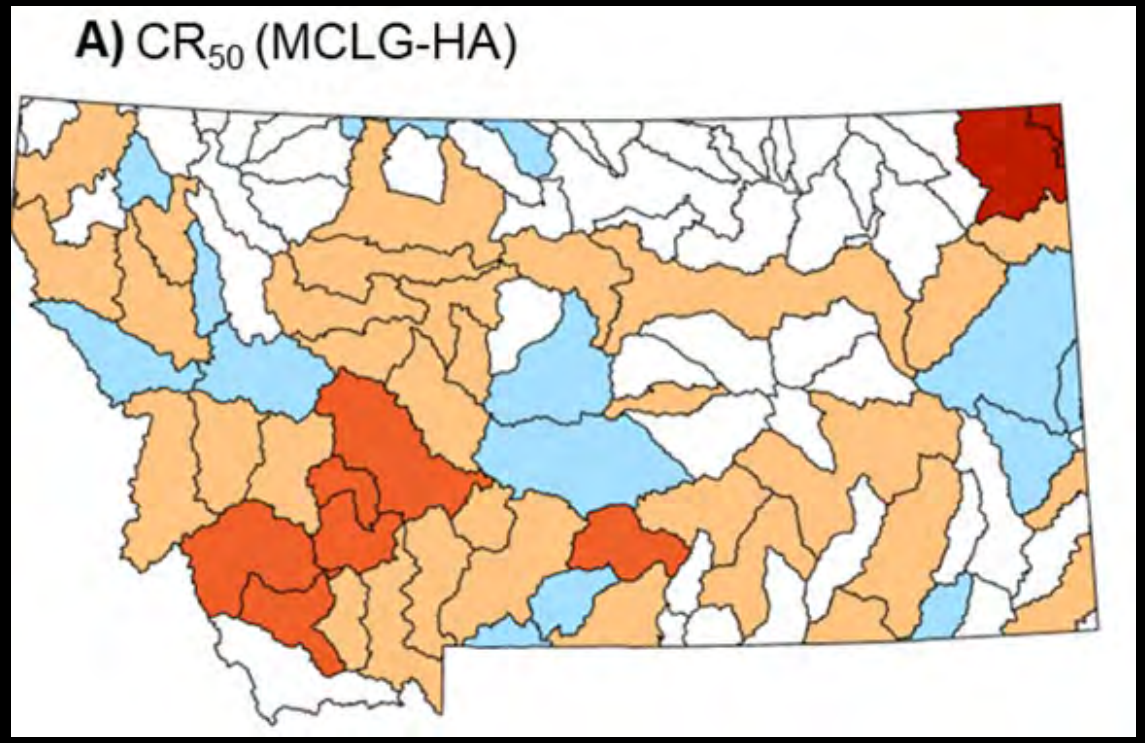
Data from: Montana Bureau of Mines and Geology (MBMG), Groundwater Information Center (GWIC)

1. Analysis by HUC8 Watershed (96)
2. Calculated median concentration to calculate hazard quotients
3. Required a minimum of 5 results per analyte per HUC8
4. Conducted extensive sensitivity analysis across scenarios of thresholds and data use filters



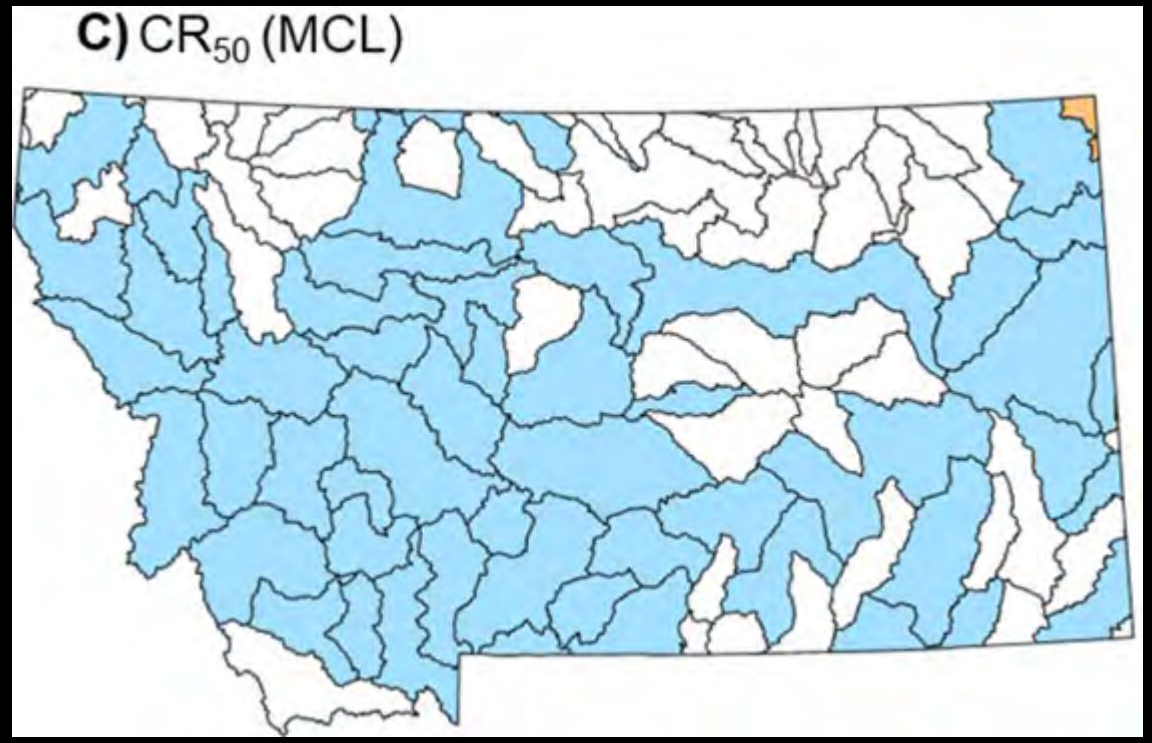
Cumulative Risk Results

MCLG-Ha (health) Thresholds



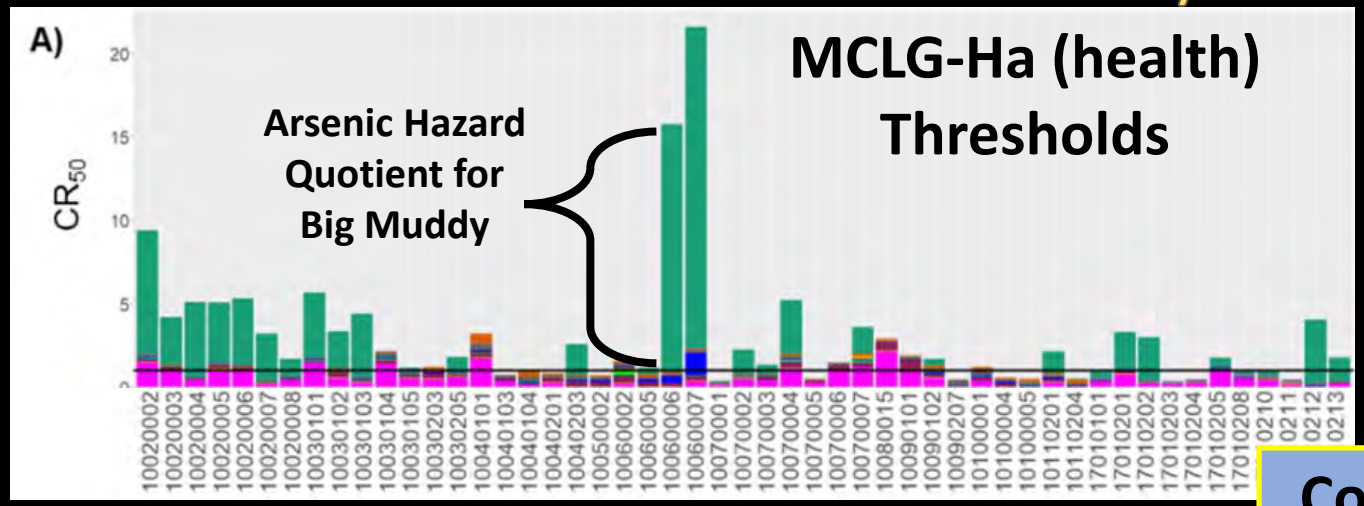
75% (38/51) of HUC8s have a CR >1

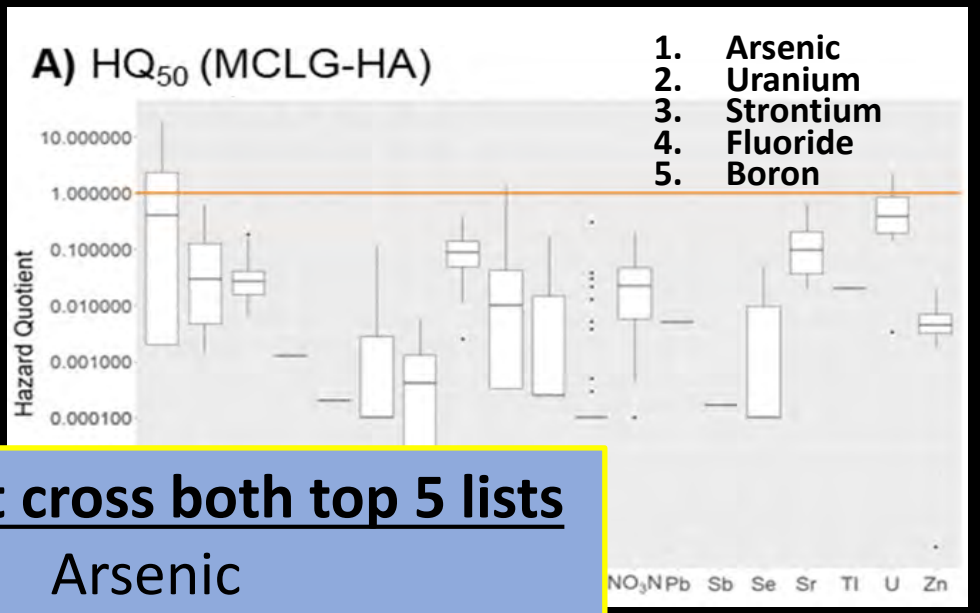
MCL Thresholds



2% (1/51) of HUC8s have a CR >1

Results by Analyte



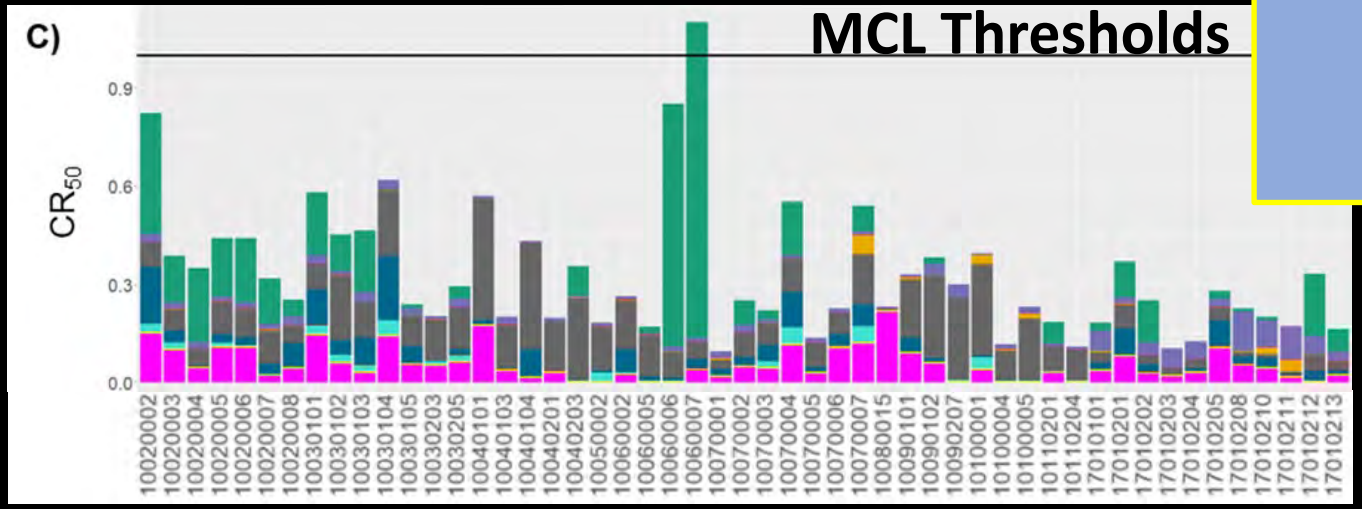


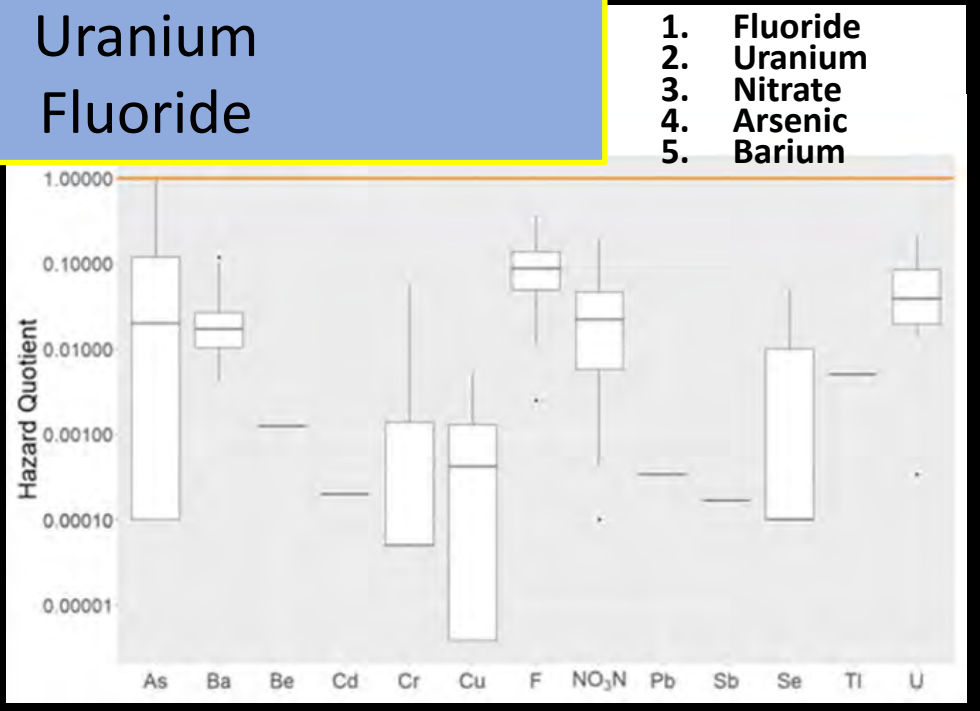
Consistent cross both top 5 lists

Arsenic

Uranium

Fluoride





Foundation for refined statewide education campaign

Cascade County

Human health related groundwater quality testing suggestions

County Test Guidance for Well Owners

Well Educated program summary results and county test guidance for general population

Well Ed Plots for Partners

General plots (click here)

Conservative health thresholds (click here)

General health thresholds (click here)

General Test Guidance

Your well water can taste great and look fine, but still have health risks. Protect your family's health by testing your well water for:

Nitrate and **Bacteria** (E. coli and total coliform) should be tested regularly, ideally every year.

Lead can be a concern if household plumbing was installed prior to the mid-1990s, especially if well water is corrosive.

Copper can be an issue if household plumbing includes copper and well water is corrosive.

Arsenic and **Uranium** are the most widespread contaminants posing human health risks in Montana groundwater.

Watershed specific test guidance for sensitive groups

- Arrow Watershed (click here)
- Belt Watershed (click here)
- Judith Watershed (click here)
- Smith Watershed (click here)
- Sun Watershed (click here)
- Upper Missouri Watershed (click here)
- Upper Missouri-Dearborn Watershed (click here)

Sensitive groups include children, elderly, pregnant women, and those with chronic health conditions. The watershed specific guidance is based on groundwater quality data from the Montana Bureau of Mines and Geology GWIC Database.

ll Educated Website

Search pages & people

ontana Well Educated Program Testing Your Well Water

County

n has provided water quality testing assistance to private well
des insights about what parameters (arsenic, nitrate, etc.) well
s of the state.

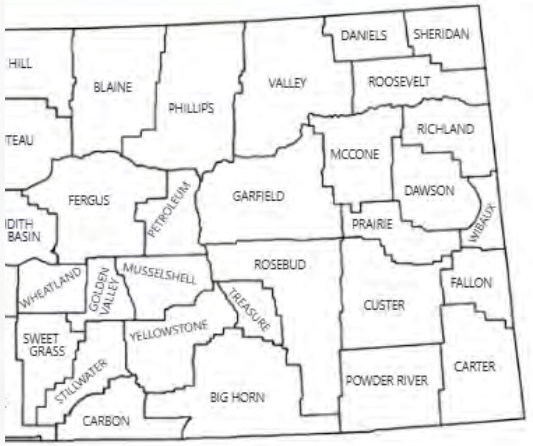
d on location. You can test your water by contacting a certified
ty partner in the Well Educated Program (click here for Well
g packages and a parameter glossary, click here. For information
s, see our results interpretation page here.

g recommendations and parameters of concern in your area,
this map.

w to use the map

see past Well Educated program results for guidance on what to

for sensitive groups by county and watershed



Cascade County

Human health related groundwater quality testing suggestions

County Test Guidance for Well Owners

Well Educated program summary results and county test guidance for general population

Well Ed Plots for Partners

General plots (click here)

Conservative health thresholds (click here)

General health thresholds (click here)

General Test Guidance

Your well water can taste great and look fine, but still have health risks. Protect your family's health by testing your well water for:

Nitrate and **Bacteria** (E. coli and total coliform) should be tested regularly, ideally every year.

Lead can be a concern if household plumbing was installed prior to the mid-1990s, especially if well water is corrosive.

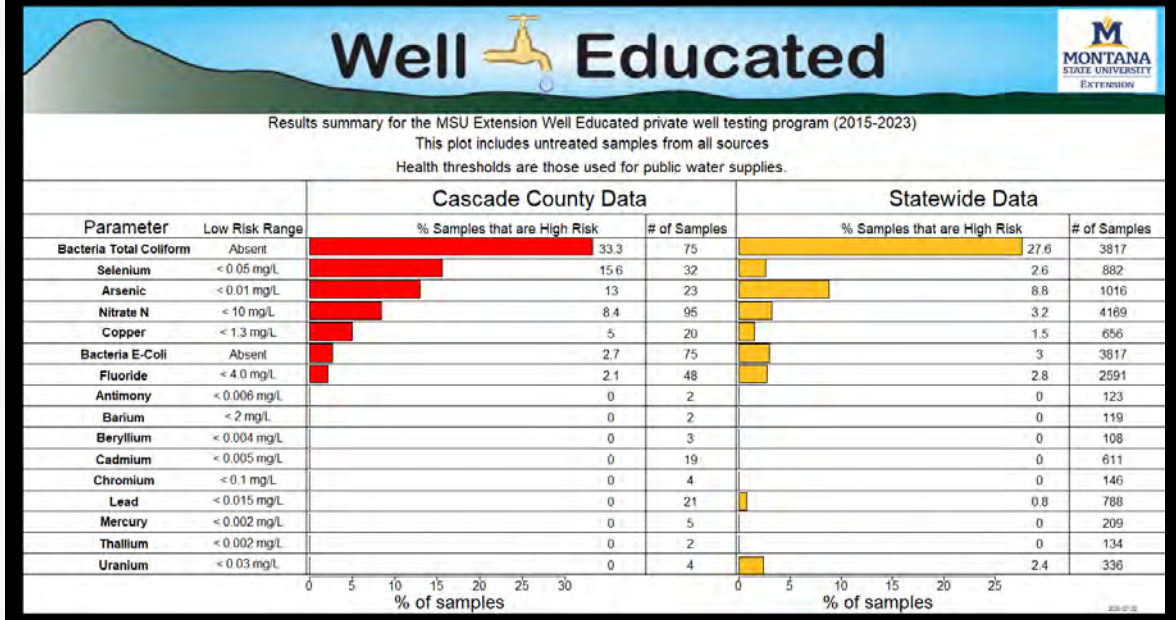
Copper can be an issue if household plumbing includes copper and well water is corrosive.

Arsenic and **Uranium** are the most widespread contaminants posing human health risks in Montana groundwater.

Watershed specific test guidance for sensitive groups

- Arrow Watershed (click here)
- Belt Watershed (click here)
- Judith Watershed (click here)
- Smith Watershed (click here)
- Sun Watershed (click here)
- Upper Missouri Watershed (click here)
- Upper Missouri-Dearborn Watershed (click here)

Sensitive groups include children, elderly, pregnant women, and those with chronic health conditions. The watershed specific guidance is based on groundwater quality data from the Montana Bureau of Mines and Geology GWIC Database.



Cascade County

Human health related groundwater quality testing suggestions

General Test Guidance

Your well water can taste great and look fine, but still have health risks. Protect your family's health by testing your well water for:

Nitrate and **Bacteria** (E. coli and total coliform) should be tested regularly, ideally every year.

Lead can be a concern if household plumbing was installed prior to the mid-1990s, especially if well water is corrosive.

Copper can be an issue if household plumbing includes copper and well water is corrosive.

Arsenic and **Uranium** are the most widespread contaminants posing human health risks in Montana groundwater.

County Test Guidance for Well Owners

Well Educated program summary results and county test guidance for general population

Well Ed Plots for Partners

General plots (click here)

Conservative health thresholds (click here)

General health thresholds (click here)

Watershed specific test guidance for sensitive groups

- Arrow Watershed (click here)
- Belt Watershed (click here)
- Judith Watershed (click here)
- Smith Watershed (click here)
- Sun Watershed (click here)
- Upper Missouri Watershed (click here)
- Upper Missouri-Dearborn Watershed (click here)

Sensitive groups include children, elderly, pregnant women, and those with chronic health conditions. The watershed specific guidance is based on groundwater quality data from the Montana Bureau of Mines and Geology GWIC Database.

Sun River Watershed Top Contaminants

Well Educated

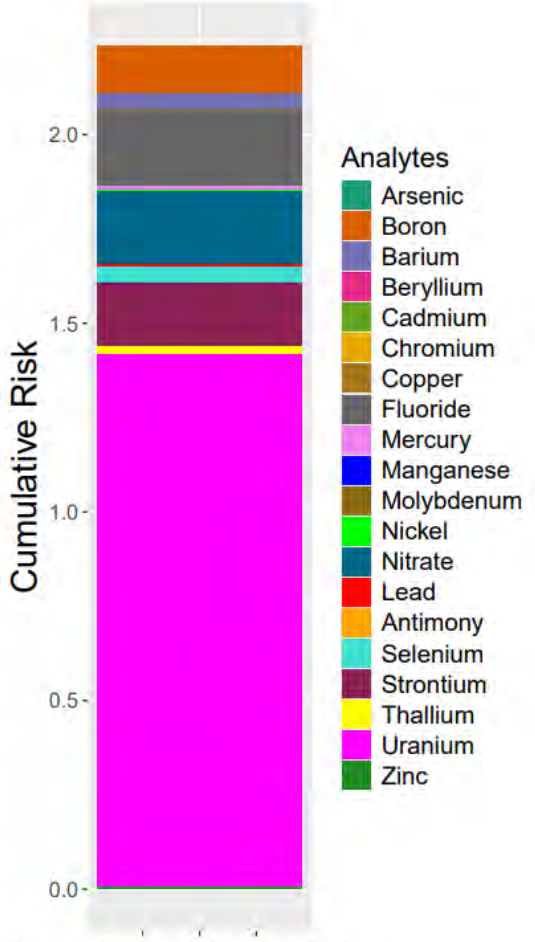
MONTANA STATE UNIVERSITY EXTENSION

The contaminants below are ranked in order of health concern, with the most important to test for at the top of the list.

The "Threshold" is the most conservatively health protective concentration, above which health risks exist for lifetime consumption. The hazard quotient (HQ), is the most common (median) contaminant concentration for the watershed, divided by the health threshold. The higher the HQ, the higher the health risk and values greater than 1 are considered unacceptable for lifetime consumption. The Cumulative Health Risk is all the HQs added together; values greater than 1 indicate health risks for long-term consumption by sensitive groups, including children, elderly, pregnant women, and those with chronic health conditions.

Cumulative Risk: 2.24

Rank	Analyte	Threshold (µg/L)	HQ
1	Uranium	3.0	1.41333
2	Fluoride	4.0	0.20000
3	Nitrate	10.0	0.19633
4	Strontium	4000.0	0.16634
5	Boron	1000.0	0.12500
6	Selenium	50.0	0.04400
7	Barium	1300.0	0.04204
8	Thallium	0.5	0.02000
9	Mercury	2.0	0.01000
10	Zinc	2000.0	0.00600
11	Lead	1.0	0.00500
12	Manganese	0.1	0.00250
13	Copper	1300.0	0.00243
14	Arsenic	0.5	0.00200
15	Beryllium	4.0	0.00125
16	Molybdenum	40.0	0.00025
17	Cadmium	5.0	0.00020
18	Antimony	6.0	0.00017
19	Chromium	50.0	0.00010
20	Nickel	100.0	0.00010



These results are based on data from the Montana Bureau of Mines and Geology, Groundwater Information Center Database, as of August 24, 2022

Deep dives: Montana State researchers create tool for testing private well water

Alex Mitchell Lee Newspapers Sep 8, 2025

1 of 3

A water well pours out water at a subdivision north of Bozeman.
Adrian Sanchez-Gonzalez/Chronicle

MORE INFORMATION

Ag producers mostly optimistic about

A first-of-its-kind Montana State University study found the private well water many Montanans rely on might be more unhealthy than owners think.

The study found 75% of the 51 watersheds researchers analyzed were contaminated with human carcinogens such as arsenic and uranium, which were frequently detected above federal lifetime health risks.

Extension Well Test Programs

~400-800 per year **~3000 per year** **~8000 per year**

	Montana Extension	West Virginia Extension	Wisconsin Extension
Timing	Always rolling	One sample drop-off date	Always rolling
Lab	Private Lab	On Campus	On Campus
Certified	Yes	No	Yes
Follow up	Ad hoc phone/email; no meeting	Public presentation	Don't think so

MSU Team's Pilot Clinic Work

1. Madison Jefferson public facing clinic – October 2023
2. On campus analysis internal samples - March 2025
3. On campus analysis with public samples – October 2025 (happening now)

Pilot #1

Madison & Jefferson County Well Test Clinic Fall 2023

State and National Partners

MSU Extension
MSU Environmental Health
MSU Community Health
Montana Bureau of Mines and Geology
Montana Institute on Ecosystems
US Geological Survey

Local Partners

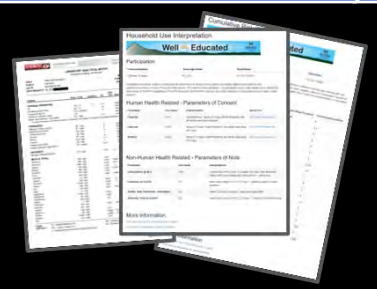
Madison & Jefferson County Extension
Madison Conservation District
Madison County Health
Jefferson County Health
Madison Valley Library

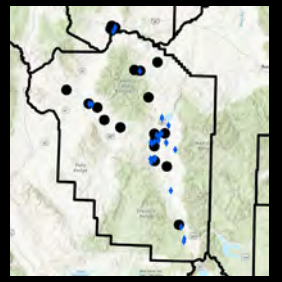
Funding

Montana Institute on Ecosystems
Montana Water Center
USGS for PFAS Testing

Program Outline (3 months)

Recruit → **Distribute Kits** → **Collect & Analyze Samples** → **Interpret & Deliver Results** → **Present to Communities** → **Research**

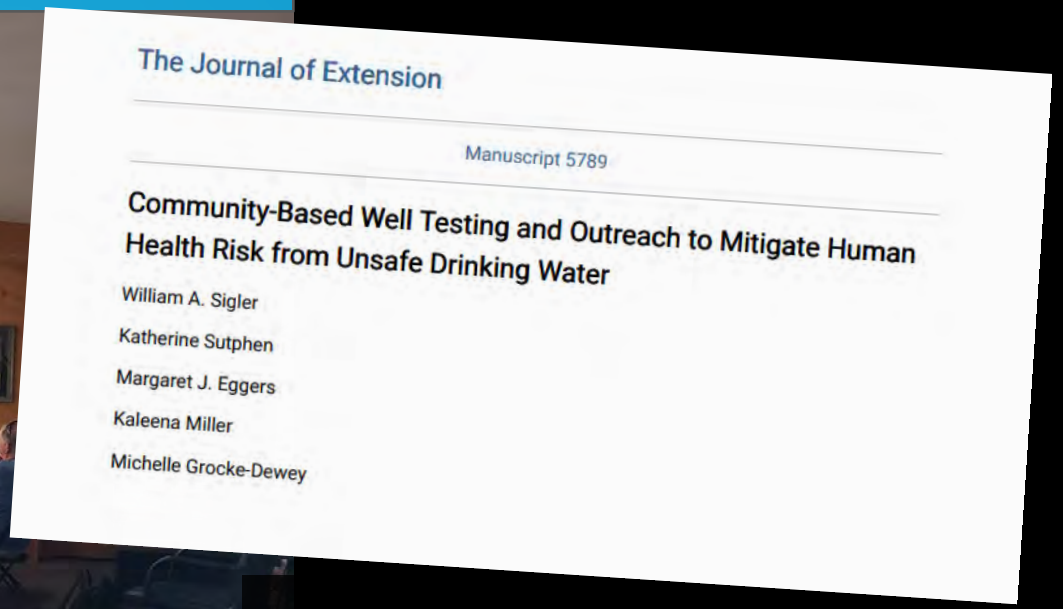




Pilot #1

Pilot Well Test Clinic
Madison & Jefferson Counties Fall 2023

Public Presentation of Results, Ennis, October 19th



The Journal of Extension

Manuscript 5789

Community-Based Well Testing and Outreach to Mitigate Human Health Risk from Unsafe Drinking Water

William A. Sigler

Katherine Sutphen

Margaret J. Eggers

Kaleena Miller

Michelle Grocke-Dewey

Public Meeting Speakers

1. Adam Sigler (MSU) – Wells and Test Results
2. Mari Eggers (MSU)– Cumulative Health Risk
3. Sara Edinberg (MBMG) – Local Hydrogeology
4. Megan Bullock (MC) – Septic Systems
5. Tess Sobolewski (MSU) – PFAS testing opportunity
6. Adam Sigler (MSU) – Treatment, Testing, Summary

Pilot #2

Pilot Well Test Clinic
Analysis on MSU Campus (internal) – March 2025

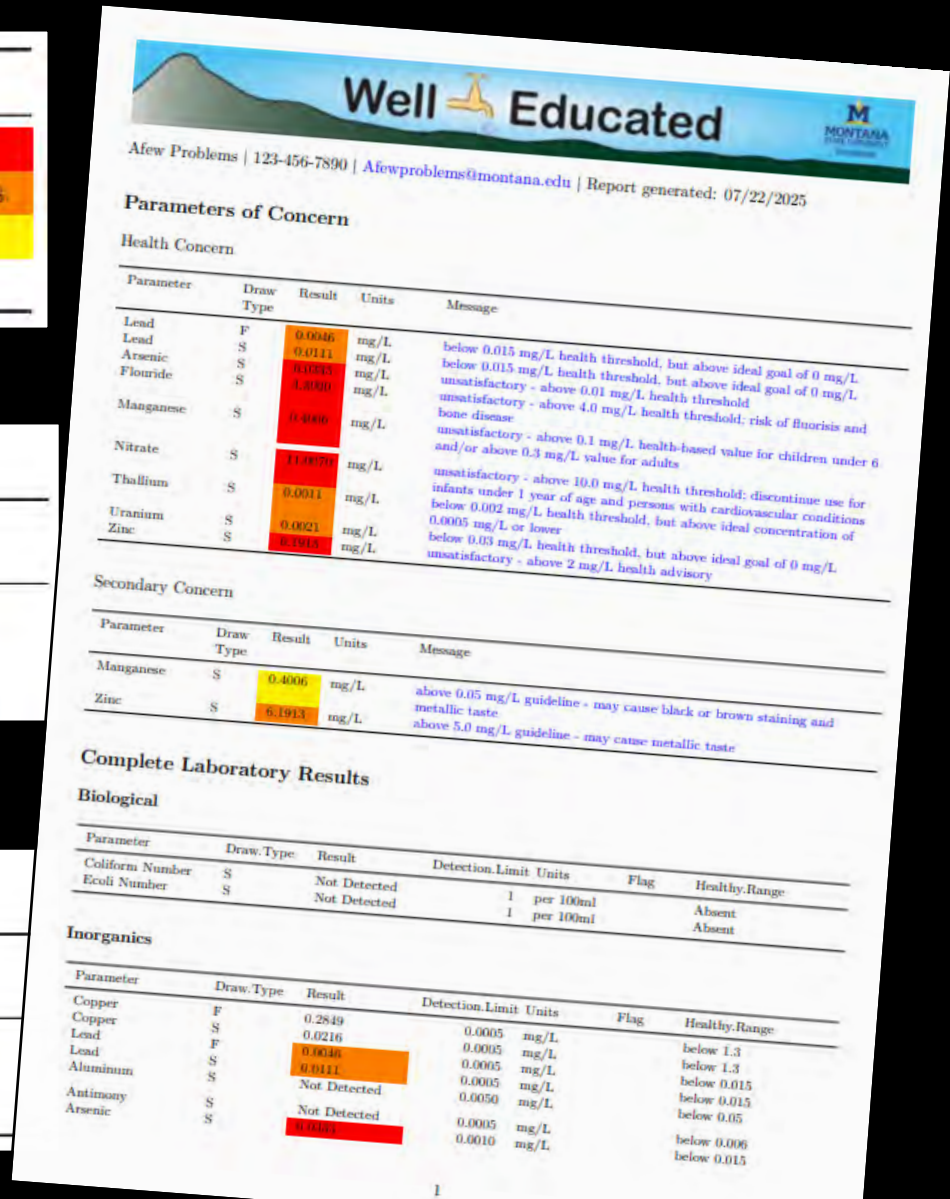
Color Meanings
Red: Exceeds health thresholds, will cause health problems
Orange: Exceeds ideal health guideline but within health thresholds, may cause health effects
Yellow: Within health thresholds but may cause aesthetic problems
No Color: Within healthy range

Health Concern

Parameter	Draw Type	Result	Units	Message
Lead	F	0.0046	mg/L	below 0.015 mg/L health threshold, but above ideal goal of 0 mg/L
Lead	S	0.0111	mg/L	below 0.015 mg/L health threshold, but above ideal goal of 0 mg/L
Arsenic	S	0.0333	mg/L	unsatisfactory - above 0.01 mg/L health threshold
Flouride	S	4.3000	mg/L	unsatisfactory - above 4.0 mg/L health threshold; risk of fluorisis and

Secondary Concern

Parameter	Draw Type	Result	Units	Message
Manganese	S	0.4006	mg/L	above 0.05 mg/L guideline - may cause black or brown staining and metallic taste
Zinc	S	6.1913	mg/L	above 5.0 mg/L guideline - may cause metallic taste



Well Educated

Afew Problems | 123-456-7890 | Afewproblems@montana.edu | Report generated: 07/22/2025

Parameters of Concern

Health Concern

Parameter	Draw Type	Result	Units	Message
Lead	F	0.0046	mg/L	below 0.015 mg/L health threshold, but above ideal goal of 0 mg/L
Lead	S	0.0111	mg/L	below 0.015 mg/L health threshold, but above ideal goal of 0 mg/L
Arsenic	S	0.0333	mg/L	unsatisfactory - above 0.01 mg/L health threshold
Flouride	S	4.3000	mg/L	unsatisfactory - above 4.0 mg/L health threshold; risk of fluorisis and bone disease
Manganese	S	0.4006	mg/L	unsatisfactory - above 0.1 mg/L health-based value for children under 6 and/or above 0.3 mg/L value for adults
Nitrate	S	11.0870	mg/L	unsatisfactory - above 10.0 mg/L health threshold; discontinue use for infants under 1 year of age and persons with cardiovascular conditions
Thallium	S	0.0011	mg/L	below 0.002 mg/L health threshold, but above ideal concentration of 0.0005 mg/L or lower
Uranium	S	0.0021	mg/L	below 0.03 mg/L health threshold, but above ideal goal of 0 mg/L
Zinc	S	6.1913	mg/L	unsatisfactory - above 2 mg/L health advisory

Secondary Concern

Parameter	Draw Type	Result	Units	Message
Manganese	S	0.4006	mg/L	above 0.05 mg/L guideline - may cause black or brown staining and metallic taste
Zinc	S	6.1913	mg/L	above 5.0 mg/L guideline - may cause metallic taste

Complete Laboratory Results

Biological

Parameter	Draw.Type	Result	Detection.Limit	Units	Flag	Healthy.Range
Coliform Number	S	Not Detected	1	per 100ml		Absent
Ecoli Number	S	Not Detected	1	per 100ml		Absent

Inorganics

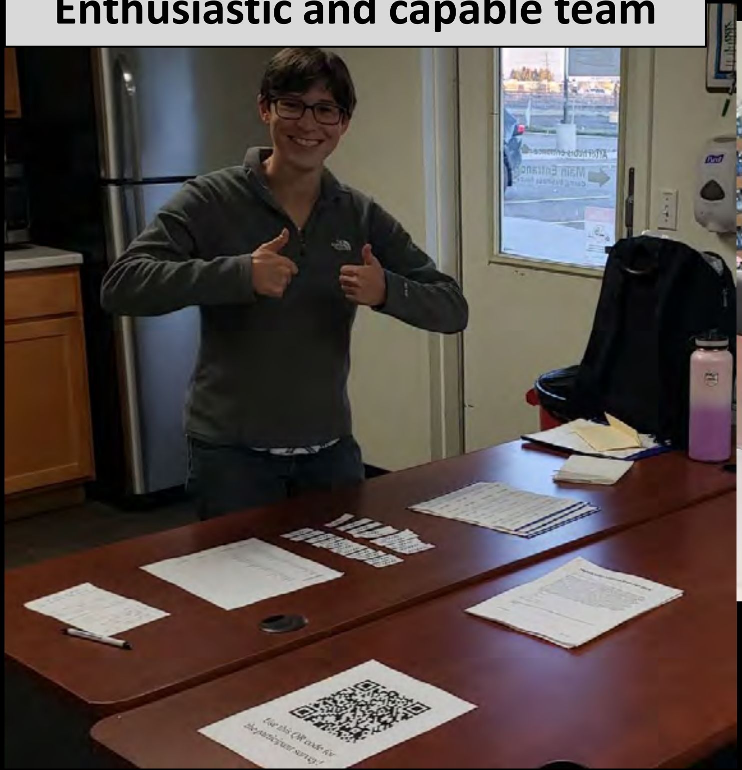
Parameter	Draw.Type	Result	Detection.Limit	Units	Flag	Healthy.Range
Copper	F	0.2849	0.0005	mg/L		below 1.3
Copper	S	0.0216	0.0005	mg/L		below 1.3
Lead	F	0.0046	0.0005	mg/L		below 0.015
Lead	S	0.0111	0.0005	mg/L		below 0.015
Aluminum	S	Not Detected	0.0050	mg/L		below 0.05
Antimony	S		0.0005	mg/L		below 0.006
Arsenic	S	Not Detected	0.0010	mg/L		below 0.015

1

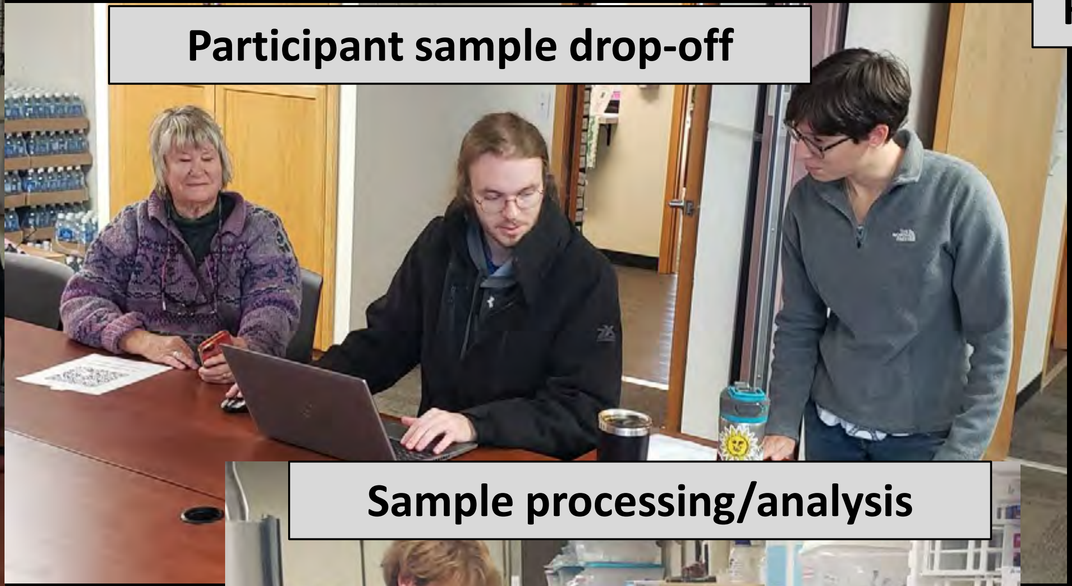
Pilot #3

Pilot Well Test Clinic
Analysis on MSU Campus (public) Sept-Nov 2025

Enthusiastic and capable team



Participant sample drop-off



Sample processing/analysis

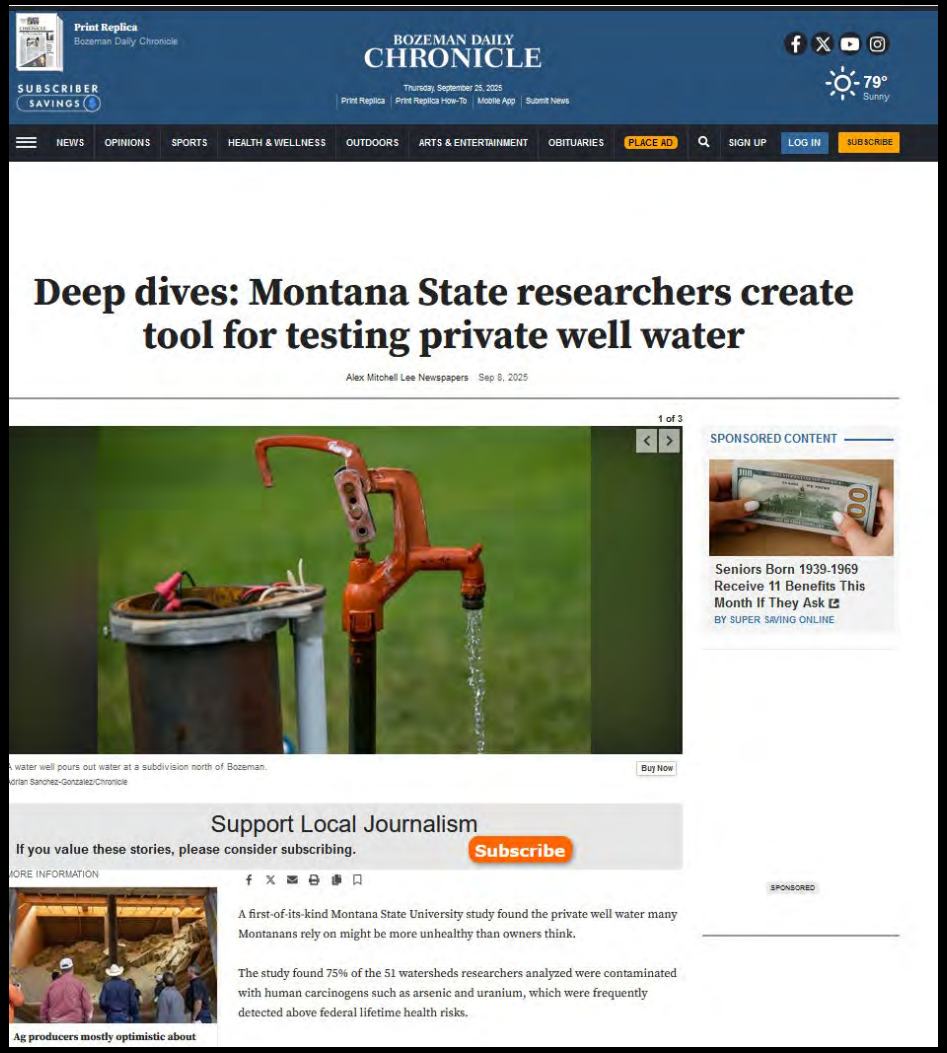
Results/interp delivery – Nov 3rd

Public workshop – Nov 17th

Gallatin Pilot Sample Drop Off
October 6th
<u>Monday this Week</u>!

“The future was wide open” (Tom Petty)

Questions?



Print Replica
Bozeman Daily Chronicle

BOZEMAN DAILY CHRONICLE

Thursday, September 25, 2025
Print Replica | Print Replica How-To | Mobile App | Submit News

79° Sunny

SUBSCRIBER SAVINGS

NEWS | OPINIONS | SPORTS | HEALTH & WELLNESS | OUTDOORS | ARTS & ENTERTAINMENT | OBITUARIES | PLACE AD | SIGN UP | LOG IN | SUBSCRIBE

Deep dives: Montana State researchers create tool for testing private well water

Alex Mitchell Lee Newspapers Sep 8, 2025

1 of 3

A water well pours out water at a subdivision north of Bozeman.
Adrian Sanchez-Gonzalez/Chronicle

Buy Now

Support Local Journalism
If you value these stories, please consider subscribing. Subscribe

MORE INFORMATION

Ag producers mostly optimistic about

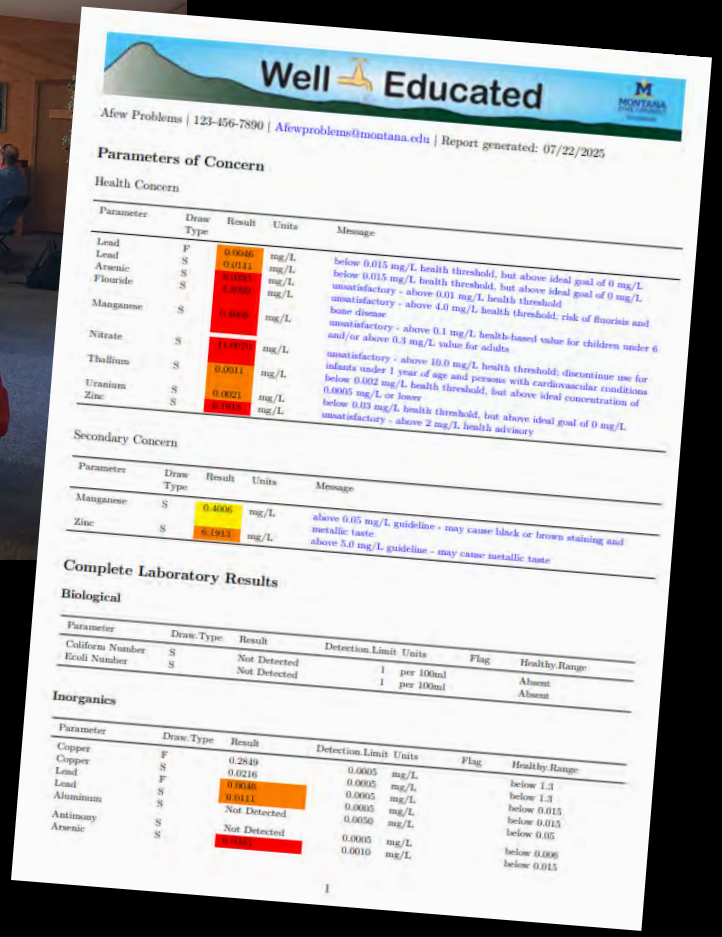
A first-of-its-kind Montana State University study found the private well water many Montanans rely on might be more unhealthy than owners think.

The study found 75% of the 51 watersheds researchers analyzed were contaminated with human carcinogens such as arsenic and uranium, which were frequently detected above federal lifetime health risks.

SPONSORED CONTENT

Seniors Born 1939-1969 Receive 11 Benefits This Month If They Ask
BY SUPER SAVING ONLINE

SPONSORED



Well Educated

Afew Problems | 123-456-7890 | Afewproblems@montana.edu | Report generated: 07/22/2025

Parameters of Concern

Health Concern

Parameter	Draw Type	Result	Units	Message
Lead	F	0.0046	mg/L	below 0.015 mg/L health threshold, but above ideal goal of 0 mg/L
Lead	S	0.0111	mg/L	below 0.015 mg/L health threshold, but above ideal goal of 0 mg/L
Arsenic	S	0.0215	mg/L	unsatisfactory - above 0.01 mg/L health threshold
Flouride	S	4.8930	mg/L	unsatisfactory - above 4.0 mg/L health threshold; risk of fluorisis and bone disease
Manganese	S	0.4006	mg/L	unsatisfactory - above 0.1 mg/L health-based value for children under 6 and/or above 0.3 mg/L value for adults
Nitrate	S	11.0070	mg/L	unsatisfactory - above 10.0 mg/L health threshold; discontinue use for infants under 1 year of age and persons with cardiovascular conditions
Thallium	S	0.0311	mg/L	below 0.002 mg/L health threshold, but above ideal concentration of 0.0005 mg/L or lower
Uranium	S	0.0021	mg/L	below 0.03 mg/L health threshold, but above ideal goal of 0 mg/L
Zinc	S	6.1913	mg/L	unsatisfactory - above 2 mg/L health advisory

Secondary Concern

Parameter	Draw Type	Result	Units	Message
Manganese	S	0.4006	mg/L	above 0.05 mg/L guideline - may cause black or brown staining and metallic taste
Zinc	S	6.1913	mg/L	above 5.0 mg/L guideline - may cause metallic taste

Complete Laboratory Results

Biological

Parameter	Draw Type	Result	Detection Limit	Units	Flag	Healthy Range
Coliform Number	S	Not Detected	1	per 100ml		Absent
Ecoli Number	S	Not Detected	1	per 100ml		Absent

Inorganics

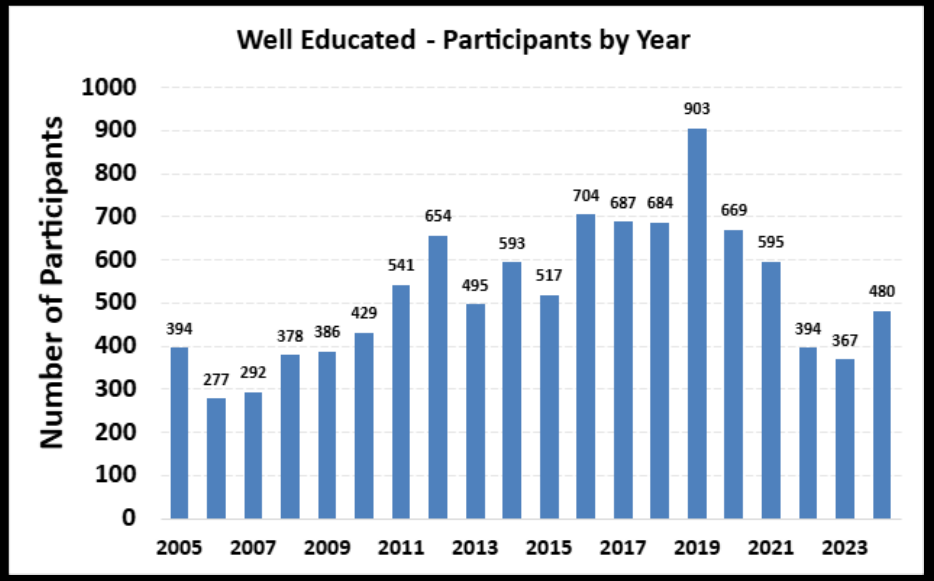
Parameter	Draw Type	Result	Detection Limit	Units	Flag	Healthy Range
Copper	F	0.2849	0.0005	mg/L		below 1.3
Copper	S	0.0216	0.0005	mg/L		below 1.3
Lead	F	0.0046	0.0005	mg/L		below 0.015
Lead	S	0.0111	0.0005	mg/L		below 0.015
Aluminum	S	Not Detected	0.0050	mg/L		below 0.05
Antimony	S	Not Detected	0.0005	mg/L		below 0.006
Arsenic	S	0.0215	0.0010	mg/L		below 0.015

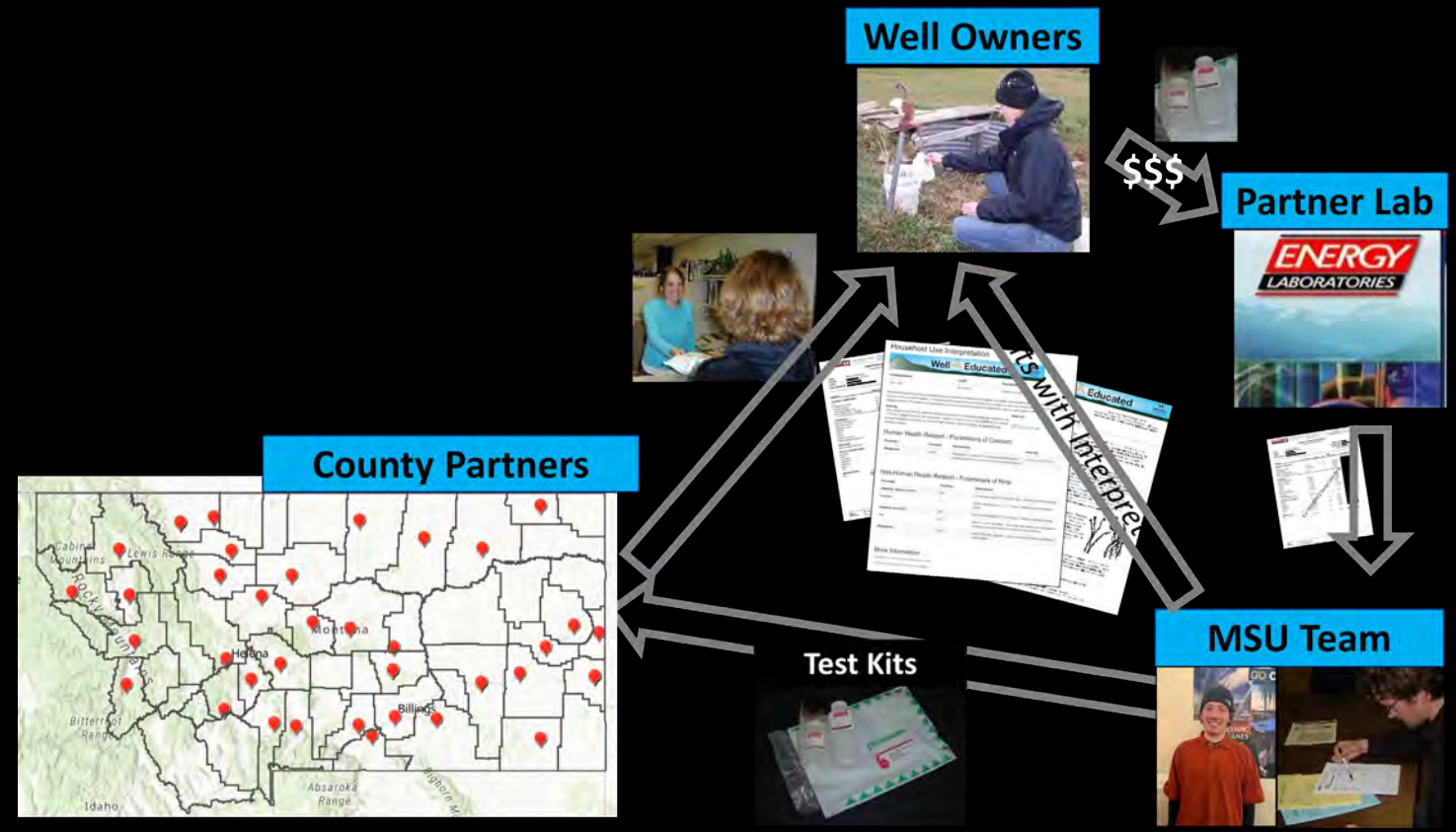
1

Well Educated

Program Goals

1. Well owner education: water suitability and groundwater protection
2. Centralized data resource: research and education





19 Analytes

GWIC heading & units	Analyte	Health Thresholds (USGS 2022)	Health Thresholds Source	MCL Thresholds	MCL Source	RL cutoff	ND set value
As (µg/L)	arsenic	0.5	MCLG (RL)	10	MCL	2	0.0001
B (µg/L)	boron	2400	WHO			2400	0.05
Ba (µg/L)	barium	1300	WHO	2000	MCL	1300	0.08
Be (µg/L)	beryllium	4	MCLG	4	MCL = MCLG	4	0.005
Cd (µg/L)	cadmium	5	MCLG	5	MCL = MCLG	5	0.001
Cr (µg/L)	chromium	50	WHO	100	MCL	50	0.005
Cu (µg/L)	copper	1300	MCLG	1300	AL - MCLG	1300	0.005
F (mg/l)	fluoride	4	MCLG	4	MCL = MCLG	4	0.01
Mn (mg/l)	manganese	0.3	Health Advisory			0.3	0.0001
Mo (µg/L)	molybdenum	40	Health Advisory			40	0.01
Ni (µg/L)	nickel	100	Health Advisory			100	0.02
NO3-N (mg/l)	nitrate	10	MCLG	10	MCL = MCLG	10	0.001
Pb (µg/L)	lead	1	AAP	15	AL	2	0.005
Sb (µg/L)	antimony	6	MCL	6	MCL = MCLG	6	0.001
Se (µg/L)	selenium	50	MCLG	50	MCL = MCLG	50	0.005
Sr (µg/L)	strontium	4000	Health Advisory			4000	0.07
Tl (µg/L)	thallium	0.5	MCLG	2	MCL	2	0.01
U (µg/L)	uranium	3	MCLG (RL)	30	MCL	3	0.01
Zn (µg/L)	zinc	2000	Health Advisory			2000	0.001

Contribution/Value

Summary - Broader Impacts

1. First statewide cumulative risk (CR) assessment in the US
2. Higher CR using MCLG-Ha (health) thresholds relative to MCLs
   - attributed more to the lower threshold values for some analytes (As, Ba, Cr, Pb, Tl, U)
   - than to the 6 analytes lacking an MCL (B, Mn, Mo, Ni, Sr, Zn).

In Montana

1. Foundation for refined statewide education campaign

Challenges/Limitations

1. High detection limits on some analytes produce a high frequency of non-detect values
2. Many watersheds with insufficient data to assess
3. Analysis is not on individual wells, so mapping is at relatively coarse watershed scale

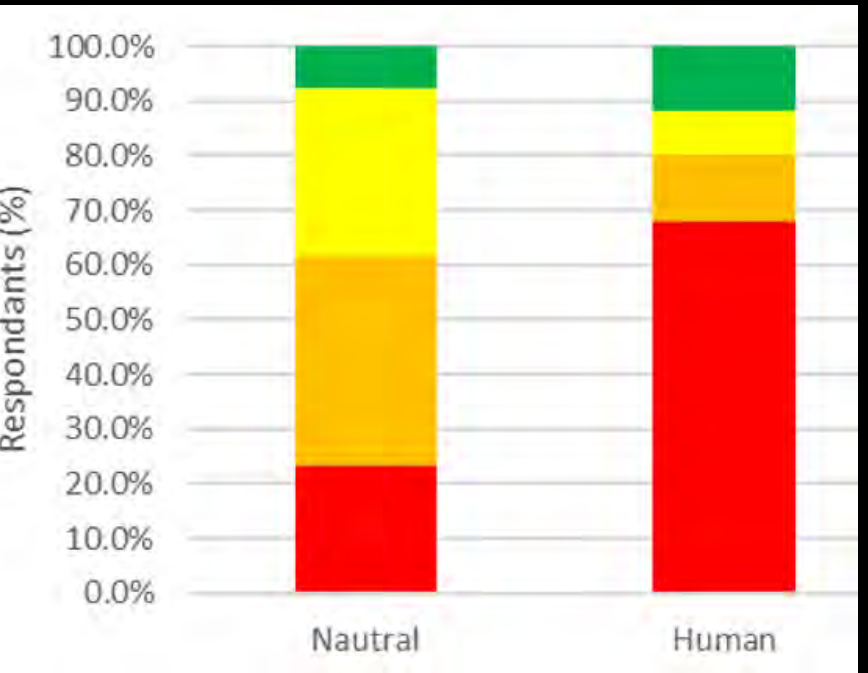
Concern about risk based on source type

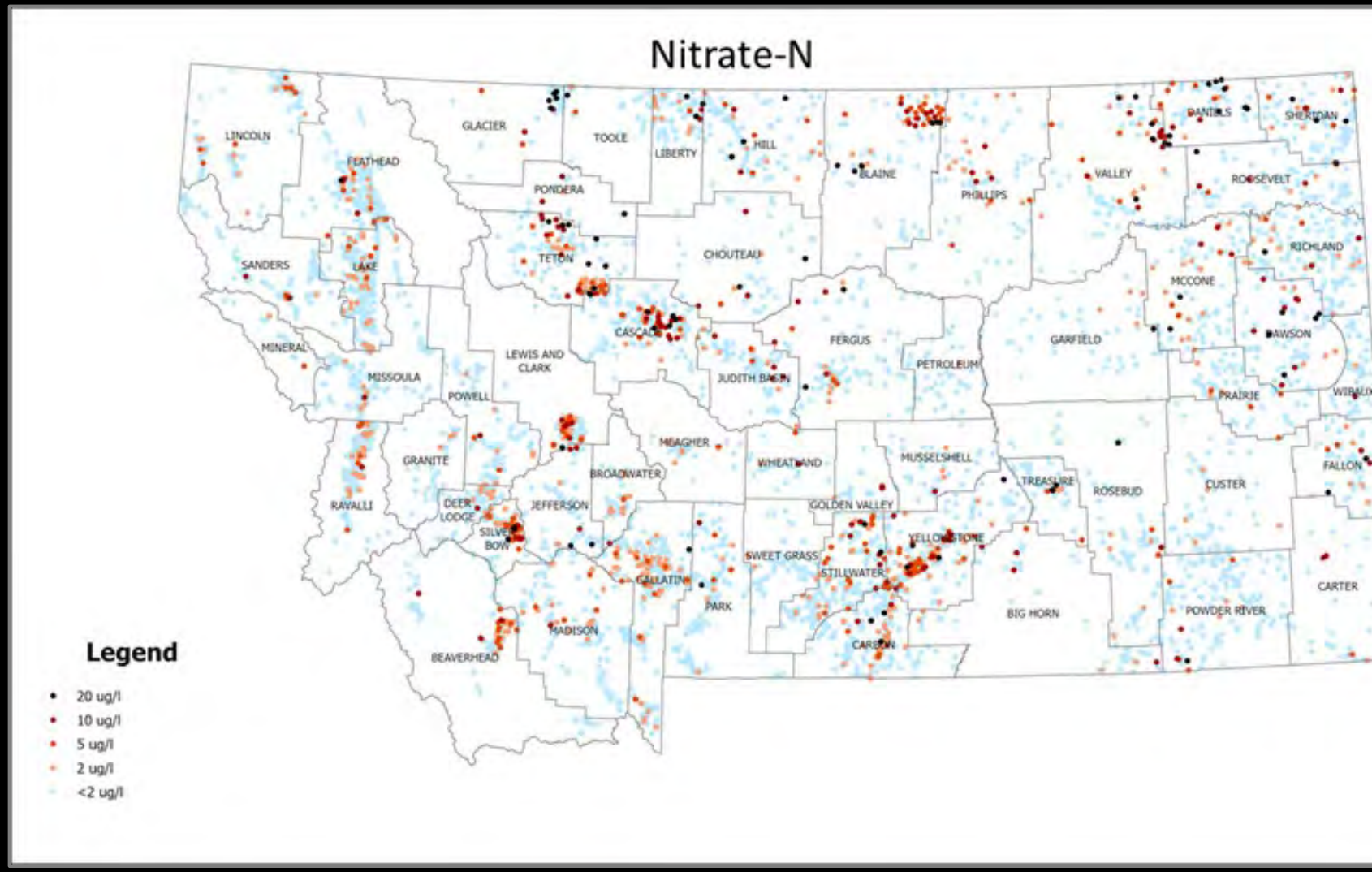
% “very concerned” about contaminants in their well water

Human Sources = 68%

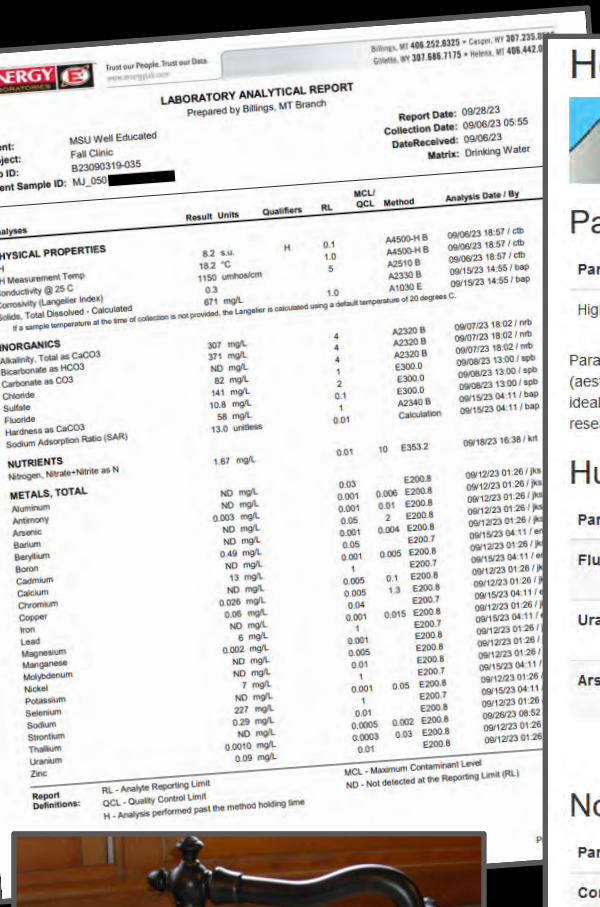
Natural Sources = 23%

- Not At All Concerned
- A Little Concerned
- Moderately Concerned
- Very Concerned





Individual Participant Results



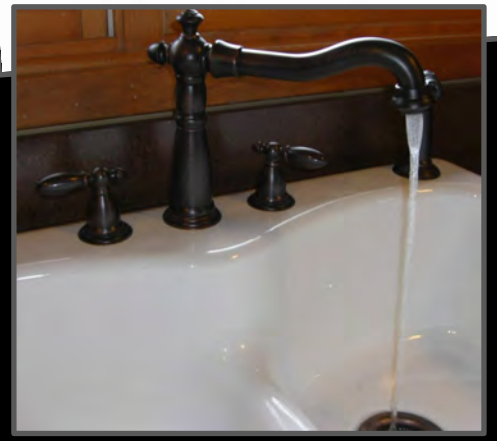
LABORATORY ANALYTICAL REPORT
Prepared by Billings, MT Branch

Client: MSU Well Educated
Project: Fall Clinic
Lab ID: B23090319-035
Client Sample ID: MJ_050 [redacted]

Report Date: 09/28/23
Collection Date: 09/06/23 05:55
DateReceived: 09/06/23
Matrix: Drinking Water

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
pH	8.2	s.u.	H	0.1		A4500-H B	09/06/23 18:57 / ctb
pH Measurement Temp	18.2	°C		1.0		A4500-H B	09/06/23 18:57 / ctb
Conductivity @ 25 C	1150	umhos/cm		5		A2510 B	09/06/23 18:57 / ctb
Corrosivity (Langelier Index)	0.3					A2330 B	09/15/23 14:55 / bap
Solids, Total Dissolved - Calculated	671	mg/L		1.0		A1030 E	09/15/23 14:55 / bap
If a sample temperature at the time of collection is not provided, the Langelier is calculated using a default temperature of 20 degrees C.							
INORGANICS							
Alkalinity, Total as CaCO3	307	mg/L		4		A2320 B	09/07/23 18:02 / nrb
Bicarbonate as HCO3	371	mg/L		4		A2320 B	09/07/23 18:02 / nrb
Carbonate as CO3	ND	mg/L		4		A2320 B	09/07/23 18:02 / nrb
Chloride	82	mg/L		1		E300.0	09/08/23 13:00 / spb
Sulfate	141	mg/L		2		E300.0	09/08/23 13:00 / spb
Fluoride	10.8	mg/L		0.1		E300.0	09/08/23 13:00 / spb
Hardness as CaCO3	58	mg/L		1		A2340 B	09/15/23 04:11 / bap
Sodium Absorption Ratio (SAR)	13.0	unitless		0.01		Calculation	09/15/23 04:11 / bap
NUTRIENTS							
Nitrogen, Nitrate+Nitrite as N	1.67	mg/L		0.01	10	E353.2	09/18/23 16:38 / krt
METALS, TOTAL							
Aluminum	ND	mg/L		0.03		E200.8	09/12/23 01:26 / jks
Antimony	ND	mg/L		0.001	0.006	E200.8	09/12/23 01:26 / jks
Arsenic	0.003	mg/L		0.001	0.01	E200.8	09/12/23 01:26 / jks
Barium	ND	mg/L		0.05	2	E200.8	09/12/23 01:26 / jks
Beryllium	ND	mg/L		0.001	0.004	E200.8	09/12/23 01:26 / jks
Boron	0.49	mg/L		0.05		E200.7	09/15/23 04:11 / ers
Cadmium	ND	mg/L		0.001	0.005	E200.8	09/12/23 01:26 / jks
Calcium	13	mg/L		1		E200.7	09/15/23 04:11 / ers
Chromium	ND	mg/L		0.005	0.1	E200.8	09/12/23 01:26 / jks
Copper	0.026	mg/L		0.005	1.3	E200.8	09/12/23 01:26 / jks
Iron	0.06	mg/L		0.04		E200.7	09/15/23 04:11 / ers
Lead	ND	mg/L		0.001	0.015	E200.8	09/12/23 01:26 / jks
Magnesium	6	mg/L		1		E200.7	09/15/23 04:11 / ers
Manganese	0.002	mg/L		0.001		E200.8	09/12/23 01:26 / jks
Molybdenum	ND	mg/L		0.005		E200.8	09/12/23 01:26 / jks
Nickel	ND	mg/L		0.01		E200.8	09/12/23 01:26 / jks
Potassium	7	mg/L		1		E200.7	09/15/23 04:11 / ers
Selenium	ND	mg/L		0.001	0.05	E200.8	09/12/23 01:26 / jks
Sodium	227	mg/L		1		E200.7	09/15/23 04:11 / ers
Strontium	0.29	mg/L		0.01		E200.8	09/12/23 01:26 / jks
Thallium	ND	mg/L		0.0005	0.002	E200.8	09/26/23 08:52 / jks
Uranium	0.0010	mg/L		0.0003	0.03	E200.8	09/12/23 01:26 / jks
Zinc	0.09	mg/L		0.01		E200.8	09/12/23 01:26 / jks

Report Definitions:
RL - Analyte Reporting Limit
QCL - Quality Control Limit
H - Analysis performed past the method holding time
MCL - Maximum Contaminant Level
ND - Not detected at the Reporting Limit (RL)



Household Use Interpretation

Well Educated — MONTANA

Participation

ParticipantName	TrackingNumber	ReportDate
HighRisk, Example	MJ_050	Fri Oct 13 2023

Parameters mentioned in this document indicate parameters of health concern and/or non-health related parameters of note (aesthetic/secondary concern) from your water sample. This means certain parameter concentrations in your water sample were outside the ideal range or threshold suggested by the EPA (Maximum Contaminant Level and Secondary Maximum Contaminant Level) or water quality research.

Human Health Related - Parameters of Concern

Parameter	YourValue	Interpretation	More Info
Fluoride	10.8	unsatisfactory - above 4.0 mg/L health threshold; risk of fluorisis and bone disease	Click here for more info
Uranium	0.001	below 0.03 mg/L health threshold, but above ideal goal of 0 mg/L	Click here for more info
Arsenic	0.003	below 0.01 mg/L health threshold, but above ideal goal of 0 mg/L	Click here for more info

Non-Human Health Related - Parameters of Note

Parameter	YourValue	Interpretation
Conductivity @ 25 C	1150	conductivity of 800 uS/cm is roughly 500 mg/L total dissolved solids, which may cause salty taste (uS/cm = umhos/cm)
Hardness as CaCO3	58	below ideal range of 61 to 120 mg/L - related to pipe corrosion potential
Solids, Total Dissolved - Calculated	671	above 500 mg/L guideline - may cause salty taste
Alkalinity, Total as CaCO3	307	above ideal range of 100 to 200 mg/L - related to potential scaling

More Information

Click here for more on interpreting your results.

Click here for information on water treatment.

Cumulative Risk Report

Well Educated — MONTANA

Participation

ParticipantName	TrackingNumber	ReportDate
HighRisk, Example	MJ_050	Fri Oct 13 2023

This cumulative risk calculation is an assessment of the combined risks to human health from a lifetime of drinking and cooking with your home well water. The "PublicWater" based risk uses thresholds that are applied for public water supplies, while the "Conservative" based risk uses thresholds that are more conservatively protective of human health. See the "Cumulative Risk Guide" for more information on cumulative risk.

Analyte Risk Table

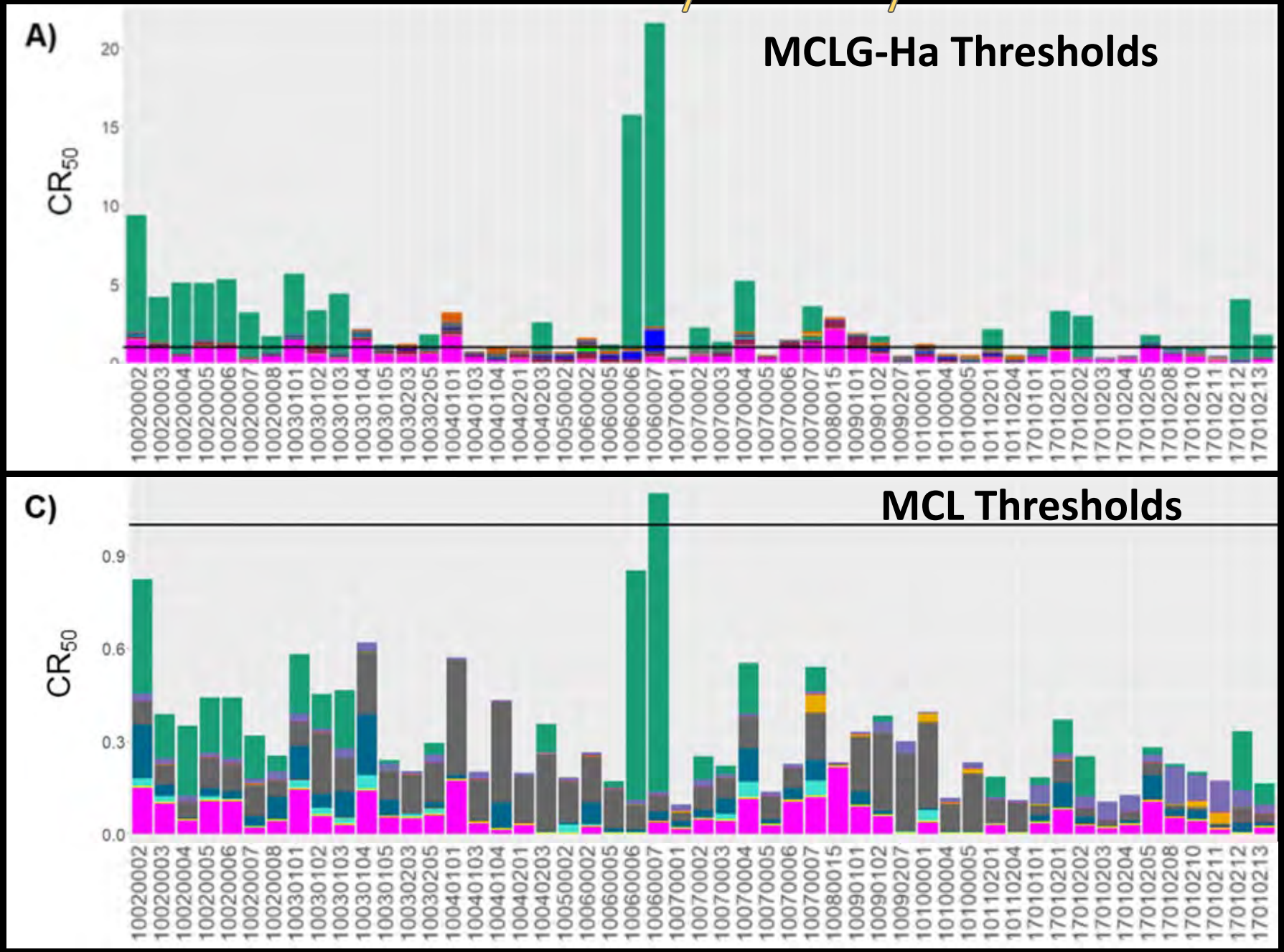
Analyte	YourValue	ConservativeThreshold	ConservativeBasedRisk	PublicWaterThreshold	PublicWaterBasedRisk
Antimony	0	0.006	0	0.006	0
Arsenic	0.003	0.0005	6	0.01	0.3
Barium	0	1.3	0	2	0
Beryllium	0	0.004	0	0.004	0
Boron	0.49	2.4	0.2		0
Cadmium	0	0.005	0	0.005	0
Chromium	0	0.05	0	0.1	0
Copper	0.026	1.3	0.02	1.3	0.02
Fluoride	10.8	4	2.7	4	2.7
Lead	0	0.001	0	0.015	0
Manganese	0.002	0.3	0.01		0
Molybdenum	0	0.04	0		0
Nickel	0	0.1	0		0
Nitrate	1.67	10	0.17	10	0.17
Selenium	0	0.05	0	0.05	0
Strontium	0.29	4	0.07		0
Thallium	0	0.0005	0	0.002	0
Uranium	0.001	0.003	0.33	0.03	0.03
Zinc	0.09	2	0.04		0
Cumulative Risk			**9.55**		**3.22**

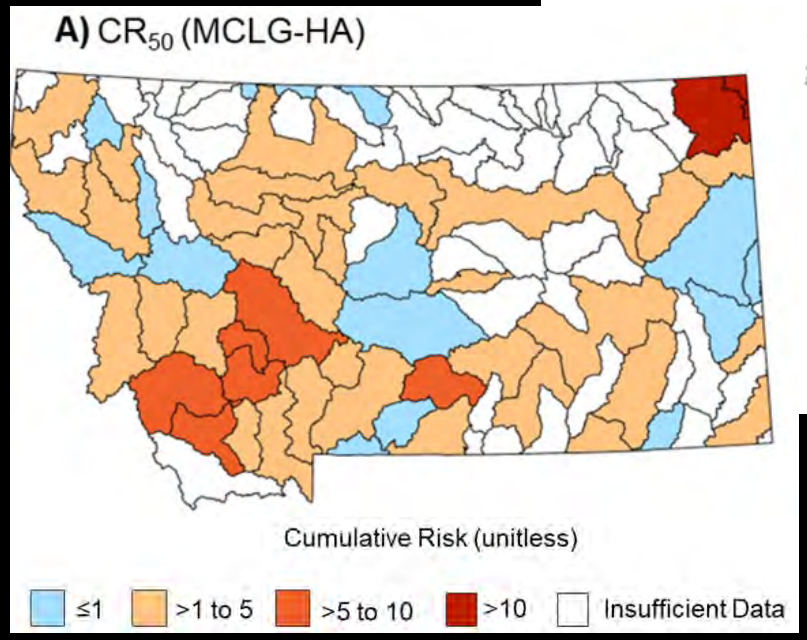
More Information

Click here for more on interpreting your results.

Click here for information on water treatment.

Results by Analyte




A) CR_{50} (MCLG-HA)
Cumulative Risk (unitless)
≤1
>1 to 5
>5 to 10
>10
Insufficient Data