



An introduction to the Alaska Groundwater Quality Project: Naturally Occurring Contaminants



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ALASKA DNR/DIVISION OF GEOLOGICAL & GEOPHYSICAL SURVEYS (DGGS)

ALASKA WATER WELL ASSOCIATION 2022 CONFERENCE

FEBRUARY 17-18, 2022

VIDEO PRESENTATION



<https://tinyurl.com/mrx3nxm8>

GOOGLE FORM FOR FEEDBACK ON PRESENTATION

DNR Division of Geological & Geophysical Surveys (DGGS)



Alaska Geologic Materials Center

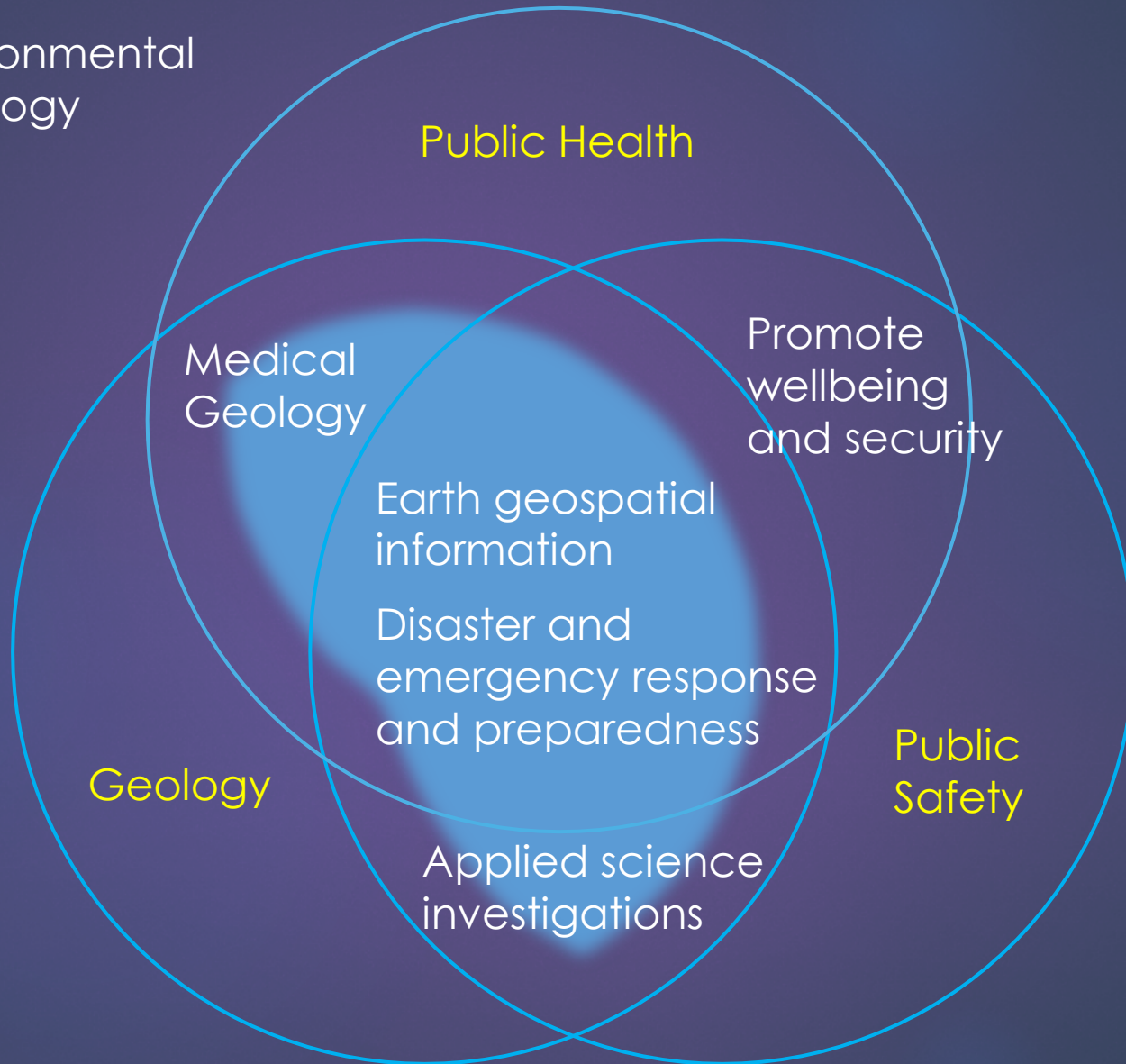


DGGS mission:

Determine the potential of Alaskan land for production of metals, minerals, fuels, and geothermal resources, the locations and supplies of groundwater and construction material, and the potential **geologic hazards** to buildings, roads, bridges, and other installations and structures (AS 41.08.020).



Environmental
Geology



Other applied science programs at DGGS

NATURAL RESOURCE MANAGEMENT Energy Resources Geologic Mapping Geologic Materials Center Geophysics Mineral Resources	About Engineering Geology Surficial-geologic Mapping Construction Materials Hydrogeology	About Geologic Hazards Guide to Geologic Hazards Climate & Cryosphere Hazards Coastal Hazards Volcanic Studies Restless Volcanoes Active Tectonics Tsunami Modeling Landslides Permafrost and Periglacial Hazards
Engineering Geology		
NATURAL HAZARDS		
Geologic Hazards		
Environmental Hazards		
DATA DISTRIBUTION Data & Tools Donate Samples or Data Interactive Maps Publications		

Other environmental geology programs include...

NATURAL RESOURCE MANAGEMENT

Energy Resources
Geologic Mapping
Geologic Materials Center
Geophysics
Mineral Resources
Engineering Geology

NATURAL HAZARDS

Geologic Hazards
Environmental Hazards

DATA DISTRIBUTION

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Interactive Maps
Publications

Radon

Naturally Occurring Asbestos

Arsenic in Groundwater

Department of Natural Resources
GEOLOGICAL & GEOPHYSICAL SURVEYS

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State of Alaska / Natural Resources / Geological & Geophysical Surveys / Geologic Hazards / Radon

RADON IN ALASKA

You can't see or smell radon gas, but it's dangerous. Breathing in high levels of radon can raise your risk of lung cancer. In the United States, radon is the #2 cause of lung cancer, after smoking, and it is estimated to cause over 20,000 deaths each year. In fact, if you live in a home with high radon...

Contact
Jennifer E. Athey

Department of Natural Resources
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State of Alaska / Natural Resources / Geological & Geophysical Surveys / Geologic Hazards / Asbestos

NATURALLY OCCURRING ASBESTOS

Asbestos has been mined and used for more than 1,000 years for its excellent heat-resistant properties, although, due to health concerns, many countries have now banned or restricted its use in products. Coatings, insulation, fire retardants, and damaged and released fibers can be inhaled, creating an environmental hazard.

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State of Alaska / Natural Resources / Geological & Geophysical Surveys / Geologic Hazards / Arsenic

ARSENIC IN GROUNDWATER

Arsenic is a toxic element that occurs naturally in rock and soil. It is used for a variety of purposes within industry and agriculture, like wood preservative and insecticide, and is a byproduct of copper smelting, mining, and coal burning. Arsenic is commonly found in groundwater, which must be tested, since it does not give the water a detectable taste, smell, or color.

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Winchite-richterite asbestos (left) and gray metallic arsenopyrite (right) under a scanning electron microscope. Photo credit: U.S. Geological Survey.

Six naturally occurring minerals (tremolite, fibrous anthophyllite, actinolite, hornblende, actinolite, and actinolite) are used in construction materials. Arsenic is found in multiple forms, some of which are more toxic to humans than others. In Alaska, most arsenic in groundwater is likely derived from inorganic arsenic that occurs naturally in the Earth's crust, most commonly as the mineral arsenopyrite. When arsenopyrite oxidizes into its elemental components (similar to the way iron rusts) and those components enter the groundwater system, the resulting arsenic, as pentavalent arsenic [As(V) or arsenate] and trivalent arsenic [As(III) or arsenite], is toxic.

Gray metallic arsenopyrite and light green scorodite (Fe-As oxide). Photo credit: U.S. Geological Survey.

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Alaska is challenged by poor water quality in some areas of the state, including health-concerning levels of arsenic, nitrate, and other contaminants, but very little is currently known about levels and locations of these contaminants.

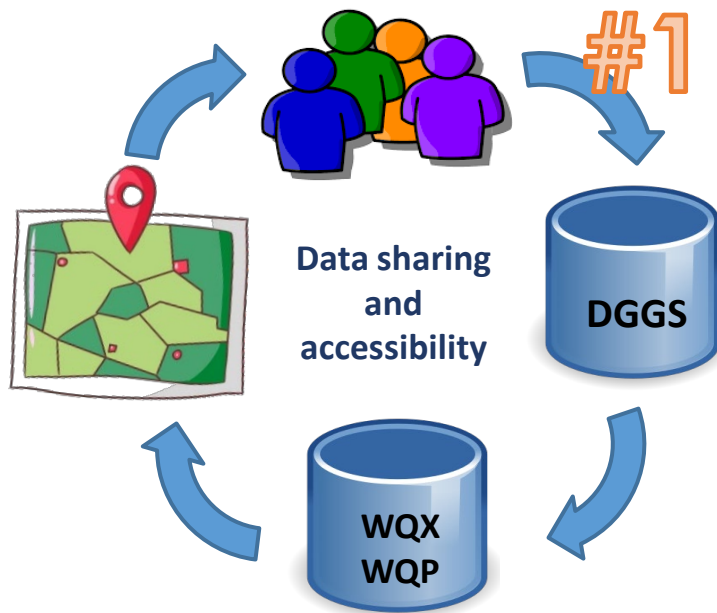
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- Observations of the author

DGGS is interested to work with you, as stakeholders in groundwater quality information, to make data on natural contaminants in groundwater widely available.



Goal 1: Partner with AK ground-water data creators and users



Reduce exposure to contaminants through high-quality, timely, standardized data: facilitate robust scientific modeling, public health studies, and new public outreach materials on a local and state scale.

- Build a network of Alaska groundwater data creators, users, and other stakeholders
- Identify sources of groundwater quality information for natural contaminants

Project Goal 2: Develop an Alaska version of the “Be Well Informed” tool

Note the **Be Well Informed** tool does not collect data. It is informational only.

Examples of **Be Well Informed** from other states:
<https://bewellinformed.info>

Be Well Informed Water Analysis Tool

Entry

Resources

Results

Enter the Results of Your Drinking Water Test

Routine Water Analysis

Arsenic	<input type="text"/>	mg/L	▼	Chloride	<input type="text"/>	mg/L	▼
Copper	<input type="text"/>	mg/L	▼	Copper Stagnant	<input type="text"/>	mg/L	▼
Fluoride	<input type="text"/>	mg/L	▼	Hardness	<input type="text"/>	mg/L	▼
Iron	<input type="text"/>	mg/L	▼	Lead	<input type="text"/>	mg/L	▼
Lead Stagnant	<input type="text"/>	mg/L	▼	Manganese	<input type="text"/>	mg/L	▼
Nitrite-N	<input type="text"/>	mg/L	▼	Nitrate-N	<input type="text"/>	mg/L	▼
pH	<input type="text"/>	unit	▼	Sodium	<input type="text"/>	mg/L	▼

Bacteria / Microbiology


Total Coliform	<input type="text"/>	CFU/100 m	▼	E. Coli	<input type="text"/>	CFU/100 m	▼
<input type="radio"/> Present <input type="radio"/> Absent				<input type="radio"/> Present <input type="radio"/> Absent			













Radionuclides

Radon	<input type="text"/>	pCi/L	▼	Uranium	<input type="text"/>	pCi/L	▼
Gross Alpha	<input type="text"/>	pCi/L	▼				

Results Summary

Key

-  Meets the Drinking Water Limit
-  Above the Drinking Water Limit
-  Close to the Drinking Water Limit
-  [Consult VDH Radon Program](#)

Result	Element	Your Entry	Limit	About Your Well Water
	Chloride	5000 mg/L	250 mg/L	The value entered exceeds the drinking water guideline
	Copper	5000 mg/L	1.3 mg/L	The value entered exceeds the drinking water standard
	Copper first-draw/stagnant	5000 mg/L	1.3 mg/L	The value entered exceeds the drinking water standard
	Lead	5000 mg/L	0.015 mg/L	The value entered exceeds the drinking water standard
	Lead first-draw/stagnant	5000 mg/L	0.015 mg/L	The value entered exceeds the drinking water standard
	Arsenic	5000 mg/L	0.01 mg/L	The value entered exceeds the drinking water standard
	Hardness	5000 mg/L	-	There is no drinking water guideline or standard
	E. coli	5000 MPN/100 mL	0 MPN/100 mL or Absent	The value entered exceeds the drinking water standard. YOUR WATER SHOULD NOT BE CONSIDERED SAFE TO CONSUME.
	Fluoride	5000 mg/L	2 mg/L	The value entered exceeds the drinking water standard
	Iron	5000 mg/L	0.3 mg/L	The value entered exceeds the drinking water guideline
	Manganese	5000 mg/L	0.05 mg/L	The value entered exceeds the drinking water guideline
	Nitrate-N	5000 mg/L	10 mg/L	The value of nitrate or total nitrogen (nitrate + nitrite) entered exceeds the drinking water standard. YOUR WATER SHOULD NOT BE CONSIDERED SAFE FOR BABIES UNDER SIX MONTHS OLD TO CONSUME.

Results:

- Water safety according to MCLs
- Health concerns
- Water treatments
- Resources

Additional Resources

Alaska Department of Health and Social Services, Health Related Information

Division of Public Health, Environmental Public Health Program

<http://dhss.alaska.gov/dph/Epi/eph/Pages/default.aspx>

Email: eph@alaska.gov

907-269-8054

Alaska Department of Environmental Conservation, Division of Environmental Health

Drinking Water Program (Public Water Systems)

<http://dec.alaska.gov/eh/dw.aspx>

Private (Unregulated) Drinking Water Wells & Systems

<https://dec.alaska.gov/eh/dw/dwp/private-wells/>

Alaska Department of Natural Resources, Division of Mining, Land and Water

Alaska Hydrologic Survey

<http://dnr.alaska.gov/mlw/water/hydro>

Email: dnr.water.reports@alaska.gov

Alaska Department of Environmental Conservation, Contaminated Sites Program

Division of Spill Prevention and Response

<https://dec.alaska.gov/spar/csp/>

Contaminated Real Estate in Alaska

<https://dec.alaska.gov/spar/csp/csp-real-estate/>

Centers for Disease Control and Prevention

1600 Clifton Rd

Atlanta, GA 30333

800-CDC-INFO (800-232-4636)

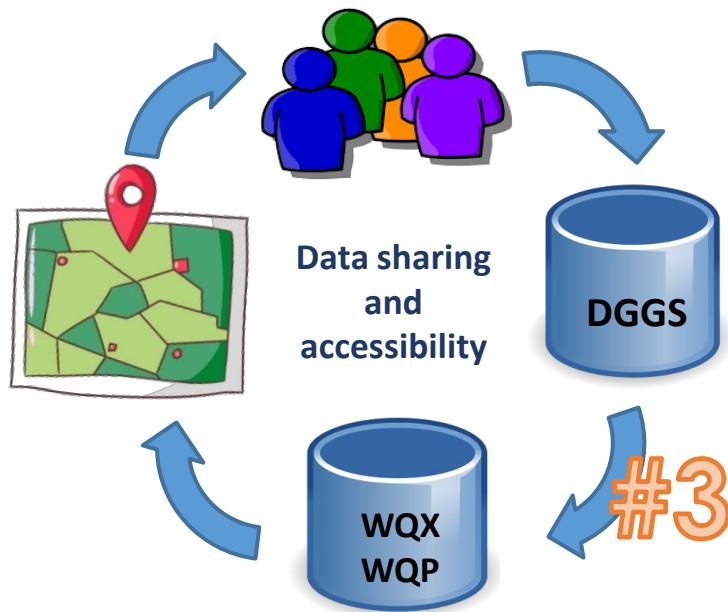
TTY: (888) 232-6348

Contact CDC-INFO

Long list of
resources:

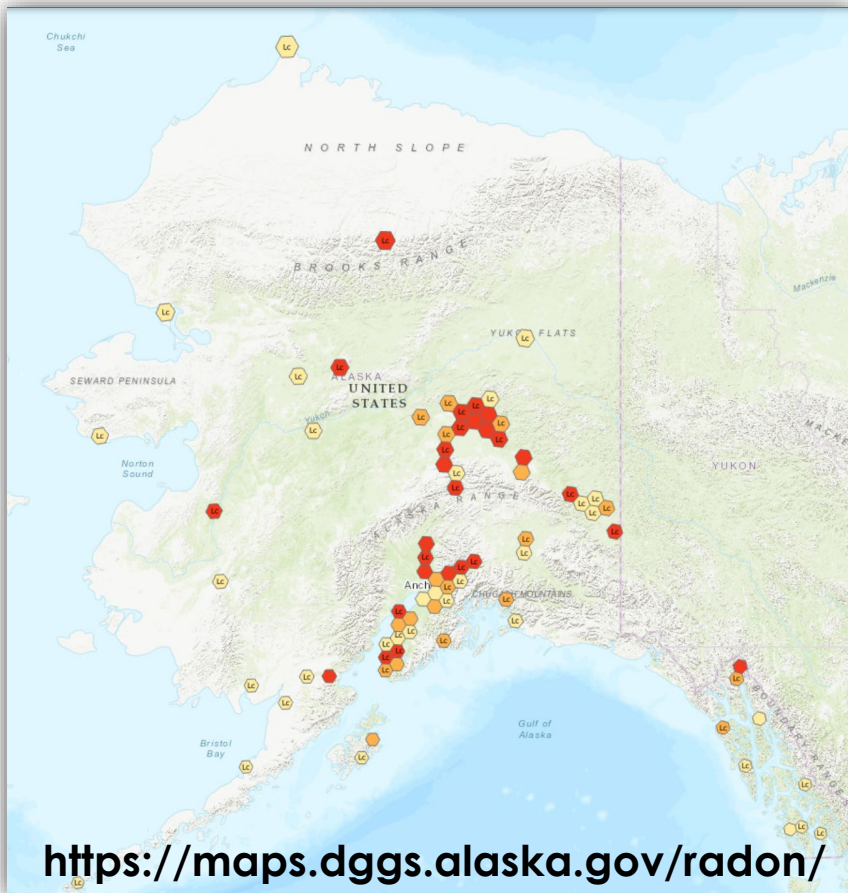
- App phone support by Cooperative Extension Service and DGGs
- Agencies
- Helpful organizations

Project Goal 3: Integrate Alaska data into the national database



DGGS, with guidance from stakeholders, will develop a schema for a staging database in preparation for transferring non-confidential and/or location-obscured data to the Water Quality Exchange (WQX).

Project Goal 4: Develop online maps



DGGS will develop maps and tools with the aim of making the information available and approachable for non-technical users.

The interface is anticipated to be similar to that in the Alaska Radon Map shown here.

Quality data collection

Alaska Radon Program • UAF, School of Natural Resources and Extension, <https://www.uaf.edu/scs/naturalresources/radon/>
• Alaska Division of Geological & Geophysical Surveys, <http://dgggs.alaska.gov/>

ENVIRONMENTAL DATA COLLECTION WITH IN-DOOR RADON TESTING

by U.S. Centers for Disease Control and Prevention

Test Address: _____

Test basics (check box)

1. Test is conducted: ☐ Yes ☐ No
2. Reason for test: ☐ New home ☐ Existing home ☐ School ☐ Other

Pre-Test information.

3. Device identifier: _____
4. Test Start Date: _____
5. Device type (check box) ☐ Short-term ☐ Long-term ☐ Continuous

Test location information. (check)

6. Foundation ☐ Basement ☐ Crawlspace ☐ Other
7. Floor level tested ☐ 1st ☐ 2nd ☐ 3rd
8. Building purpose ☐ Home ☐ School ☐ Office ☐ Other
9. Residence type ☐ Single ☐ Multi-unit ☐ Mobile home ☐ Other
10. Device location (residence) ☐ Living room ☐ Bedroom ☐ Bathroom ☐ Other

Post-Test information. (informant)

11. Test Stop Date: _____
12. Test Report Date: _____
13. Measured Value: _____
14. Test Result Identifier (if known)
15. Testing person/contractor: _____
16. Testing Laboratory: _____

PERMISSION FORM FOR DATA
Data Dictionary last revised July

Your Radon Test can help other Alaskans

Alaska Division of Public Health (DHPH) says:
Radon is an under-recognized health risk in Alaska that warrants widespread attention.

Alaskans and researchers need your help.

Health researchers need a better understanding of the health risk of radon in Alaska.

Please share your radon test results with the University of Alaska Fairbanks, School of Natural Resources and Extension and the Alaska Division of Geological & Geophysical Surveys, who are working on helpful radon tools for Alaskans.

I release my radon test result and environmental data (see reverse side) to the Alaska Department of Natural Resources, Division of Geological & Geophysical Surveys, with the understanding that my result and data will be statistically merged with other radon data before it is made available to the public, and that my address and test result will be kept confidential except in the event a court of law orders that they be produced.

Signature _____ Date _____

Printed name _____ Phone _____ Email _____

You can't see radon gas. You can't smell it. But it's dangerous. Breathing in high levels of radon can raise your risk of lung cancer.

Fairbanks, Delta Junction, Healy, and Two Rivers in Interior Alaska have the highest proportion of concerning radon levels; however, many homes throughout Alaska have dangerous levels of radon (greater than the EPA action level of 4 pCi/L).

- Alaska DPH, <http://epibulletin.dphos.alaska.gov/Document/130409/DocumentId-36>



Q: What are the statistics for Alaska?
A: We don't know. We need more data.

EPA Radon Zones (<https://www.epa.gov/radon/>) where red (darker) is high and yellow (lighter) is low.



Current radon data grouped by Alaska's large borough and census districts makes useful analysis nearly impossible.



DATA COLLECTION FORM on reverse side



DATA CONFIDENTIALITY

DGGS treats radon data as confidential and **will not release the data unless required to do so by a court of law.** Data will be **statistically merged with other radon data** before they are made available to the public.

Potential ways
you can help
with this effort



[https://tinyurl.com/
mrx3nxm8](https://tinyurl.com/mrx3nxm8)

- Spread the word about the **Be Well Informed** tool
- Hand out flyers about the project
- Encourage homeowners or others with data to submit it to DGGs
- Attend project meetings
- Provide feedback on project goals



Project flyer

Alaska Groundwater Quality Project

Alaska Division of Geological & Geophysical Surveys



Newsletter February 14, 2022

The Division of Geological & Geophysical Surveys (DGGS) is funded by the EPA to aggregate and make available to the public and agencies Alaska groundwater quality data for natural contaminants and create maps and data visualization tools to help land managers, agencies, developers, and the public make informed decisions when locating private and public wells intended to supply drinking water. New maps and tools for data visualization will also encourage the public to perform regular water tests on their private wells.

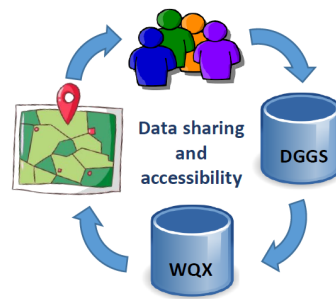


Applied Science for the Benefit of Alaskans

DGGS is a science-focused agency within the Department of Natural Resources. Its mission is to "determine the potential of Alaskan land for production of metals, minerals, fuels, and geothermal resources, the locations and supplies of groundwater and construction material, and the potential geologic hazards to buildings, roads, bridges, and other installations and structures" (AS 41.08.020). DGGS' goal is to provide unbiased scientific data and interpretations to answer important questions about the geology of the state, to benefit the health and welfare of all Alaskans. We partner with emergency coordinators, communities, private industry, agencies, and other stakeholders to provide timely information on imminent and long-term threats to the public and infrastructure, such as this Alaska Groundwater Quality Project. Alaska is challenged by poor water quality in some areas of the state, including health-concerning levels of arsenic, nitrate, and other contaminants, but very little is currently known about levels and locations of these contaminants. DGGS is interested to work with you, as stakeholders in groundwater quality information, to make information on natural contaminants in groundwater widely available.

Project Goal 1: Partner with Alaska groundwater data creators and users to assist them in submitting data to DGGS

High-quality, timely, standardized data facilitate robust scientific modeling, public health studies, and new public outreach materials on a local and state scale to reduce exposure to contaminants. To significantly increase the amount, quality, security, and accessibility of Alaska groundwater quality data, DGGS will first build a network of Alaska groundwater data creators and users among state and federal agencies, universities, Alaska Native organizations, private citizens, and other stakeholders. These entities will identify sources of non-confidential groundwater quality data for natural contaminants, which DGGS will compile into a database for Alaska, to be submitted through the national Water Quality Exchange database (WQX).



Arsenic in groundwater flyers

Naturally Occurring Arsenic in Alaska Groundwater

Alaska Division of Geological & Geophysical Surveys



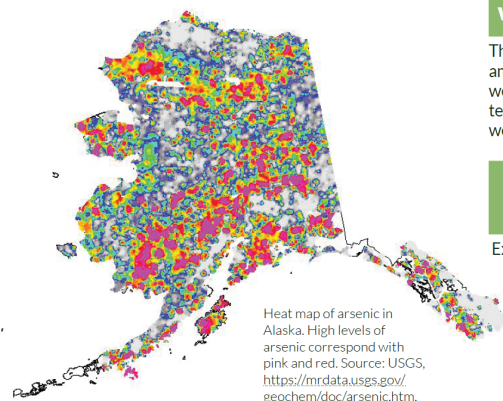
33
As
Arsenic
74.922

Arsenic (chemical symbol As) is a toxic metal that occurs naturally in the Earth's crust.

Arsenic that is bound up in minerals may be liberated and make its way into drinking water and soils. Levels of arsenic greater than **10 parts per billion (ppb)**, the current EPA drinking water standard, have been documented in Interior Alaska, Seward and Kenai peninsulas, Mat-Su Valley, and Anchorage.

Where does the arsenic come from?

Natural geologic processes can concentrate arsenic, along with gold and other minerals, in mineral deposits in bedrock. Over time, favorable geologic conditions for the concentration of arsenic have occurred broadly in Alaska, resulting in widespread arsenic-rich rocks. These naturally occurring arsenic-rich rocks are the most likely source of arsenic in groundwater.



Why do arsenic levels change?

Several variables can contribute to changing levels of arsenic from year to year, including:

**Changes in rainfall
Water use from wells
Thawing permafrost**

What should I do if I find arsenic in my well water?

Basic purification methods, such as boiling water, will not remove arsenic from water. To ensure water is safe to drink, an arsenic mitigation system, like a reverse osmosis system, should be installed and maintained, and the water should be routinely tested.

Is there arsenic in the well water of my neighborhood?

There can be extreme variability in the amount of arsenic in adjacent wells, and in wells from year to year, so wells should be tested annually. The only way to know if your well contains arsenic is to test.

What are the health effects of arsenic?

Exposure to arsenic can cause a variety of health problems, including an increased risk of developing certain cancers. More information can be found here:

<https://www.atsdr.cdc.gov/phs/phs.asp?id=18&tld=3>

Learn more online: dggs.alaska.gov or contact Jennifer Athey: jennifer.athey@alaska.gov | 907-451-5000
IC 69 | <http://doi.org/10.14509/30060>

Naturally Occurring Arsenic in Interior Alaska Groundwater

Alaska Division of Geological & Geophysical Surveys



33
As
Arsenic
74.922

Arsenic (chemical symbol As) is a toxic metal that occurs naturally in the Earth's crust. Depending on chemical factors such as acidity and oxidation of an area's water, arsenic that is bound up in the crystal structure of minerals may be liberated and make its way into drinking water and soils. **Levels of arsenic greater than 10 parts**

per billion (ppb), the current EPA drinking water standard, have been documented in many areas around Fairbanks, notably on Ester and Murphy domes, and in the Steele Creek and Goldstream neighborhoods. In some Fairbanks area locations, arsenic in well water has been measured to exceed the drinking water standard by a factor of 1,000.

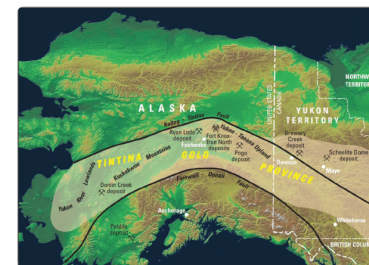
Is there arsenic in the well water of my neighborhood?

In the Fairbanks area, several studies have looked at the distribution of arsenic in groundwater by testing water from randomly distributed, private wells. Although **there is extreme variability in the amount of arsenic** in adjacent wells, overall some areas in and around Fairbanks appear to have more or less arsenic. Because of the extremely variable concentrations of arsenic in well water, **all wells in Alaska should be tested annually for arsenic.** Arsenic concentrations in groundwater will naturally vary over time with changes in rainfall and subsequent groundwater recharge, drawdown from wells, thawing permafrost, etc. Arsenic mitigation systems, such as reverse osmosis systems, should be maintained and resultant water should also be tested.

Area of Study	Average Arsenic Concentrations (Estimated)	Range of Arsenic Concentrations
Fairbanks (including Ester Dome)	180 ppb	0 - >10,000 ppb
Ester Dome	210 ppb	<3 - 1,160 ppb
Steele Creek	70 ppb	0 - 5,100 ppb
Goldstream/Murphy Dome	66 ppb	0 - 1,600 ppb
Chena Ridge	3 ppb	0 - 28 ppb

EPA recommended arsenic levels

Less than 10 ppb	Drinking water
Less than 100 ppb	Watering garden and livestock
Less than 500 ppb	Bathing and washing



Tintina Gold Province. Figure from <http://pubs.usgs.gov/fts/2007/3061/>

Where does the arsenic come from?

The Golden Heart of the Interior is known for its history of gold exploration and production, which continue to this day. Gold prospects and mines follow an east-west, arc-shaped trend from Canada through the center of the state called the Tintina Gold Belt (or "Province"; above) by the mineral resources community. Sporadic gold mineralization in this region naturally occurs with other metals, and commonly includes arsenic. Many more unknown occurrences of arsenic, in the form of the mineral arsenopyrite and its oxidation products scorodite and iron-oxide minerals, are likely below the surface than are currently known. These underground arsenic-rich zones, usually as veins or scattered disseminations, are the source of the arsenic in the groundwater.

Learn more online: dggs.alaska.gov or contact Jennifer Athey: jennifer.athey@alaska.gov | 907-451-5028
IC 71 | <http://doi.org/10.14509/30094>

Contact us

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