gardenroots
The Superior, AZ Garden Project

The Superior, AZ Gardenroots Results Booklet

Kit: **GS-12**

THE UNIVERSITY OF ARIZONA
COLLEGE OF AGRICULTURE & LIFE SCIENCES
Environmental Science

Ramirez-Andreotta
Integrated Environmental Science
& Health Risk Laboratory

COLLEGE OF ENGINEERING
Chemical & Environmental
Engineering

Dear participant,

We did it! Thank you for participating in the University of Arizona's (UA) Gardenroots: A Citizen Science Garden Project. This booklet shows the test results of your submitted water, soil (yard/garden), and/or frisbee dust. Your results are highlighted and compared to other Gardenroots participants in your community as well as regulatory standards and/or reference values when available. In this package, we have included the following:

- Project Overview
- How to log in and view your results online
- Important terms that you will see throughout your results
- A guide to reading your results
- Your outdoor household and community study results
- General information on selected contaminants of concern
- References for further information on environmental quality and guidelines

Please note that this report is focused on your water, soil, and frisbee dust results. The foliar dust data are not included in the booklet. Analyzing the leaf dust is an experimental procedure that we are trying to validate and determine it's reliability. Lastly, this was a scientific research project, therefore the analytical methods were informed by the US Environmental Protection Agency's standard methods, but modifications may have been made.

We strongly encourage you to go online and see your results online through our interactive website!
After going through the instructions starting on page 2, please visit:
https://gardenroots.arizona.edu/community-status.

Gardenroots thanks you for your participation. We appreciate all your hard work and time you have invested. We are happy to report the results. Any feedback you may have on the process or results would be greatly appreciated.

Sincerely,

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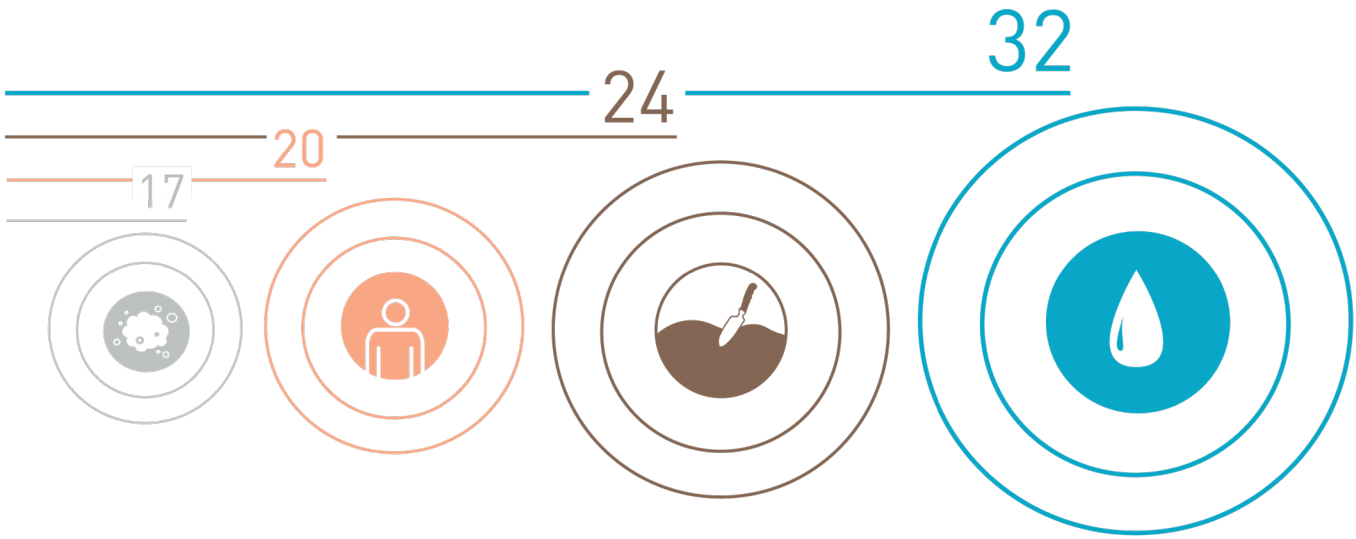
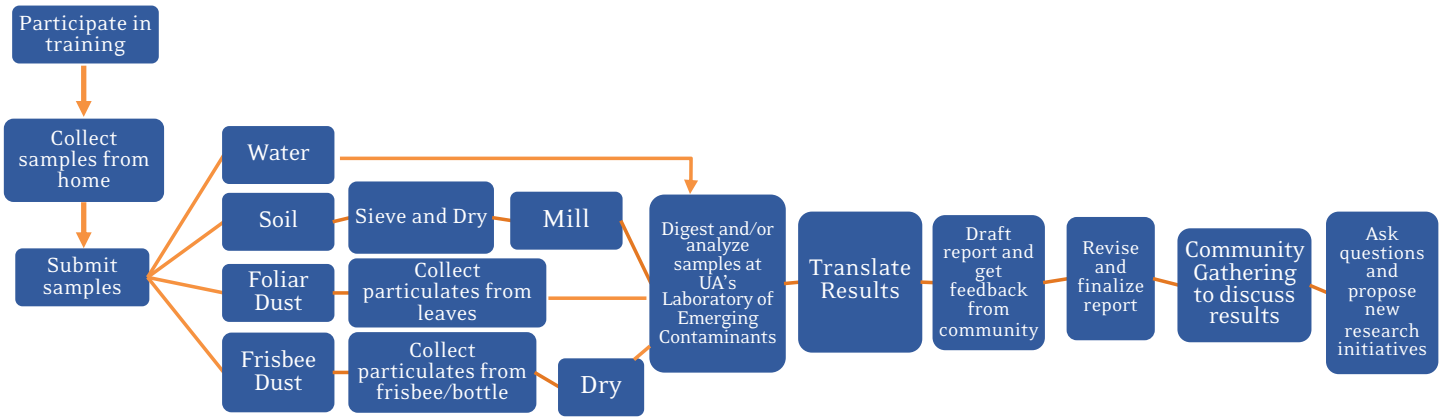
Project Overview

We have successfully completed Gardenroots in Superior, AZ! I would like to give a special thanks to the 18 participants for their efforts, motivation and patience throughout this research project. Altogether, 20 community members were trained, and 17 frisbee dust samples, 24 soil samples, and 32 water (including field blanks) were prepared and analyzed form your community.



Based on community member's concerns regarding environmental quality, Gardenroots: The Superior, AZ Garden Project was developed. Seeing gardens as hubs for environmental health research and education, Gardenroots is trying to understand the state of environmental quality in communities impacted by resource extraction and/or environmental pollution. Together, we are co-generating a robust environmental monitoring dataset, while informing safe gardening practices and public health prevention and intervention strategies.

Project Methodology



Data may be subject to revisions.
The results have been internally reviewed, but have not undergone external peer review and may be subjected to minor changes.

Metals occur naturally in the environment.
While we can measure the level of a metal in certain substances, like water or soil, it is difficult to know the original source of the metal. For example, arsenic may be found in soil in many parts of the state because it also naturally occurs in these regions.

Single exposure measurements are "snapshots in time".
We are measuring metal concentrations at a single point in time. Measuring metal concentrations with a single sampling does not establish what the exposures were in the past or what they may be in the future.

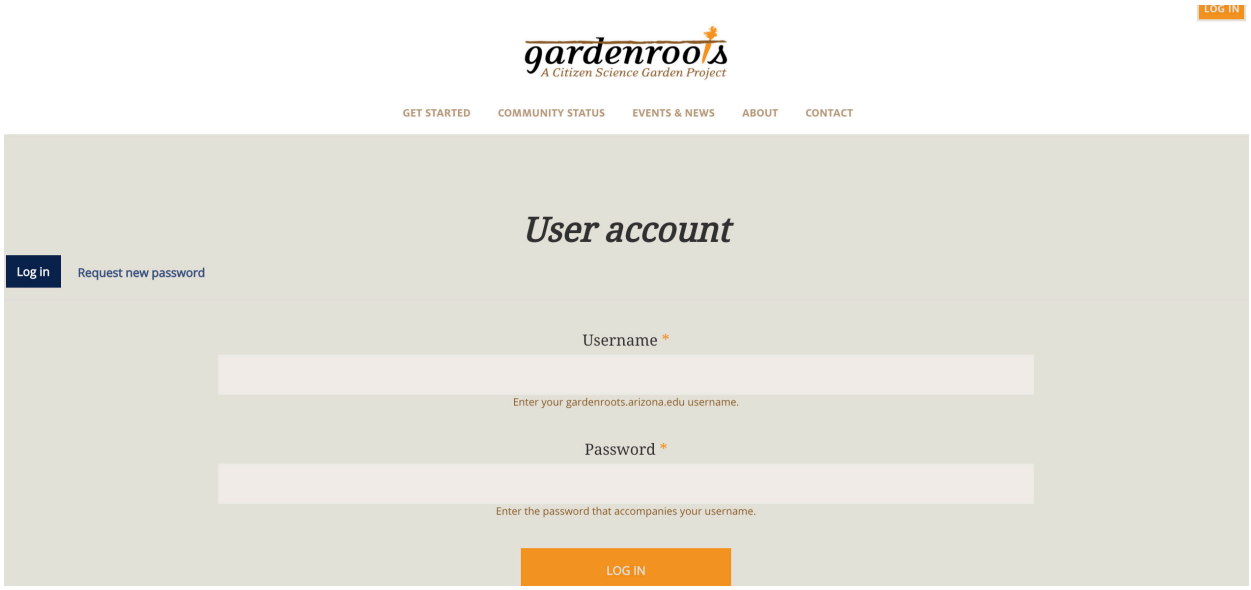
Friendly reminder - To view our your results online or for more information about the study, other participating communities, and safe gardening practices, please visit the Gardenroots website: **http://www.gardenroots.arizona.edu/**.

How to log in to our website and see your data

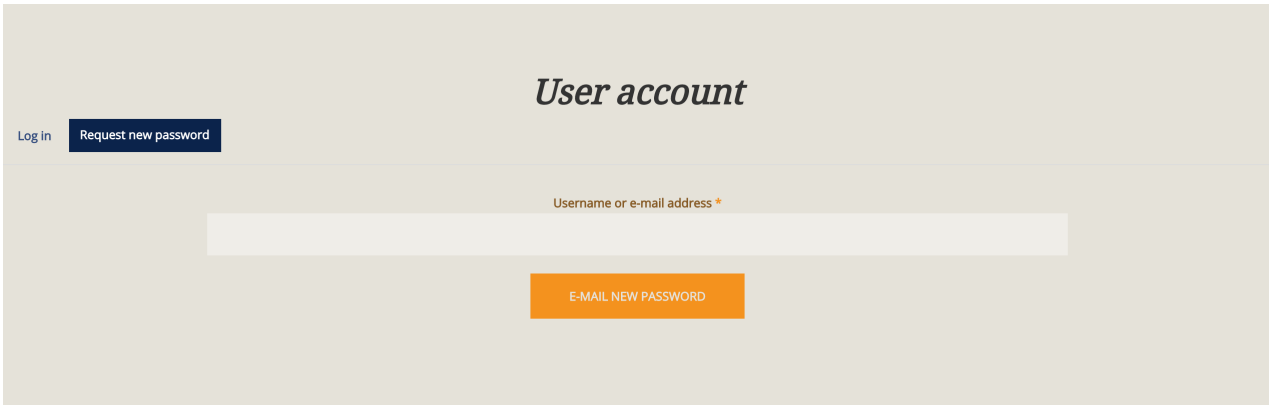
To view your data online, you will have to set up an account through our website. Please create a password to keep your data secure. Once you have made your password, you can use it to log into our website and view your data at any time! Instructions with screenshots are provided here.

1. Visit **gardenroots.arizona.edu**
2. Click login in the top right corner of the website.

3. The next page will ask you for your kit username and password.



4. **Your username is your kit number.** You will have to make a new password so that your data is secure.
5. Click on the “Request new password” tab.



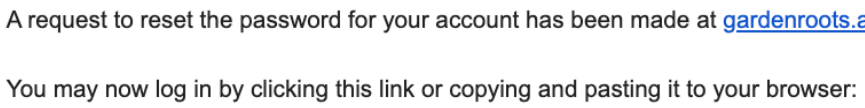
6. Type in your kit number as it appears in the front of this booklet (GS-##) or the email you gave our Project

Harvest team into the box under “Username or email-adress”

7. Click on the “email new password” button.

8. Once you have clicked the button, a green bar will appear saying “Further instructions have been sent to your email address.” This indicates an email has been sent. Our system will send you a one-time secure web link to your email, the one that you received this message with.

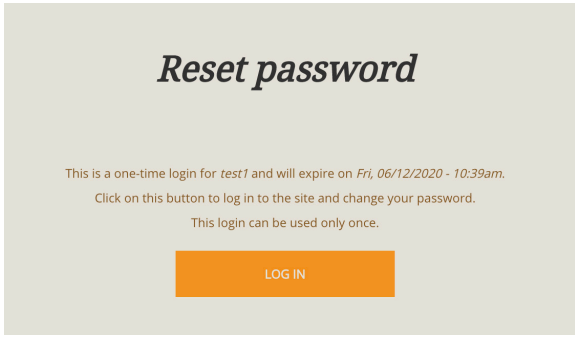
9. Open your email and you should have an email titled “Replacement login information for GS-## at gardenroots.arizona.edu.” **Make sure to check your spam folder**, in case the email is sent there. The beginning of the email will read:

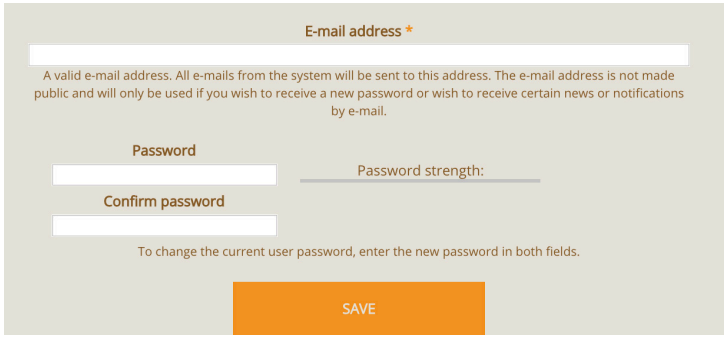


10. Click on the link in your email to set up your password. (If you have not given us your email and want to view your results online, please contact us through phone (by text or phone call) at **(520)314-1533** or email us at **ssandhaus@email.arizona.edu** and we will set up your account. Also, contact us if you do not receive an email.)

11. The link will take you to the reset password page. Click on “Log In”. Then you will be directed to the page below, see screenshot.

12. Type in your email address, making sure to use the same one. Then type in your new password into the two boxes. Then, hit “Save.”

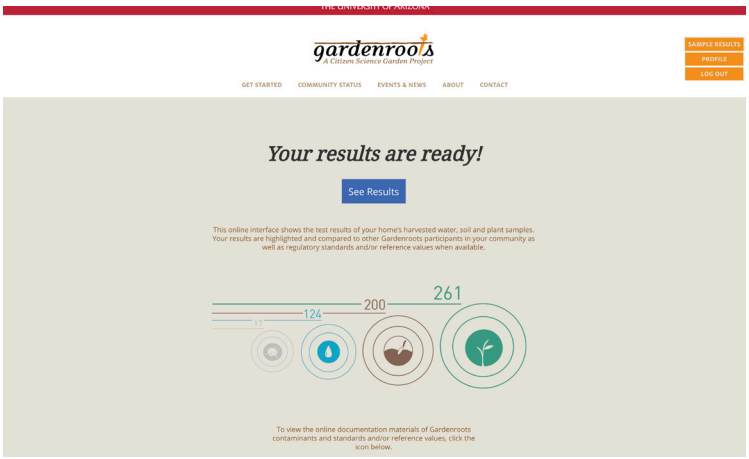




13. **Now, you are logged in! From now on, you can log in using your username (GS-##) and password that you set.**

Important Notes:

- Once you are logged in, you will be at the sample results page, it will say: “Your results are ready”. You can always revisit this page by clicking on the “Sample Results” button in the top right hand corner.



- Scroll down to see materials (“Important Terms”, “How to read your results” that will help you read through your results.
- After reviewing the supporting materials, click the “See results” button.
- A menu will pop up, where you can click on the type of results you would like to view Chose one: water, soil, plant, or dust.

- Your results for the selected type will be shown. Scroll down to see all contaminants measured. Move your mouse over the graphs and click around for more details. Information on the contaminant is provided, to the right of the “legend” tab.
- To switch the type of results, click the “Results Menu” button at the top of the page.

- You can also view data from other communities. Switch the community by clicking on the Location drop down menu in the blue bar at the top of the page.

Important Terms

Action Level (AL) – The U.S. Environment Protection Agency (U.S. EPA) regulates lead under the Lead and Copper Rule. This rule describes the water treatment requirements needed to control plumbing corrosion that may contaminate drinking water. If the water concentration of lead is above the action level, this means actions are required to correct the water system to meet this regulation.

Concentration – The amount of a chemical in a given mass of water, soil, or plant tissue. This is written as µg/L (micrograms per liter), µg/m3(micrograms per cubic meter), or µg/g (micrograms per gram).

Guideline – A non-enforceable, but recommended maximum concentration of a chemical.

Inorganic – Metals, minerals, or compounds that contain little or no carbon and are generally geologically derived (come from the Earth, like the rocks, minerals, fossils, landforms, and the layers of the Earth's surface).

Limit of Detection – The lowest concentration that our laboratory can measure (or detect) a contaminant. Samples that are below the Limit of Detection are represented as half of the detection limit (Limit of Detection/2).

MCL (Maximum Contaminant Level) – The MCL is the maximum amount of a contaminant allowed in drinking water so that it is still safe to drink over many years. This level is set by the US Environmental Protection Agency.
Median–The value at the midpoint (middle value) of the range of values.

Median – The value at the midpoint (middle value) of the range of values.

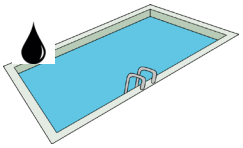
ml (Milliliters) – A unit of measure that is equal to one-thousandth of a liter, equal to a drop of water approximately as large as your thumbnail. One liter contains 1,000 milliliters.

mg/kg (Milligrams per Kilogram) – A measure of how many milligrams of a substance (such as a metal) are in a kilogram of a solid (such as garden or yard soil). This measure is also referred to as parts per million (ppm).

National Ambient Air Quality Standard (NAAQS) –These are standards established by the U.S. EPA to protect human health. The standard for lead defines the maximum allowable concentration of lead in a cubic squared meter of outdoor air. This standard is current set to 0.15 µg/m3.

Standards – The standards reported in this booklet are enforceable and regulatory values, developed either by federal agencies or by the state of Arizona for water providers/utilities. They are different from advisories (see definition on previous page) and guidelines.

µg/L (Micrograms per Liter) – A measure of how many micrograms of a substance (such as a metal, chemical) are in a liter of liquid (such as water). This measure can also be called parts per billion (ppb) or 0.0000001%. For comparison, 1 µg/L or ppb is the equivalent to a drop of ink in a 15,000 gallon backyard swimming pool.



Micrograms per liter (µg/L)	Parts per billion (ppb)	1/1,000,000,000

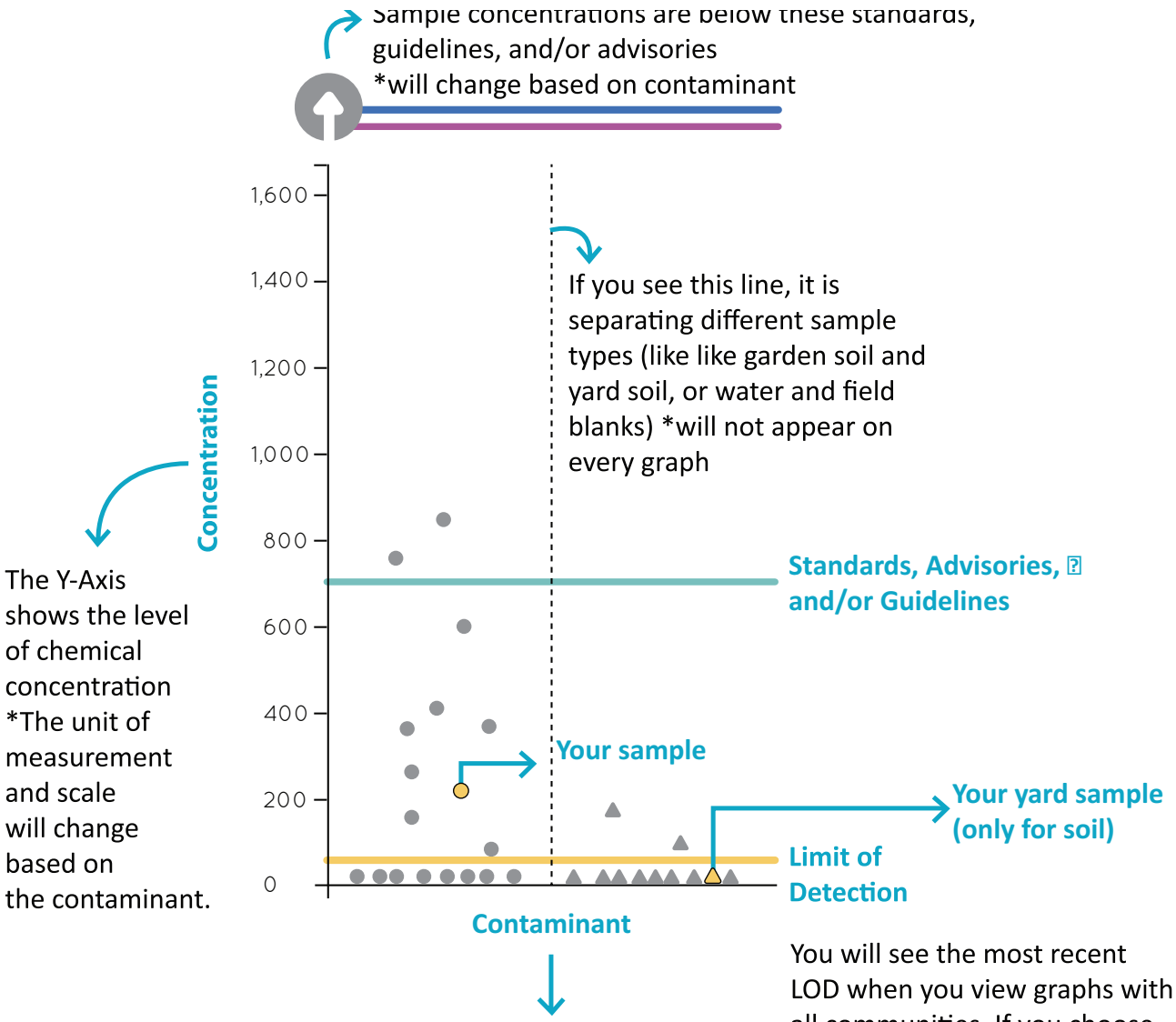
µg/sq ft^2 (Concentration micrograms per square foot) –
A measure of how many micrograms of a substance (such as a metal, chemical) are in one square foot.

1 ft^2 **1'**

1'

How to read your graph

Your data is shown in the graphs like the one below.
Read the descriptions to see what each component means!



Comparative standards

With your data, you will see different standards for water, soil, and dust.

Look for the corresponding standard, advisory, and/or guideline on the graph to see if your samples are below or above the value, represented by a colored line.

Drinking Water Standard

Agricultural Irrigation Standard

Surface Water - Partial Body Standard

Surface Water - Full Body Standard

Livestock and Poultry Standard

Porch Floor Clearance Action Level for Lead

Soil Remediation Level

Key:

- USDA Agricultural Irrigation Standard
- USEPA Primary Drinking Water Standard
- Dept. of Housing and Urban Development's Porch Floor Clearance Action Level for Lead
- ADEQ Surface Water - Partial Body Contact Standard
- ADEQ Surface Water - Full Body Contact Standard
- Livestock and Poultry Standard
- ADEQ Soil Remediation Level
- Limit of Detection

Other samples in your community

Your samples

Sample concentrations are below these standards, guidelines, and/or advisories

The key shows you which standards are shown on the graph. Depending on which graph you are viewing, different standards may be shown in the key.

Not all standards, advisories, and/or guidelines are shown in example.

Start here

WATER

Standards and/or reference values for WATER

How do you use your water? Based on how you use your water, select the appropriate standard, advisory, and/or guidline and compare your data! Use the colors below to guide your interpretation.

Surface Water - Partial Body Standard

Surface Water - Full Body Standard

Drinking Water Standard

Agricultural Irrigation Standard

Livestock and Poultry Standard

Different standards/advisories were selected based on:

- How you and other community members use their water
- Availability of useful standards or advisories.

Please note: Not all pollutants measured in Gardenroots have standards, advisories, and/or guidelines.

Arizona Department of Environmental Quality (ADEQ) Surface Water - Full Body Contact Standard

This ADEQ standard is set for surface waters like lakes, river, or streams that were, are, or could be used for commerce, travel, or recreation. Full body contact means your body will go completely underwater, ingestion of the water is likely, and your eyes, ears, or nose may directly contact with the water.

ADEQ Surface Water - Full Body Contact Standards for Inorganic Elements Measured in Project Harvest

Inorganic element	Standard (µg/L)	My water is above this standard, what does this mean?
Aluminum (Al)	No standard given	• Do not drink your water. • Do not swim in your water or do a recreational activity that will cause you to be completely under water.
Arsenic (As)	30	
Barium (Ba)	98,000	
Beryllium (Be)	1,867	
Cadmium (Cd)	700	
Chromium (Cr)	2,800 (as Cr-VI)	
Copper (Cu)	1,300	
Lead (Pb)	15	
Manganese (Mn)	130,667	
Nickel (Ni)	28,000	
Zinc (Zn)	280, 000	

Arizona Department of Environmental Quality (ADEQ) Surface Water - Partial Body Contact Standard

This ADEQ standard is set for surface waters like lakes, river, or streams that were, are, or could be used for commerce, travel, or recreation. Partial contact means that you may come into contact with the water (through an activity like boating or walking through), but you will not go completely underwater and accidentally ingest any of the water or the water will not come in direct contact with your eyes, ears, or nose.

ADEQ Surface Water - Partial Body Contact Standards for Inorganic Elements

Inorganic element	Standard (µg/L)	My water is above this standard, what does this mean?
Aluminum (Al)	No standard given	• Do not drink your water. • Do not let your water get into your eyes, ears, or nose.
Arsenic (As)	280	
Barium (Ba)	98,000	
Beryllium (Be)	1,867	
Cadmium (Cd)	700	
Chromium (Cr)	2,800 (as Cr-VI)	
Copper (Cu)	1,300	
Lead (Pb)	15	
Manganese (Mn)	130,667	
Nickel (Ni)	28,000	
Zinc (Zn)	280, 000	

Where can I get more information on the ADEQ Surface Water - Full and Partial Body Contact Standards?

- The Arizona Administrative Code. December 31, 2016. Title 18. Environmental Quality Chapter 11. Department of Environmental Quality - Water Quality Standards.

https://apps.azsos.gov/public_services/Title_18/18-11.pdf

U.S. Environmental Protection Agency (US EPA) Primary Drinking Water Standard

The maximum amount of a contaminant allowed in drinking water so that it is still safe to use over the long-term. This level is set and legally enforced by the US Environmental Protection Agency. They are also referred to as Maximum Contaminant Levels (MCL).

U.S. Environmental Protection Agency (US EPA) Secondary Drinking Water Standard

Non-enforceable guidelines to help manage contaminants that may cause cosmetic effects (such as skin or tooth discoloration) or effect the taste, odor, or color of drinking water.

USEPA Drinking Water Standards for Inorganic Elements Measured in Project Harvest

Inorganic element	Standard (µg/L)	My water is above this standard, what does this mean?
Aluminum (Al)	50*	• Do not drink your water.
Arsenic (As)	10	
Barium (Ba)	2,000	
Beryllium (Be)	4	
Cadmium (Cd)	5	
Chromium (Cr)	100 (as Cr-VI)	
Copper (Cu)	1,300^	
Lead (Pb)	15^	
Manganese (Mn)	50*	
Nickel (Ni)	140**	
Zinc (Zn)	5,000*	

^ These are Action Levels. Lead and copper are regulated under the Lead and Copper Rule. The treatment technique for the rule requires water providers/utilities to control the corrosiveness of their water and monitor drinking water at customer taps. If more than 10% of tap water samples exceed the action levels, water provider/utility must take additional steps.

* Secondary standard, not primary.
** Arizona Department of Environmental Quality Standard. There is no USEPA Drinking Water Standard.

Where can I get more information on the US EPA Drinking Water Standards?

- US EPA. National Primary Drinking Water Regulations.
  Last updated on March 22, 2018.

  https://www.epa.gov/ground-water-and-drinking-water/national-primary-drinking-water-regulations

- US EPA. Secondary Drinking Water Standards. Last updated on March 8, 2017.

  https://www.epa.gov/dwstandardsregulations/secondary-drinking-water-standards-guidance-nuisance-chemicals

- US EPA. Lead and Copper Rule. Last updated on March 15, 2017.

  https://www.epa.gov/dwreginfo/lead-and-copper-rule

U.S. Department of Agriculture (USDA) Agricultural Irrigation Water Standard

The USDA has set standards for chemicals that may be found in water sources used for irrigation. This standard is based on the amount of a chemical that could hurt crops (toxic to plants), change the way the way the plant uptakes essential nutrients, and/or reduce yield or quality. This standard is also based on maintaining toxic elements at a level below which they concentrate in the soil and become harmful.

USDA Agricultural Irrigation Water Standards for Inorganic Elements Measured in Project Harvest

Inorganic element	Standard (µg/L)	My water is above this standard, what does this mean?
Aluminum (Al)	5,000	• Your water might hurt your plants. • Over time, the toxic elements in your water may concentrate in the soil and harm your soil and animals.
Arsenic (As)	100	
Barium (Ba)	No standard given	
Beryllium (Be)	100	
Cadmium (Cd)	10	
Chromium (Cr)	100	
Copper (Cu)	200	
Lead (Pb)	5,000	
Manganese (Mn)	200	
Nickel (Ni)	200	
Zinc (Zn)	2,000	

The United States Department of Agriculture (USDA) Livestock and Poultry Drinking Standard

The USDA has set standards for chemicals that may be found in water sources used for livestock and poultry. This standard or maximum value is based on the amount of a chemical that could harm (cause severe health problems) in livestock and poultry.

USDA Livestock and Poultry Drinking Standards for Inorganic Elements

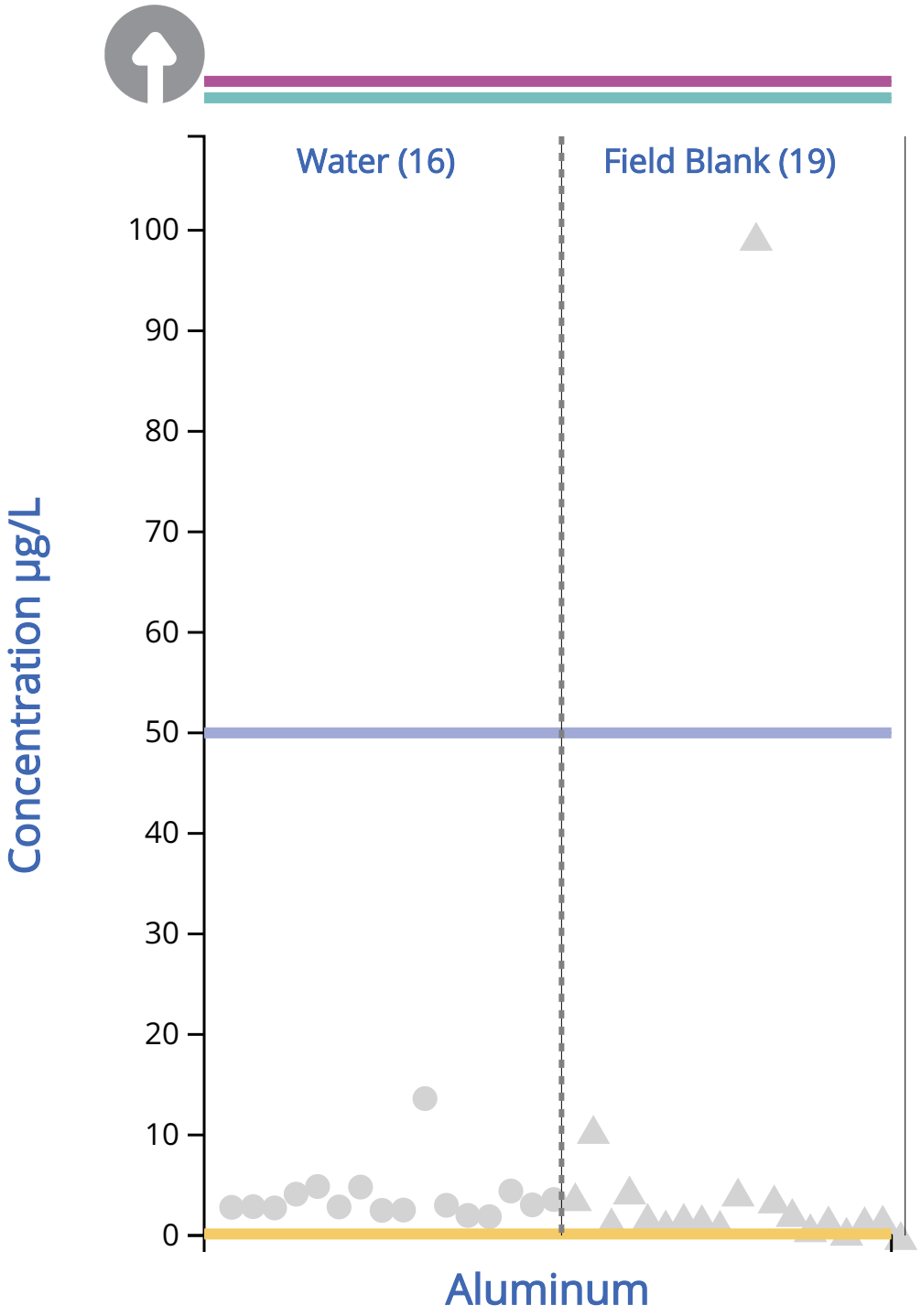
Inorganic element	Standard (µg/L)	My water is above this standard, what does this mean?
Aluminum (Al)	5,000	• Do not give your water to your livestock or poultry.
Arsenic (As)	10	
Barium (Ba)	10,000	
Beryllium (Be)	No standard given	
Cadmium (Cd)	50	
Chromium (Cr)	1,000	
Copper (Cu)	500	
Lead (Pb)	100 (lead is accumulative and problems may begin at 50 µg/L)	
Manganese (Mn)	50 (may affect taste)	
Nickel (Ni)	No standard given	
Zinc (Zn)	25,000	

Where can I get more information on the USDA Agricultural Irrigation and Livestock and Poultry Drinking Water Standards?

- Pick T. June 2011. USDA Environment Technical Note: Assessing Water Quality for Human Consumption, Agriculture, and Aquatic Life Uses.

https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs144p2_051302.pdf

Standards Descriptions


Water (16)
Field Blank (19)
100
90
80
70
60
50
40
30
20
10
0
Concentration µg/L
Aluminum

USDA Agricultural Irrigation Standard

USDA Livestock Drinking Water Standard

US EPA Secondary Drinking Water Standard (Manganese and Aluminum only)

Lower Limit of Detection (2019-2020, only for Superior)

Standard values are higher than data shown

Water (Other participant samples)

Field Blank (Other participant samples)

Aluminum

Contaminant Name: Aluminum (Al)
Contaminant Type: Metalloid

What is Aluminum?

Aluminum is the most abundant element in the earth's crust. It is generally found combined with other elements such as oxygen, silicon, and fluorine. Aluminum is used for beverage cans, pots and pans, airplanes, siding and roofing, and foil. It is also found in antacids, astringents, buffered aspirin, food additives, cosmetics, and antiperspirants.

What happens when Aluminum enters the environment?

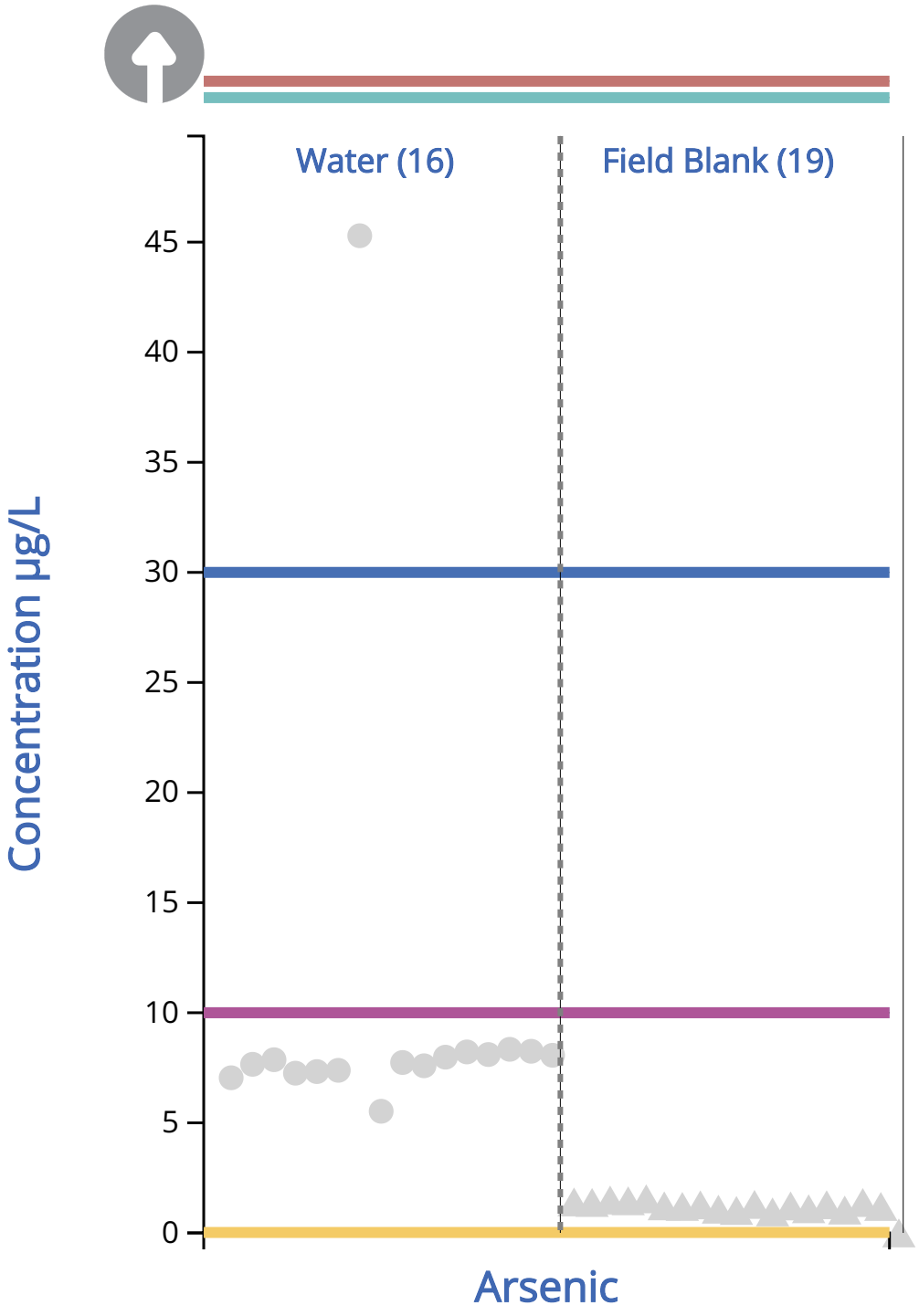
Aluminum may be released into the environment through mining and processing of aluminum ores and the production of aluminum metal, alloys, and compounds. In air, aluminum particles settle to the ground or are washed out by rain. However, very small aluminum particles can stay in the air for many days. Most aluminum-containing compounds do not dissolve very well in water unless the water is acidic or very alkaline.

How can Aluminum affect my health?

Exposure to aluminum is usually not harmful, but exposure to high levels can affect your health. Breathing in aluminum, typically in work-related settings, may result lung problems, such as coughing or abnormal chest X-rays. Aluminum has not been shown to cause cancer in animals.

Where can I get more information on Aluminum?

- Agency for Toxic Substances and Disease Registry. ToxFAQsTM for Aluminum. Last Updated on March 12, 2015. www.atsdr.cdc.gov/toxfaqs/tf.asp?id=190&tid=34#bookmark06 (https://www.atsdr.cdc.gov/toxfaqs/tf.asp?id=190&tid=34#bookmark06)


Water (16)
Field Blank (19)
45
40
35
30
25
20
15
10
5
0
Concentration µg/L
Arsenic

USDA Agricultural Irrigation Standard

ADEQ Surface Water - Partial Body Contact Standard

ADEQ Surface Water - Full Body Contact Standard

US EPA Primary Drinking Water Standard

USDA Livestock Drinking Water Standard

Lower Limit of Detection (2019-2020, only for Superior)

 Standard values are higher than data shown

Water (Other participant samples)

Field Blank (Other participant samples)

Arsenic

Contaminant Name: Arsenic (As)
Contaminant Type: Metalloid

What is Arsenic?

Arsenic naturally exists in the Earth's crust and can be found in sediments, soils, and groundwater. Arsenic may also be released into the environments via mining, ore smelting, and industrial use of the element.

What happens when Arsenic enters the environment?

In the environment, people can be exposed to arsenic in two chemical forms:

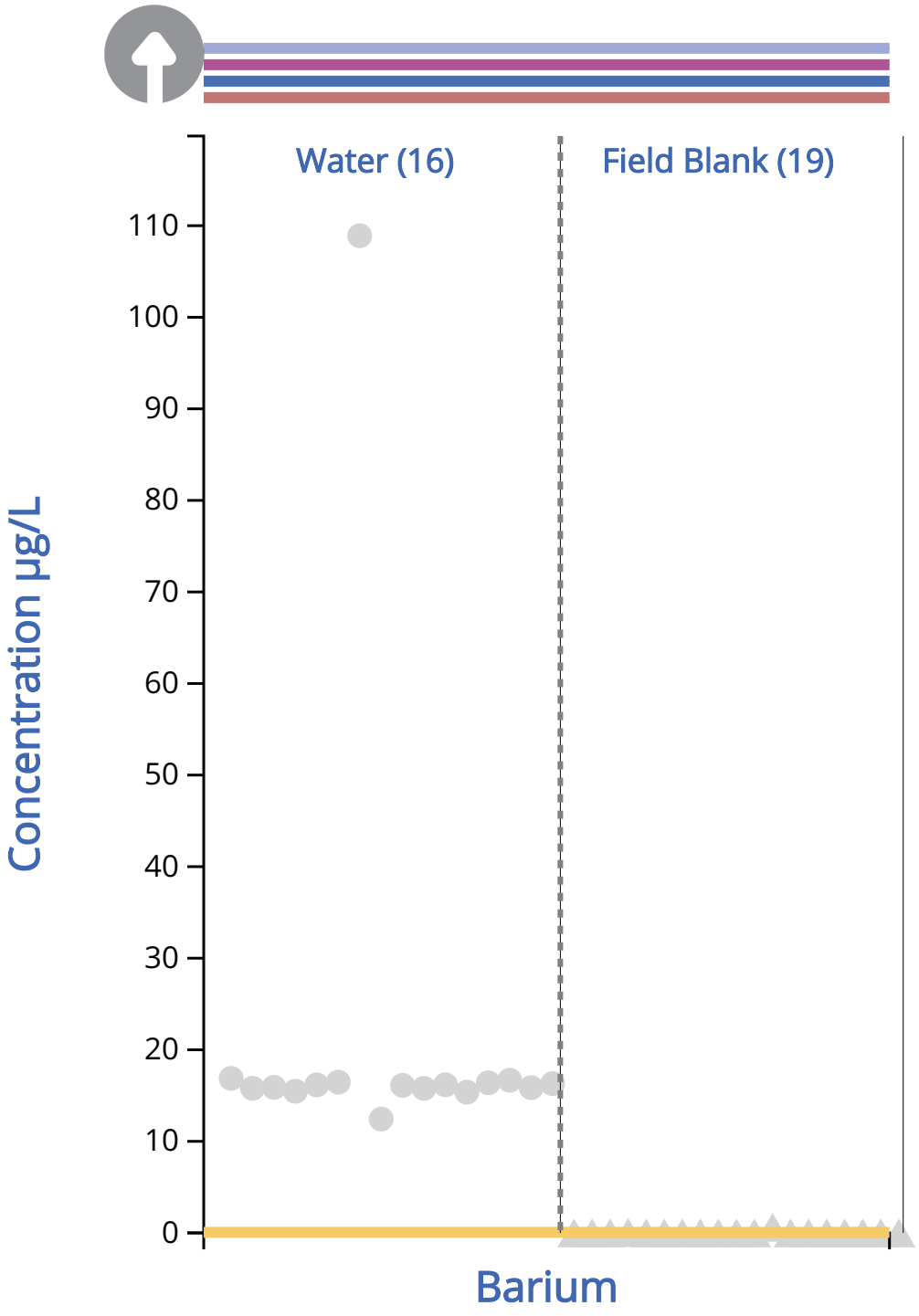
- Inorganic: Varying amounts of this poisonous (toxic forms) form can be found naturally in geologic materials (soils, rocks, aquifer materials) and in ground and surface water, which may also be impacted by mining and industrial wastes and arsenical pesticides).
- Organic (arsenic compounds that contain carbon): Varying amounts of this non-poisonous (low-toxicity) form can be found in sources such as animals, plants, fish and seafood. Fish and shellfish can accumulate arsenic; most of this arsenic is in an organic form called arsenobetaine that is much less harmful.

How can Arsenic affect my health?

Severe (acute) arsenic poisoning can cause vomiting, abdominal pain, and diarrhea. This can be followed by numbness and tingling of the extremities, muscle cramping, and death in extreme cases. Ingesting or breathing low levels of inorganic arsenic for a long time (chronic) can cause non-cancer health effects, like a darkening of the skin and the appearance of small "warts" on the palms, soles, and torso. Other non-cancer health effects linked to long-term ingestion of arsenic include developmental effects, diabetes, pulmonary disease, and cardiovascular disease. Ingestion of inorganic arsenic can increase the risk of skin cancer and cancer in the liver, bladder, and lungs. Inhalation of inorganic arsenic can cause increased risk of lung cancer.

Where can I get more information on Arsenic?

- Agency for Toxic Substances and Disease Registry. ToxFAQsTM for Arsenic. Last Updated on March 12, 2015. www.atsdr.cdc.gov/toxfaqs/tf.asp?id=19&tid=3 (https://www.atsdr.cdc.gov/toxfaqs/tf.asp?id=19&tid=3)


Water (16)
Field Blank (19)
110
100
90
80
70
60
50
40
30
20
10
0
Concentration µg/L
Barium

ADEQ Surface Water - Partial Body Contact Standard

ADEQ Surface Water - Full Body Contact Standard

USDA Livestock Drinking Water Standard

US EPA Primary Drinking Water Standard

Lower Limit of Detection (2019-2020, only for Superior)

 Standard values are higher than data shown

Water (Other participant samples)

Field Blank (Other participant samples)

Barium

Contaminant Name: Barium (Ba)
Contaminant Type: Alkaline Earth Metal

What is Barium?

Barium is a silvery-white metal and combines with other chemicals such as sulfur or carbon and oxygen to form barium compounds. Barium compounds are used by the oil and gas industries to make drilling muds. They are also used to make paint, bricks, ceramics, glass, and rubber. Barium sulfate is sometimes used by doctors to perform medical tests and to take x-rays of the gastrointestinal tract.

What happens when Barium enters the environment?

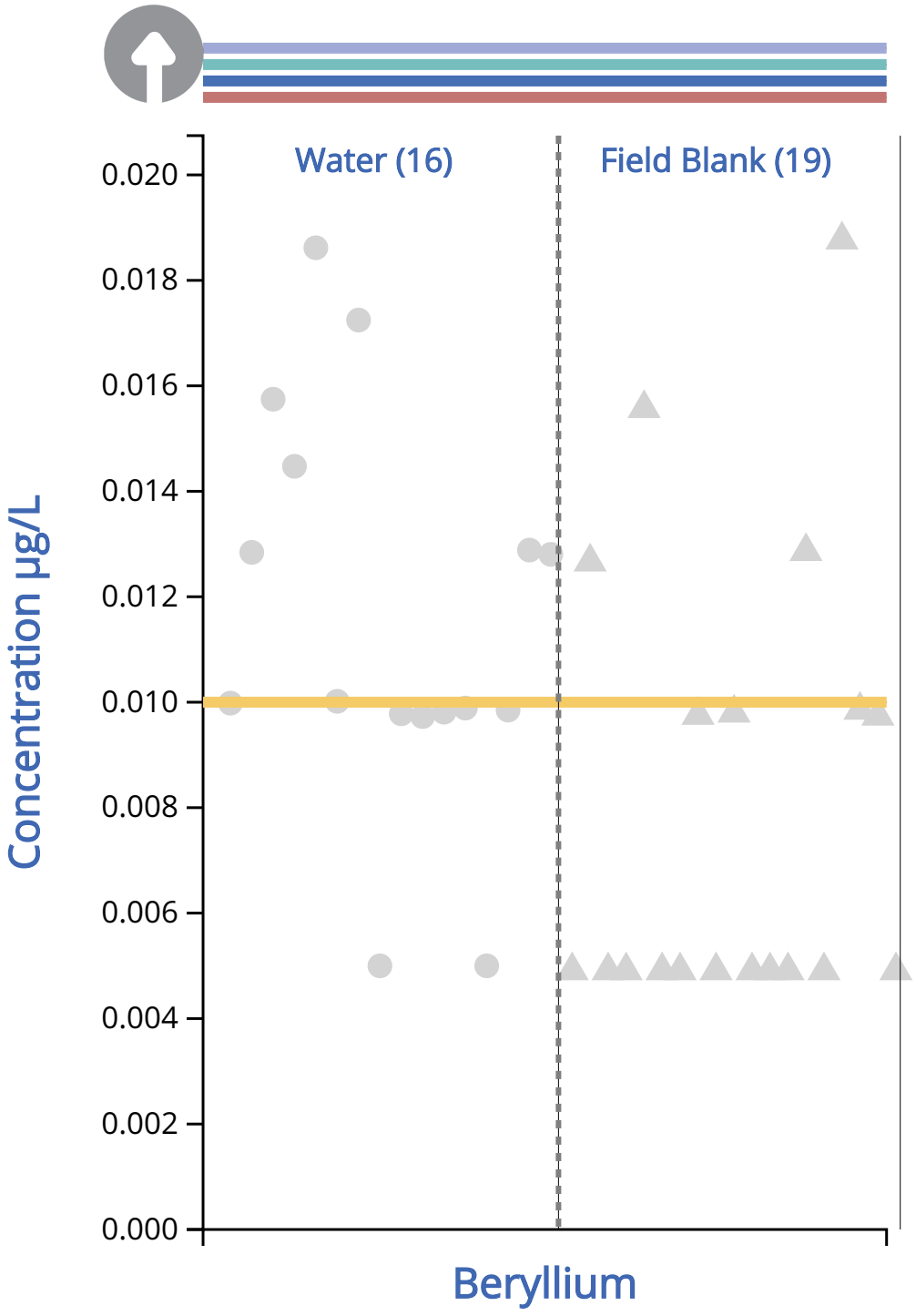
Barium gets into the air during the mining, refining, and production of barium compounds, and from the burning of coal and oil. The length of time that barium will last in air, land, water, or sediments depends on the form of barium released. Barium compounds, such as barium sulfate and barium carbonate, which do not dissolve well in water, can last a long time in the environment. Fish and aquatic organisms can accumulate barium.

How can Barium affect my health?

People with the greatest known risk of exposure to high levels of barium are those working in industries that make or use barium compounds. Exposure near hazardous waste sites may occur by breathing dust, eating soil or plants, skin contact, or drinking water that is polluted with barium. Some people who eat or drink amounts of barium above background levels found in food and water for a short period may experience vomiting, abdominal cramps, diarrhea, difficulties in breathing, increased or decreased blood pressure, numbness around the face, and muscle weakness. When barium is ingested, it is not likely to cause cancer in humans. There is not enough information to determine if it will cause cancer in humans when inhaled.

Where can I get more information on Barium?

- Agency for Toxic Substances and Disease Registry. ToxFAQsTM for Barium. Last Updated on July 27, 2015. www.atsdr.cdc.gov/toxfaqs/tf.asp?id=326&tid=57 (https://www.atsdr.cdc.gov/toxfaqs/tf.asp?id=326&tid=57)


Water (16)
Field Blank (19)
0.020
0.018
0.016
0.014
0.012
0.010
0.008
0.006
0.004
0.002
0.000
Concentration µg/L
Beryllium

ADEQ Surface Water - Partial Body Contact Standard

ADEQ Surface Water - Full Body Contact Standard

USDA Agricultural Irrigation Standard

US EPA Primary Drinking Water Standard

Lower Limit of Detection (2019-2020, only for Superior)

 Standard values are higher than data shown

Water (Other participant samples)

Field Blank (Other participant samples)

Beryllium

Contaminant Name: Beryllium (Be)
Contaminant Type: Alkaline Earth Metal

What is Beryllium?

Beryllium is found in minerals, rocks, coal, soil, and volcanic dust. Beryllium compounds are commercially mined, and purified for use in nuclear weapons and reactors, aircraft and space vehicle structures, instruments, x-ray machines, and mirrors. Beryllium ores are used to make specialty ceramics for electrical and high-technology applications. Beryllium alloys are used in automobiles, computers, sports equipment (golf clubs and bicycle frames), and dental bridges.

What happens when Beryllium enters the environment?

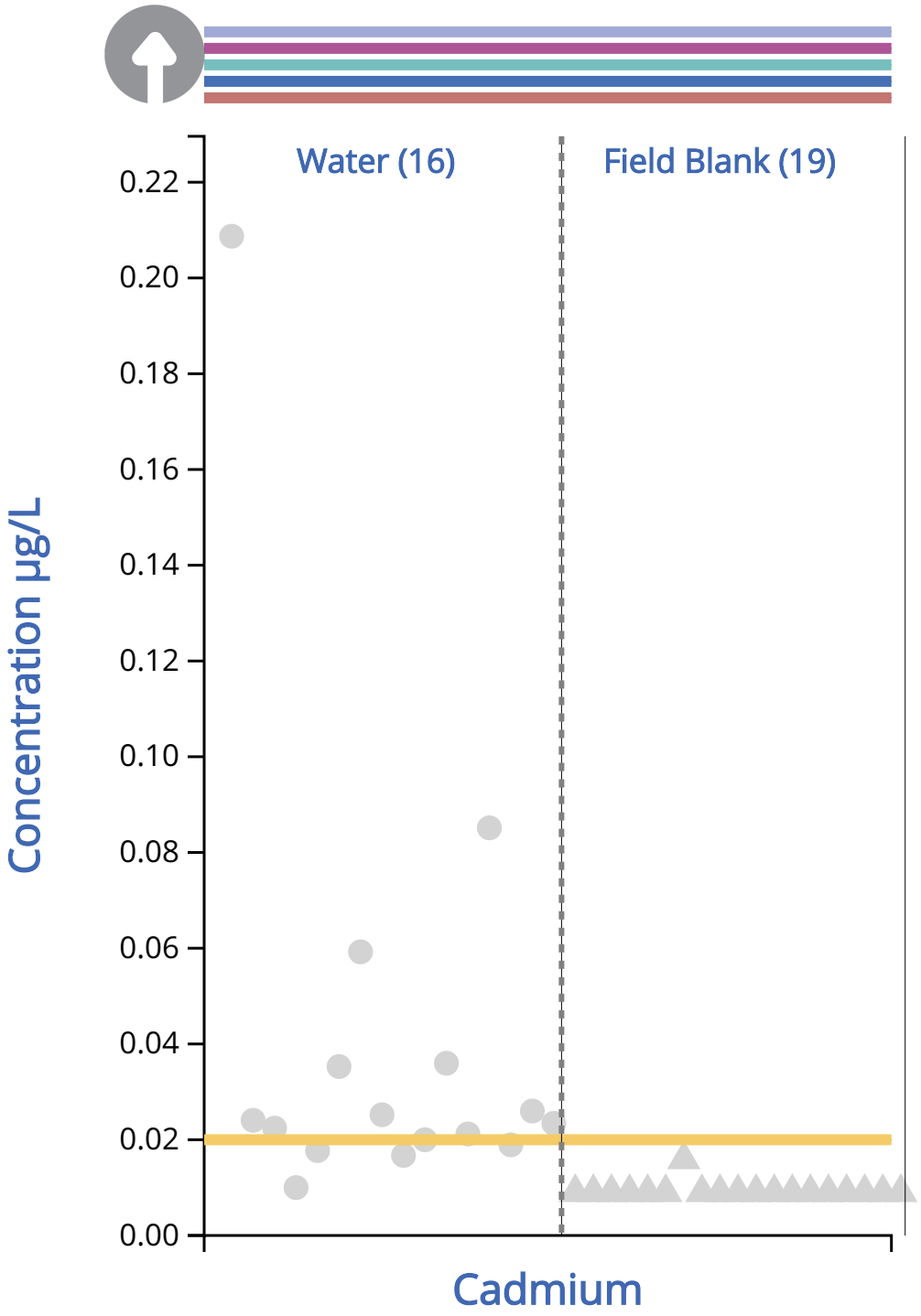
Beryllium dust enters the air from burning coal and oil. It enters water from erosion of rocks and soil, and from industrial waste. Some beryllium compounds will dissolve in water, but most stick to particles and settle to the bottom. Most beryllium in soil does not dissolve in water and remains bound to soil. Beryllium does not accumulate in the food chain.

How can Beryllium affect my health?

Beryllium can be harmful if you breathe it. People working in industries where beryllium is mined, processed, machined, or converted into metal, alloys, and other chemicals may be exposed to high levels of beryllium. People living near these industries or near uncontrolled hazardous waste sites may also be exposed to higher than normal levels of beryllium in air. Beryllium and beryllium compounds can cause cancer in humans.

Where can I get more information on Beryllium?

- Agency for Toxic Substances and Disease Registry. ToxFAQsTM for Beryllium. Last Updated on June 3, 2015. www.atsdr.cdc.gov/toxfaqs/tf.asp?id=184&tid=33 (https://www.atsdr.cdc.gov/toxfaqs/tf.asp?id=184&tid=33)


Water (16)
Field Blank (19)
0.22
0.20
0.18
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
Concentration µg/L
Cadmium

ADEQ Surface Water - Partial Body Contact Standard

ADEQ Surface Water - Full Body Contact Standard

USDA Agricultural Irrigation Standard

USDA Livestock Drinking Water Standard

US EPA Primary Drinking Water Standard

Lower Limit of Detection (2019-2020, only for Superior)

Standard values are higher than data shown

Water (Other participant samples)

Field Blank (Other participant samples)

Cadmium

Contaminant Name: Cadmium (Cd)
Contaminant Type: Heavy Metal

What is Cadmium?

Cadmium is found in the Earth's crust. Most cadmium used in the U.S. is extracted as a byproduct during the production of other metals such as zinc, lead, or copper. Cadmium is also recovered from used batteries. Cadmium is used for the following: batteries, pigments, coatings and platings, stabilizers for plastics, photovoltaic (solar power materials) devices, and other uses.

What happens when Cadmium enters the environment?

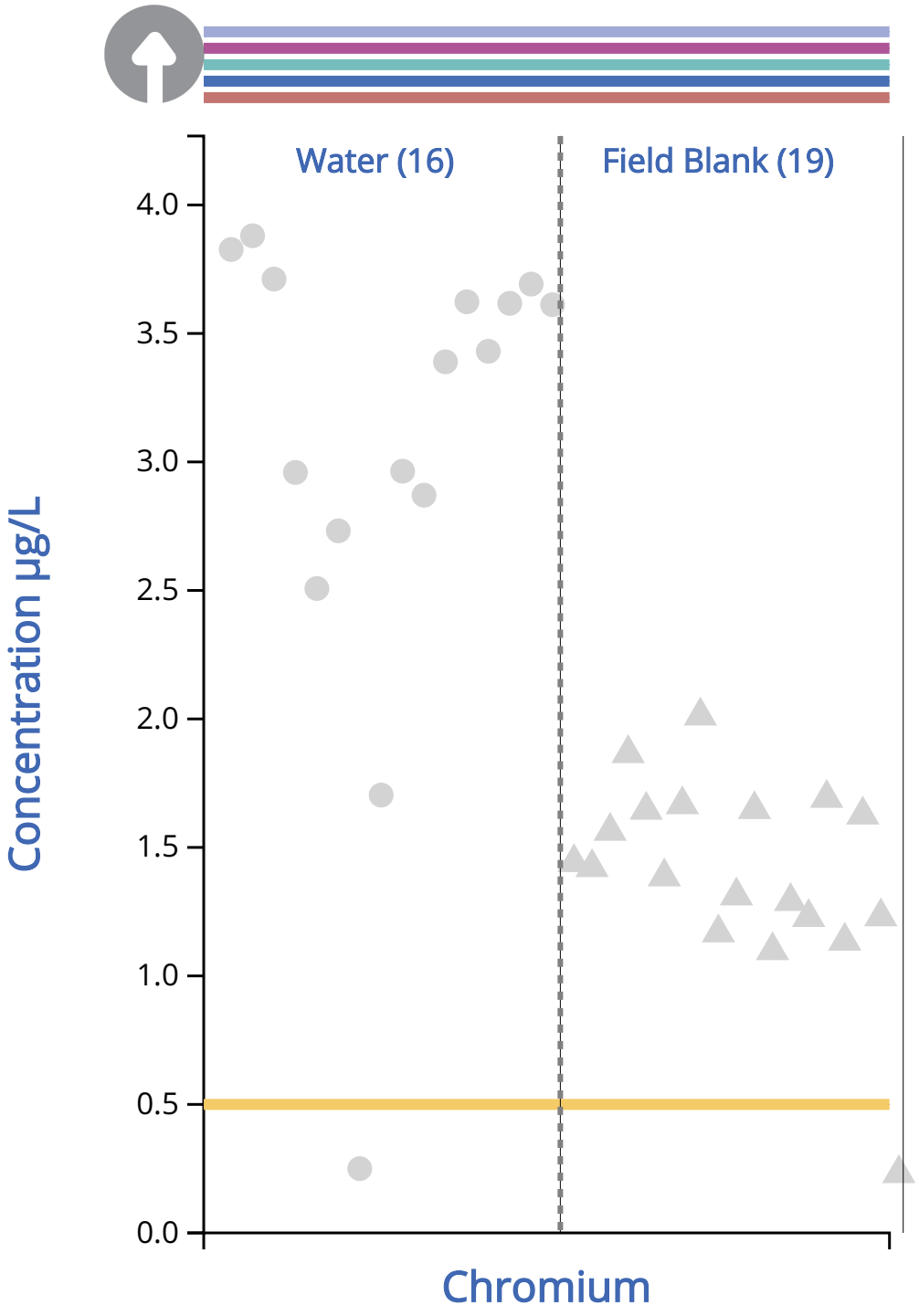
Cadmium is emitted to soil, water, and air by metal mining and refining, manufacture and application of phosphate fertilizers, fossil fuel combustion, and waste incineration and disposal. Generally, cadmium binds strongly to organic matter where it can stay in soil and be taken up by plant life, eventually entering the food supply.

How can Cadmium affect my health?

Cigarette smoking is a major exposure route to cadmium. Tobacco may have been grown in contaminated soils, or pesticides/fungicides or additives were applied during the growing and manufacturing process.Exposure to cadmium can occur through breathing contaminated workplace air, drinking contaminated water, or living near industrial facilities that release cadmium into the air. Eating food or drinking water with very high levels severely irritates the stomach, leading to vomiting and diarrhea. Long-term exposure to lower levels of cadmium in air, food, or water leads to a buildup of cadmium in the kidneys and possible kidney disease. Other long-term effects include lung damage and fragile bones. Low levels of cadmium are found in all foods (highest levels are found in shellfish, liver, and kidney meats). In the U.S., for nonsmokers the primary source of cadmium exposure is from the food supply. Breathing high levels of cadmium can severely damage the lungs. Cadmium and cadmium compounds are known to cause cancer in humans.

Where can I get more information on Cadmium?

- Agency for Toxic Substances and Disease Registry. ToxFAQsTM for Cadmium. Last Updated on March 12, 2015. www.atsdr.cdc.gov/toxfaqs/tf.asp?id=47&tid=15 (https://www.atsdr.cdc.gov/toxfaqs/tf.asp?id=47&tid=15)


Water (16)
Field Blank (19)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Concentration µg/L
Chromium

ADEQ Surface Water - Partial Body Contact Standard

ADEQ Surface Water - Full Body Contact Standard

USDA Agricultural Irrigation Standard

USDA Livestock Drinking Water Standard

US EPA Primary Drinking Water Standard

Lower Limit of Detection (2019-2020, only for Superior)

Standard values are higher than data shown

Water (Other participant samples)

Field Blank (Other participant samples)

Chromium

Contaminant Name: Chromium (Cr)
Contaminant Type: Metal

What is Chromium?

Chromium is a naturally-occurring element found in rocks, animals, plants, and soil, where it exists in combination with other elements to form various compounds. The three main forms of chromium are: chromium(0), chromium(III), and chromium(VI). Small amounts of chromium(III) are needed for human health. Chromium(VI) is known to be highly toxic, when compared to Cr-III. Chromium is widely used in manufacturing processes to make various metal alloys such as stainless steel

What happens when Chromium enters the environment?

Chromium can be found in air, soil, and water after release from industries that use chromium, such as industries involved in electroplating, leather tanning, textile production, and the manufacture of chromium-based products. Chromium can also be released into the environment from the burning of natural gas, oil, or coal. Chromium does not usually remain in the atmosphere, but is deposited into the soil and water.

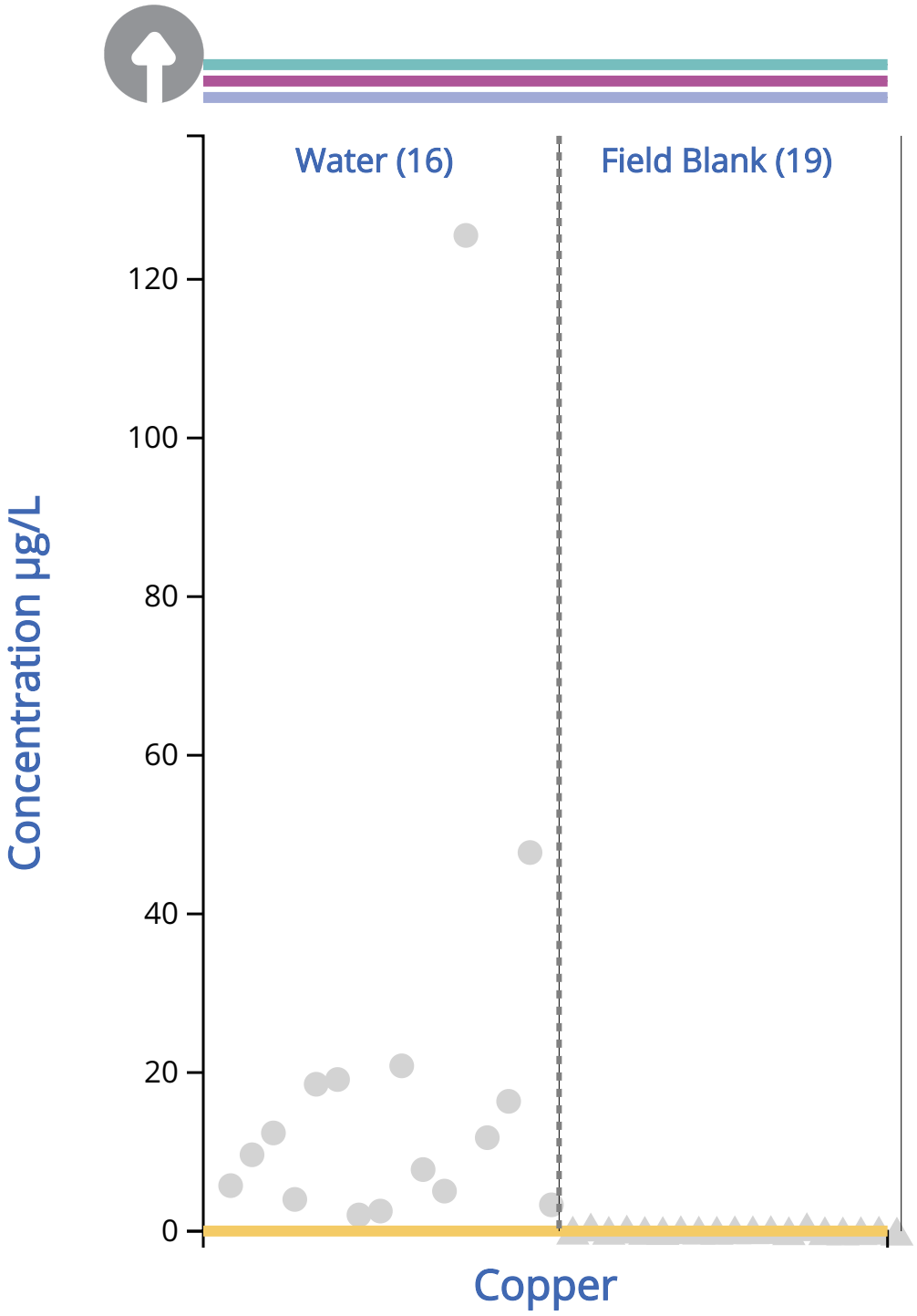
How can Chromium affect my health?

The highest potential human exposure occurs in the metallurgy and tanning industries where workers may be exposed to high air concentrations. Inhalation of chromium compounds can result in irritation of the nasal passages, breathing problems, and other upper respiratory conditions. Chromium(VI) has the potential to affect the male reproductive system and/or the small intestine, and chromium(VI) compounds are known to cause cancer in humans.

Where can I get more information on Chromium?

- Agency for Toxic Substances and Disease Registry. ToxFAQsTM for Chromium. Last Updated on September 28, 2016.

  www.atsdr.cdc.gov/toxfaqs/tf.asp?id=61&tid=17 (https://www.atsdr.cdc.gov/toxfaqs/tf.asp?id=61&tid=17)


Water (16)
Field Blank (19)
120
100
80
60
40
20
0
Concentration µg/L
Copper

US EPA Primary Drinking Water Standard
USDA Livestock Drinking Water Standard
USDA Agricultural Irrigation Standard
Lower Limit of Detection (2019-2020, only for Superior)
Standard values are higher than data shown
Water (Other participant samples)
Field Blank (Other participant samples)

Copper

Contaminant Name: Copper (Cu)
Contaminant Type: Metal

What is Copper?

Copper is a metal that occurs naturally throughout the environment, in rocks, soil, water, and air. Copper is an essential element in plants, animals, and humans, which means it is necessary for us to live. Copper is used to make many different kinds of products like wire, cars, plumbing pipes, and sheet metal. Copper is also combined with other metals to make brass and bronze pipes and faucets. Copper compounds are commonly used in agriculture to treat plant diseases like mildew, for water treatment and, as preservatives for wood, leather, and fabrics.

What happens when Copper enters the environment?

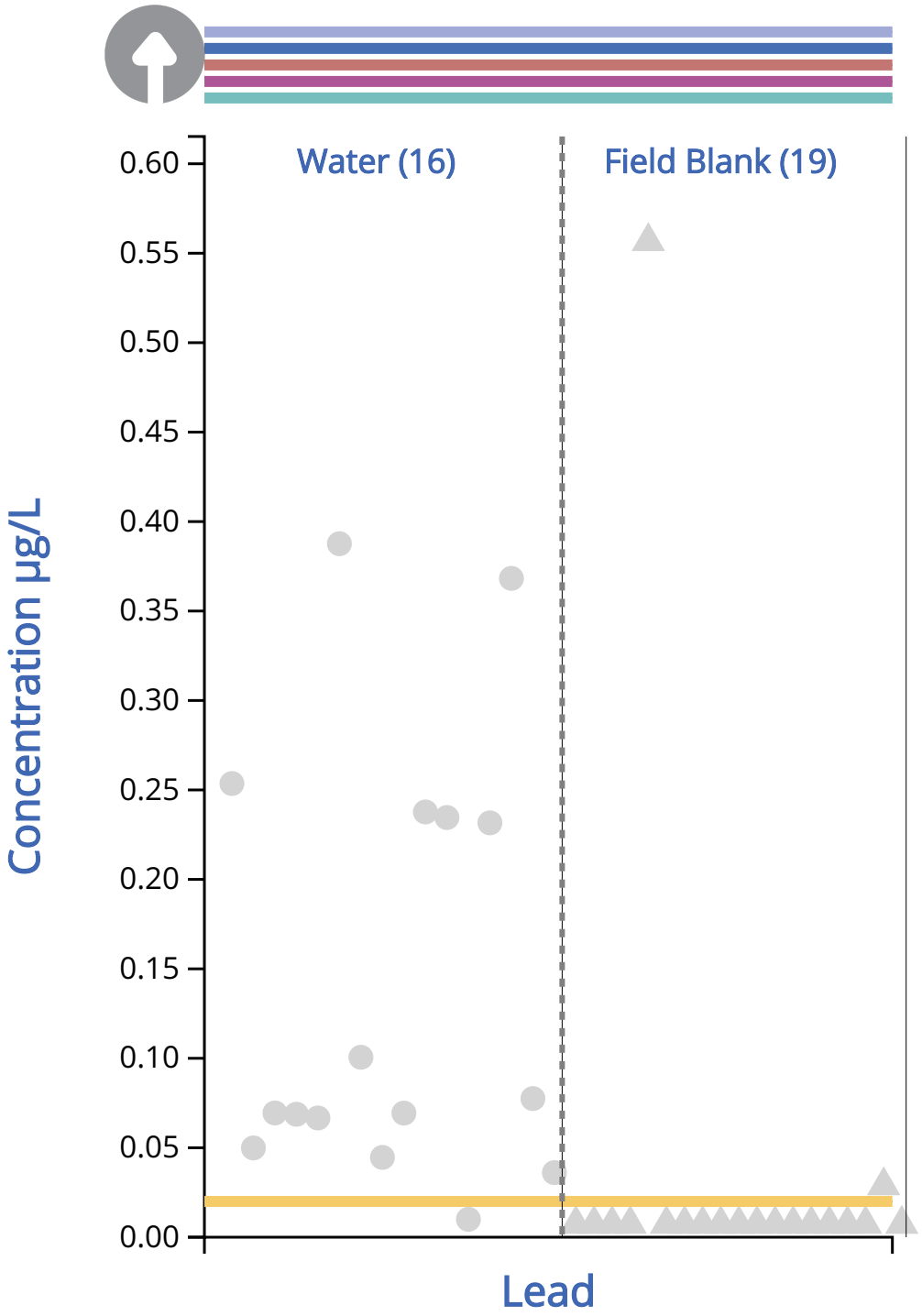
Copper is released into the environment by mining, farming, and manufacturing operations and through waste water releases into rivers and lakes. Copper is also released from natural sources, like volcanoes, windblown dusts, decaying vegetation, and forest fires. Copper released into the environment usually attaches to particles made of organic matter, clay, soil, or sand.

How can Copper affect my health?

Copper is essential for good health, but high levels of copper can be harmful. You may be exposed to copper by ingesting copper-containing fungicides or if you live near or work in a copper mine. Breathing high levels of copper can cause irritation of your nose and throat. Ingesting high levels of copper can cause nausea, vomiting, and diarrhea. Very-high doses of copper can cause damage to your liver and kidneys, and can even cause death.

Where can I get more information on Copper?

- Agency for Toxic Substances and Disease Registry. ToxFAQsTM for Chromium. Last Updated on September 28, 2016. www.atsdr.cdc.gov/phs/phs.asp?id=204&tid=37 (https://www.atsdr.cdc.gov/phs/phs.asp?id=204&tid=37)


Water (16)
Field Blank (19)
0.60
0.55
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
Concentration µg/L
Lead

USDA Agricultural Irrigation Standard

USDA Livestock Drinking Water Standard

ADEQ Surface Water - Partial Body Contact Standard

ADEQ Surface Water - Full Body Contact Standard

US EPA Primary Drinking Water Standard

Lower Limit of Detection (2019-2020, only for Superior)

Standard values are higher than data shown

Water (Other participant samples)

Field Blank (Other participant samples)

Lead

Contaminant Name: Lead (Pb)
Contaminant Type: Heavy Metal

What is Lead?

Lead is a metal in the Earth's crust that is normally found with other metals such as zinc, silver, and copper. Lead has many uses including manufacturing of paints, batteries, and fishing weights. Lead-based solder, which had been used to connect copper water pipes, was banned in the 1980s, but may still be a source of lead in drinking water in older homes. In the United States, lead was used as a gasoline additive, but was banned beginning in 1973 and eliminated by 1996.

What happens when Lead enters the environment?

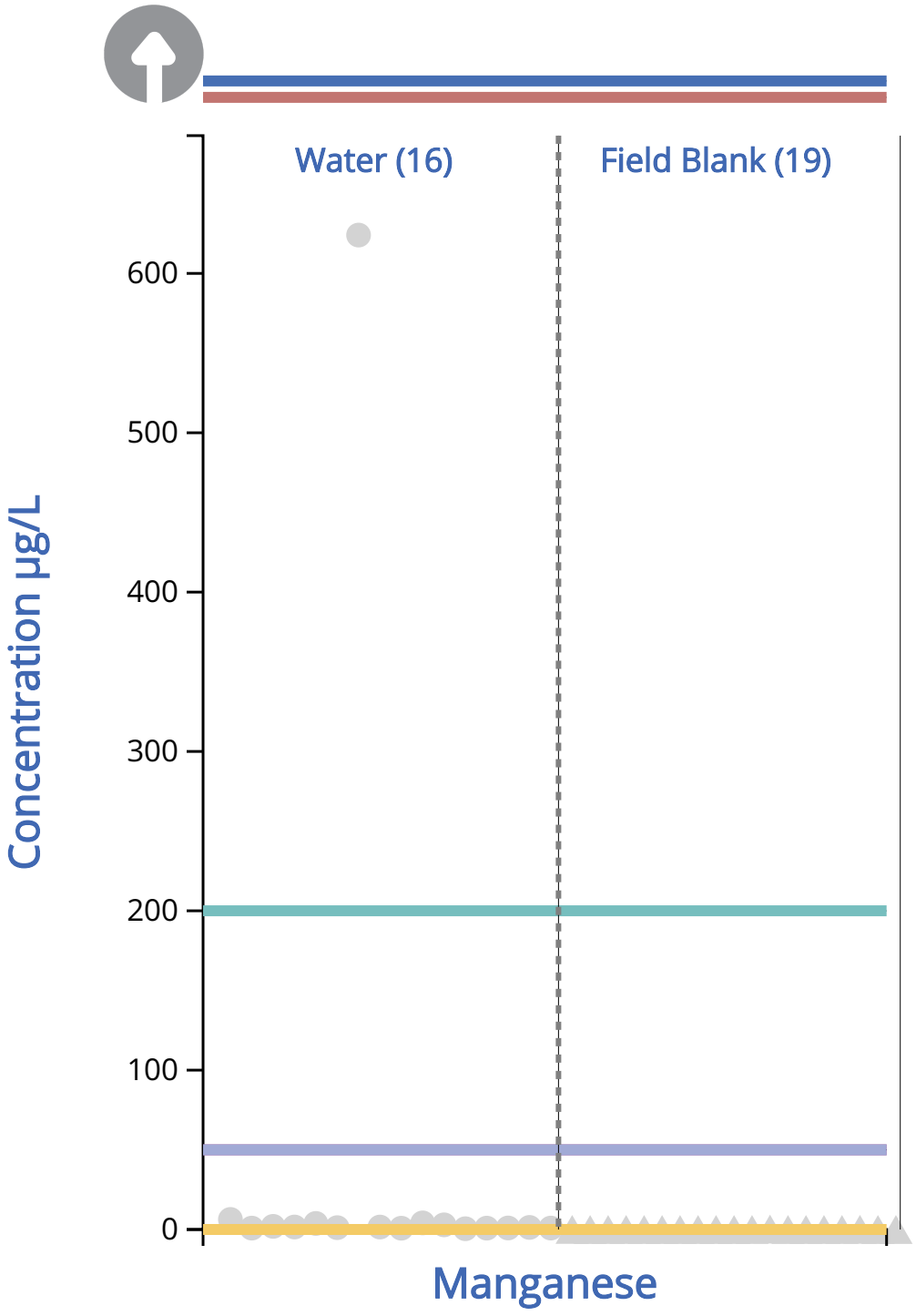
Lead itself does not break down, but lead compounds are changed by sunlight, air, and water. When lead is released to the air, it may travel long distances before settling to the ground. Once lead falls onto soil, it usually sticks to soil particles. Ingestion (soil, food, water) is the main route of exposure in humans. Children are most impacted by lead exposure because they often put their hands and/or toys in their mouths. Pregnant women can also expose their unborn child to lead via ingestion. Adults can be exposed via lifestyle choices (e.g., cigarette smoking) or through their occupation (e.g., plumbing, soldering, manufacturing plants, construction/remodeling companies, smelters, and auto repair shops). There are other sources of potential lead exposure which include: paints, glazed clay pots, wine, food, leaded glass (crystal), stained glass, dyes, and home remedies (e.g., azarcon or greta used to treat digestive illness).

How can Lead affect my health?

Lead can affect almost every organ and system in your body, both in adults and children. Exposure to lead can seriously harm a child's health. It can damage the brain and nervous system, slow growth and development, cause learning, behavior, hearing, and speech problems. It causes lower IQ, decreased ability to pay attention, and underperformance in school. Lead exposure also causes small increases in blood pressure, particularly in middle-aged and older people and can cause anemia. In pregnant women, high levels of exposure to lead may cause miscarriage. High-level exposure in men can damage the organs responsible for sperm production.

Where can I get more information on Lead?

- Agency for Toxic Substances and Disease Registry. ToxFAQsTM for Lead. Last Updated on August 24, 2016. www.atsdr.cdc.gov/toxfaqs/tf.asp?id=93&tid=22 (https://www.atsdr.cdc.gov/toxfaqs/tf.asp?id=93&tid=22)


Water (16)
Field Blank (19)
600
500
400
300
200
100
0
Concentration µg/L
Manganese

ADEQ Surface Water - Partial Body Contact Standard

ADEQ Surface Water - Full Body Contact Standard

USDA Agricultural Irrigation Standard

USDA Livestock Drinking Water Standard

US EPA Secondary Drinking Water Standard (Manganese and Aluminum only)

Lower Limit of Detection (2019-2020, only for Superior)

Standard values are higher than data shown

Water (Other participant samples)

Field Blank (Other participant samples)

Manganese

Contaminant Name: Manganese (Mn)
Contaminant Type: Metal

What is Manganese?

Manganese is naturally occurring and found in rocks and soils. Manganese does not occur as a pure metal in nature, instead it is typically bound to elements like oxygen, sulfur, and chlorine. Manganese is used to strengthen metal alloys and can be found in fireworks, fertilizers, cosmetics, etc.

What happens when Manganese enters the environment?

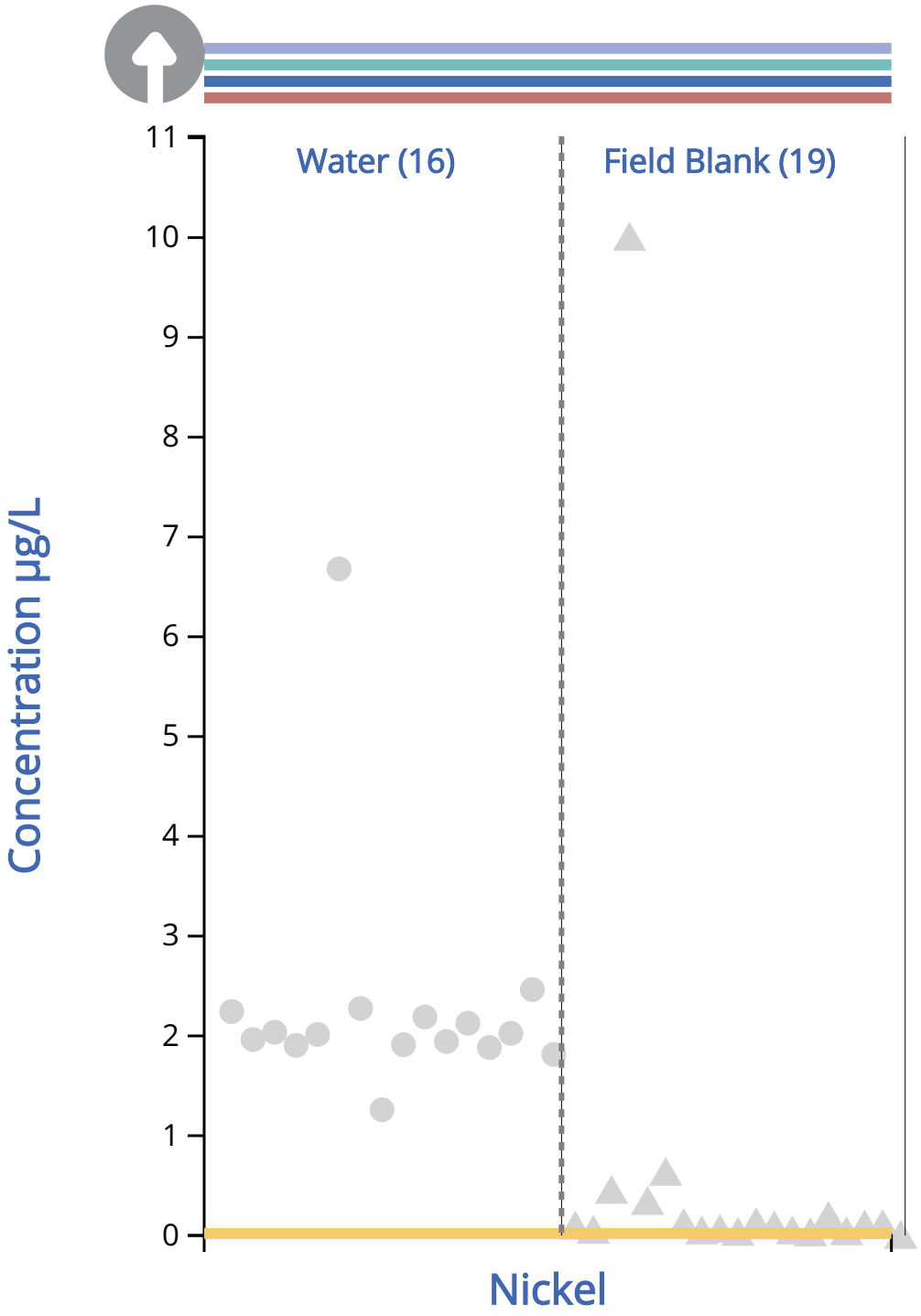
Manganese is naturally occurring in air, water, soil, and foods, but may also be released into the environment via manufacturing, and disposal of based products such as gasoline with manganese-additives. Manganese-containing additives can be broken down by sunlight.

How can Manganese affect my health?

Manganese is an essential nutrient, and eating a small amount of it each day is important to stay healthy.Manganese has the potential to cause lung irritation when inhaled. Manganese may also result in reproductive effects. Workers exposed to high levels of manganese have developed nervous system problems.

Where can I get more information on Manganese?

- Agency for Toxic Substances and Disease Registry. ToxFAQsTM for manganese. Last Updated on January 21, 2015. www.atsdr.cdc.gov/phs/phs.asp?id=100&tid=23 (https://www.atsdr.cdc.gov/phs/phs.asp?id=100&tid=23)


Water (16)
Field Blank (19)
11
10
9
8
7
6
5
4
3
2
1
0
Concentration µg/L
Nickel

ADEQ Surface Water - Partial Body Contact Standard

ADEQ Surface Water - Full Body Contact Standard

USDA Agricultural Irrigation Standard

Arizona Department of Environmental Quality Drinking Water Standard (Nickel only)

Lower Limit of Detection (2019-2020, only for Superior)

 Standard values are higher than data shown

Water (Other participant samples)

Field Blank (Other participant samples)

Nickel

Contaminant Name: Nickel (Ni)
Contaminant Type: Metal

What is Nickel?

Nickel is a natural element. Nickel can be combined with other metals and is used to make coins, jewelry, and items such as valves and heat exchangers. Most nickel is used to make stainless steel. Many nickel compounds dissolve fairly easy in water and have a green color. Nickel compounds are used for nickel plating, to color ceramics, to make some batteries, and as substances known as catalysts that increase the rate of chemical reactions.

What happens when Nickel enters the environment?

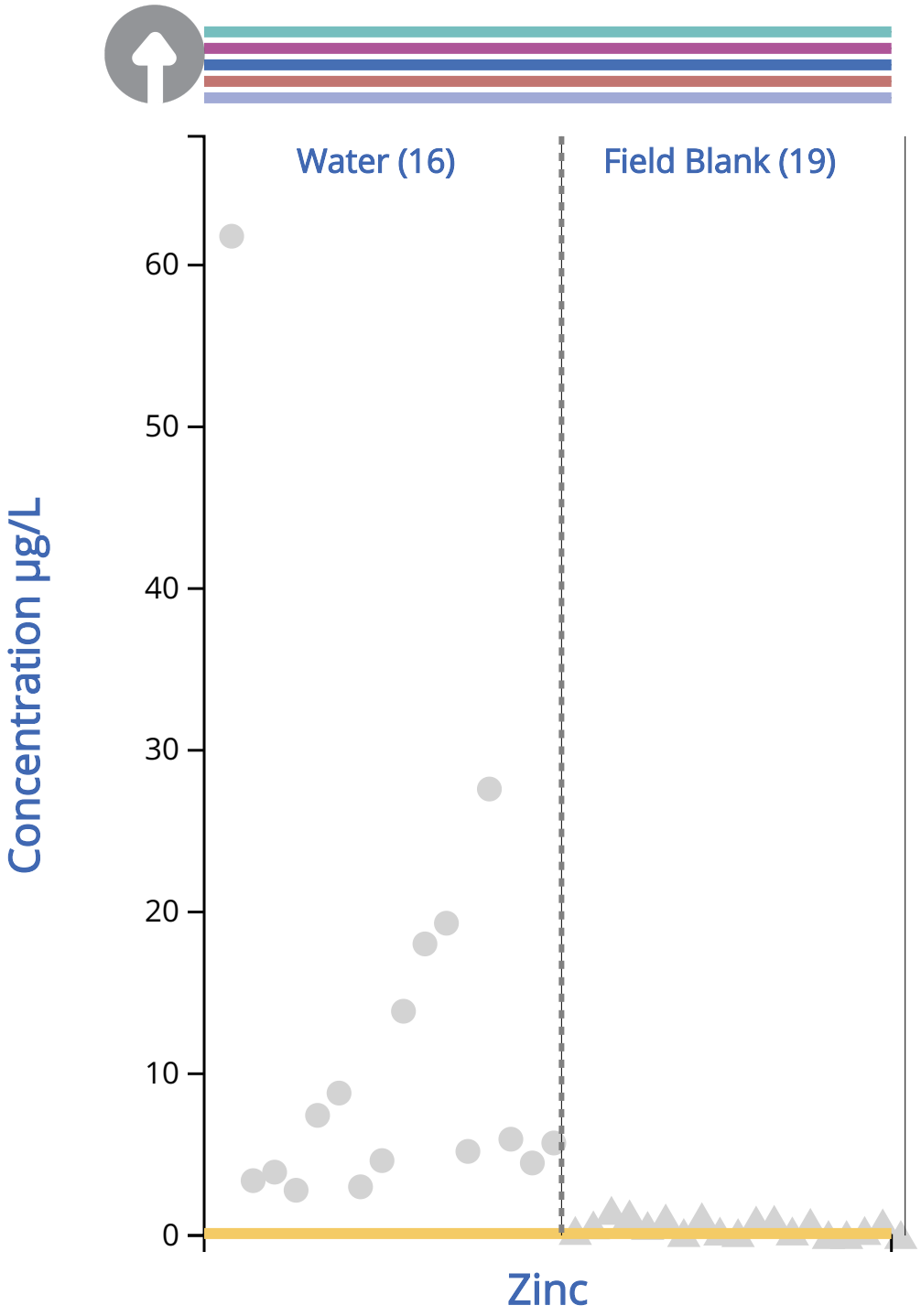
Nickel is released into the atmosphere by industries that make or use nickel, nickel alloys, or nickel compounds. Nickel is found in soil and is emitted from volcanoes. Nickel is also found in meteorites and on the ocean floor and It is also released into the atmosphere by oil-burning power plants, coal-burning power plants, and trash incinerators. In the air, it attaches to small particles of dust that settle to the ground or are taken out of the air in rain or snow; this usually takes many days. Nickel released in industrial waste-water ends up in soil or sediment where it strongly attaches to particles containing iron or manganese. Nickel does not appear to accumulate in fish or in other animals used as food.

How can Nickel affect my health?

You can be exposed to Nickel through food (major source of exposure), skin contact with soil, bath or shower water, metals containing nickel, smoking tobacco containing nickel, and by handling coins or touching jewelry containing nickel. The most common heath effect is an allergic reaction, usually a rash due to skin contact. People working in nickel refineries or nickel-processing plants have experienced chronic bronchitis and reduced lung function by breathing air containing nickel; however, such reactions are the result of breathing amounts of nickel much higher than levels found normally in the environment. Cancers of the lung and nasal sinus have resulted when workers breathed dust containing high levels of nickel compounds.

Where can I get more information on Nickel?

- Agency for Toxic Substances and Disease Registry. ToxFAQsTM for nickel. Last Updated on January 21, 2015. www.atsdr.cdc.gov/phs/phs.asp?id=243&tid=44 (https://www.atsdr.cdc.gov/phs/phs.asp?id=243&tid=44)


Water (16)
Field Blank (19)
Concentration µg/L
60
50
40
30
20
10
0
Zinc

US EPA Primary Drinking Water Standard
ADEQ Surface Water - Partial Body Contact Standard
ADEQ Surface Water - Full Body Contact Standard
USDA Livestock Drinking Water Standard
USDA Agricultural Irrigation Standard
Lower Limit of Detection (2019-2020, only for Superior)
Standard values are higher than data shown
Water (Other participant samples)
Field Blank (Other participant samples)

Zinc

Contaminant Name: Zinc (Zn)
Contaminant Type: Transitional Metal

What is Zinc?

Zinc is found in the Earth's crust. Zn is commonly used as a coating for steel, iron, and other metals to prevent rusting. Zinc compounds are widely used to make paint, rubber, dyes, wood preservatives, and ointments.

What happens when Zinc enters the environment?

Some zinc is released into the environment by natural processes, but most comes from human activities like mining, steel production, coal burning, and burning of waste. It attaches to soil, sediments, and dust particles in the air. Rain and snow remove zinc dust particles from the air. Depending on the type of soil, some zinc compounds can move into the groundwater and into lakes, streams, and rivers. Most of the zinc in soil stays bound to soil particles and does not dissolve in water. It builds up in fish and other organisms, but it does not build up in plants.

How can Zinc affect my health?

Zinc is an essential element in our diet. Too little zinc can cause problems, but too much zinc is also harmful. People can be exposed to zinc by:

- Drinking contaminated water or a beverage that has been stored in metal containers or flows through pipes that have been coated with zinc to resist rust.
- Eating too many dietary supplements that contain zinc.
- Working in any of the following jobs: construction, painting, automobile mechanics, mining, smelting, and welding; manufacture of brass, bronze, or other zinc-containing alloys; manufacture of galvanized metals; and manufacture of machine parts, rubber, paint, linoleum, oilcloths, batteries, some kind of glass, ceramics, and dyes.

Harmful effects generally begin at levels 10-15 times higher than the amount needed for good health. Large doses taken by mouth even for a short time can cause stomach cramps, nausea, and vomiting. Taken longer, it can cause anemia and decrease the levels of your good cholesterol. Inhaling large amounts of zinc (as dusts or fumes) can cause a specific short-term disease called metal fume fever. Long-term effects of breathing high levels of zinc are currently unknown.

Where can I get more information on Zinc?

- Agency for Toxic Substances and Disease Registry. ToxFAQsTM for nickel. Last Updated on January 21, 2015. www.atsdr.cdc.gov/phs/phs.asp?id=300&tid=54 (https://www.atsdr.cdc.gov/phs/phs.asp?id=300&tid=54)

SOIL

Standards and/or reference values for SOIL

Use the color below to guide your interpretation.

Soil Remediation Level

Different standards/advisories were selected based on:

- How you and other community members use their soil.
- Availability of useful standards or advisories.

Please note: Not all pollutants measured in Project Harvest have standards, advisories, and/or guidelines.

Arizona Department of Environmental Quality (ADEQ) Soil Remediation Level

This Soil Remediation Level is a residential-yard soil screening-level based on a health risk-assessment. If a metal concentration in a residential yard soil is above the level, it suggests further investigation should be taken, but does not necessarily require cleanup.

ADEQ Soil Remediation Level for Inorganic Elements Measured in Project Harvest

Inorganic element	Standard (mg/kg)
Aluminum (Al)	77,000
Arsenic (As)	10
Barium (Ba)	15,000
Beryllium (Be)	150
Cadmium (Cd)	39
Chromium (Cr)	30
Copper (Cu)	3,100
Lead (Pb)	400
Manganese (Mn)	No standard given
Nickel (Ni)	1600
Zinc (Zn)	23,000

Table continued on next page.

My soil sample is above this standard, what does this mean?

- Future studies many be needed, but does not necessarily require cleanup.
- **Since your values are above the remediation level, it is prudent to:**

-Wash your vegetables really well! Consider using a scrub brush to remove soil particles. Look at the shape of your vegetables - some can trap soil particles.

For example, soil particles can get trapped in between the flower heads on broccoli, and leafy vegetables have large surface areas where soil can collect.

Important Note: Arsenic and heavy metals occur naturally in soils. Concentrations of metals in soils may be 10 to 100 times greater than concentrations in the vegetables you grown in that soil. Because of this, it is crucial to remove soil particles that stick to your garden crops.

-Avoid gardening on windy days

-Avoid eating and drinking while you garden. Soil and dust might get on your food or drink and could be accidentally ingested.

-Keep soils moist while gardening. This will limit the amount of dust you inhale.

-Have a designated set of gardening clothes and shoes that you keep outside the home. Keep your gardening clothes and shoes in a plastic bag outside. It is

best to keep your gardening clothes and shoes out of your home.

-Stay Clean Wash up after gardening. Wash your hands and any other body surface that might have soil on it.

-Leave your shoes outside. Remove your shoes before entering your home to avoid tracking in soil.

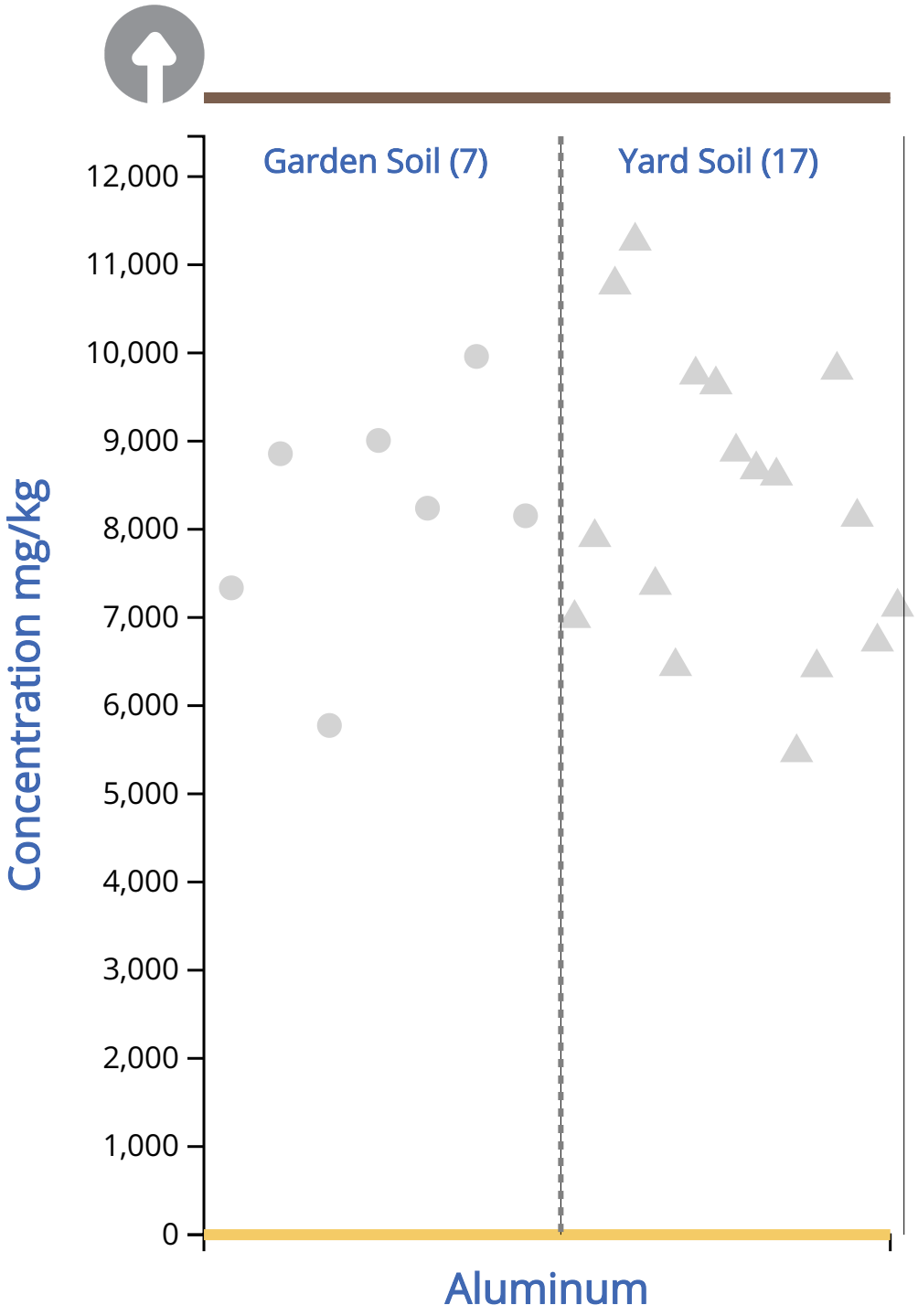
-Good housekeeping. Mop floors with a damp mop, and wipe down surfaces in your home regularly. Change your vacuum bag more often, or upgrade your vacuum to one that has a High-Efficiency Particulate Air (HEPA) filter.

-Gardening Tools. Wash, and then store all your gardening tools outside.

Where can I get more information about the Arizona Department of Environmental Quality Soil Remediation Level?

The ADEQ web page has great information from the Arizona Administrative Code. For the soil remediation information, check out Arizona Administrative Code, Department of Environmental Quality – Remedial Action. Title 18. Environmental Quality Chapter 7. Department Of Environmental Quality Remedial Action. Last updated on March 31, 2009.

https://apps.azsos.gov/public_services/Title_18/18-07.pdf


Garden Soil (7)
Yard Soil (17)
12,000
11,000
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
Concentration mg/kg
Aluminum

Arizona Department of Environmental Quality Soil Remediation Level

Lower Limit of Detection (2019-2020, only for Superior)

Standard values are higher than data shown

Garden Soil (Other participant samples)

Yard Soil (Other participant samples)

Aluminum

Contaminant Name: Aluminum (Al)
Contaminant Type: Metalloid

What is Aluminum?

Aluminum is the most abundant element in the earth's crust. It is generally found combined with other elements such as oxygen, silicon, and fluorine. Aluminum is used for beverage cans, pots and pans, airplanes, siding and roofing, and foil. It is also found in antacids, astringents, buffered aspirin, food additives, cosmetics, and antiperspirants.

What happens when Aluminum enters the environment?

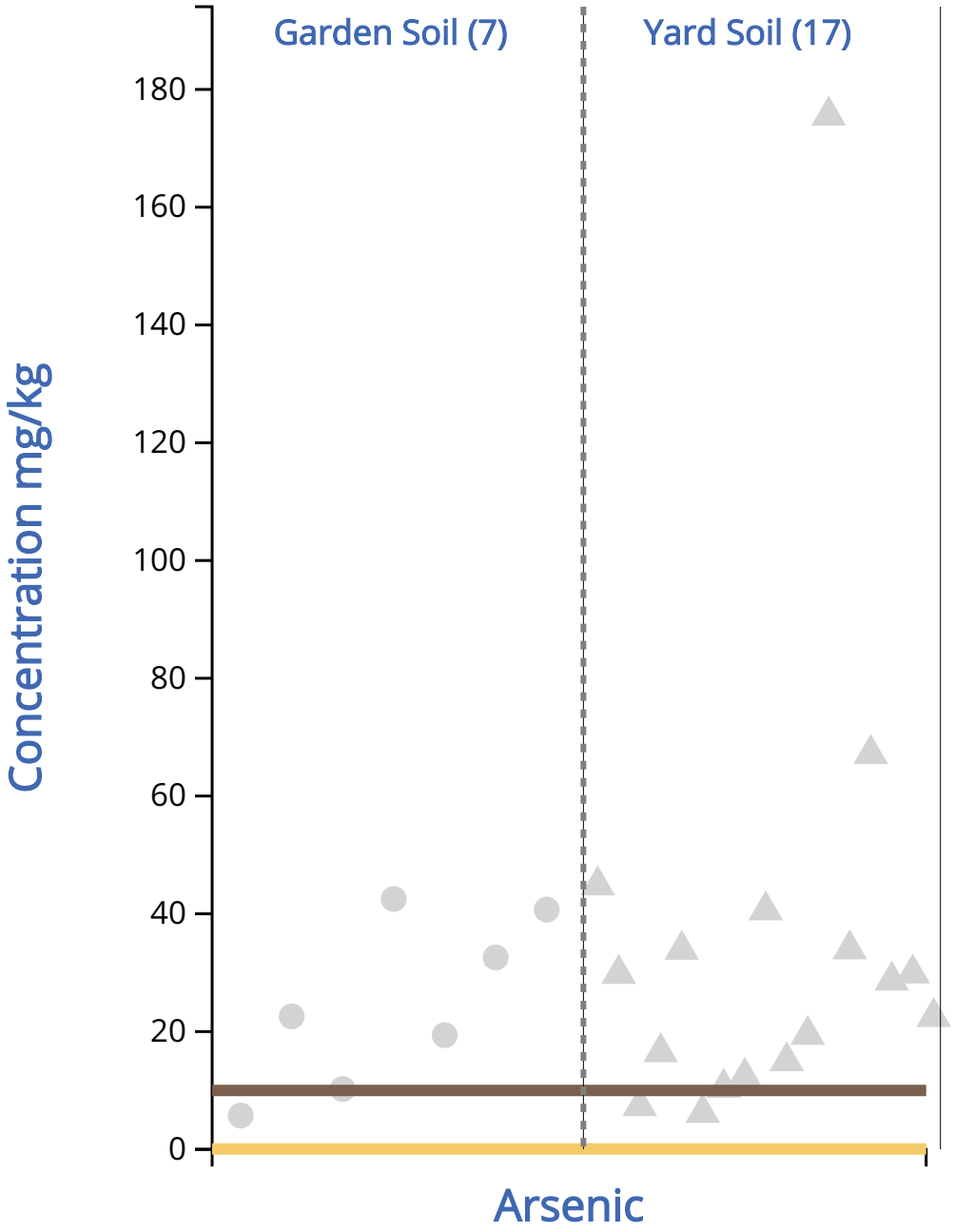
Aluminum may be released into the environment through mining and processing of aluminum ores and the production of aluminum metal, alloys, and compounds. In air, aluminum particles settle to the ground or are washed out by rain. However, very small aluminum particles can stay in the air for many days. Most aluminum-containing compounds do not dissolve very well in water unless the water is acidic or very alkaline.

How can Aluminum affect my health?

Exposure to aluminum is usually not harmful, but exposure to high levels can affect your health. Breathing in aluminum, typically in work-related settings, may result lung problems, such as coughing or abnormal chest X-rays. Aluminum has not been shown to cause cancer in animals.

Where can I get more information on Aluminum?

- Agency for Toxic Substances and Disease Registry. ToxFAQsTM for Aluminum. Last Updated on March 12, 2015. www.atsdr.cdc.gov/toxfaqs/tf.asp?id=190&tid=34#bookmark06 (https://www.atsdr.cdc.gov/toxfaqs/tf.asp?id=190&tid=34#bookmark06)


Garden Soil (7)
Yard Soil (17)
180
160
140
120
100
80
60
40
20
0
Concentration mg/kg
Arsenic

Arizona Department of Environmental Quality Soil Remediation Level

Lower Limit of Detection (2019-2020, only for Superior)

Garden Soil (Other participant samples)

Yard Soil (Other participant samples)

Arsenic

Contaminant Name: Arsenic (As)
Contaminant Type: Metalloid

What is Arsenic?

Arsenic naturally exists in the Earth's crust and can be found in sediments, soils, and groundwater. Arsenic may also be released into the environments via mining, ore smelting, and industrial use of the element.

What happens when Arsenic enters the environment?

In the environment, people can be exposed to arsenic in two chemical forms:

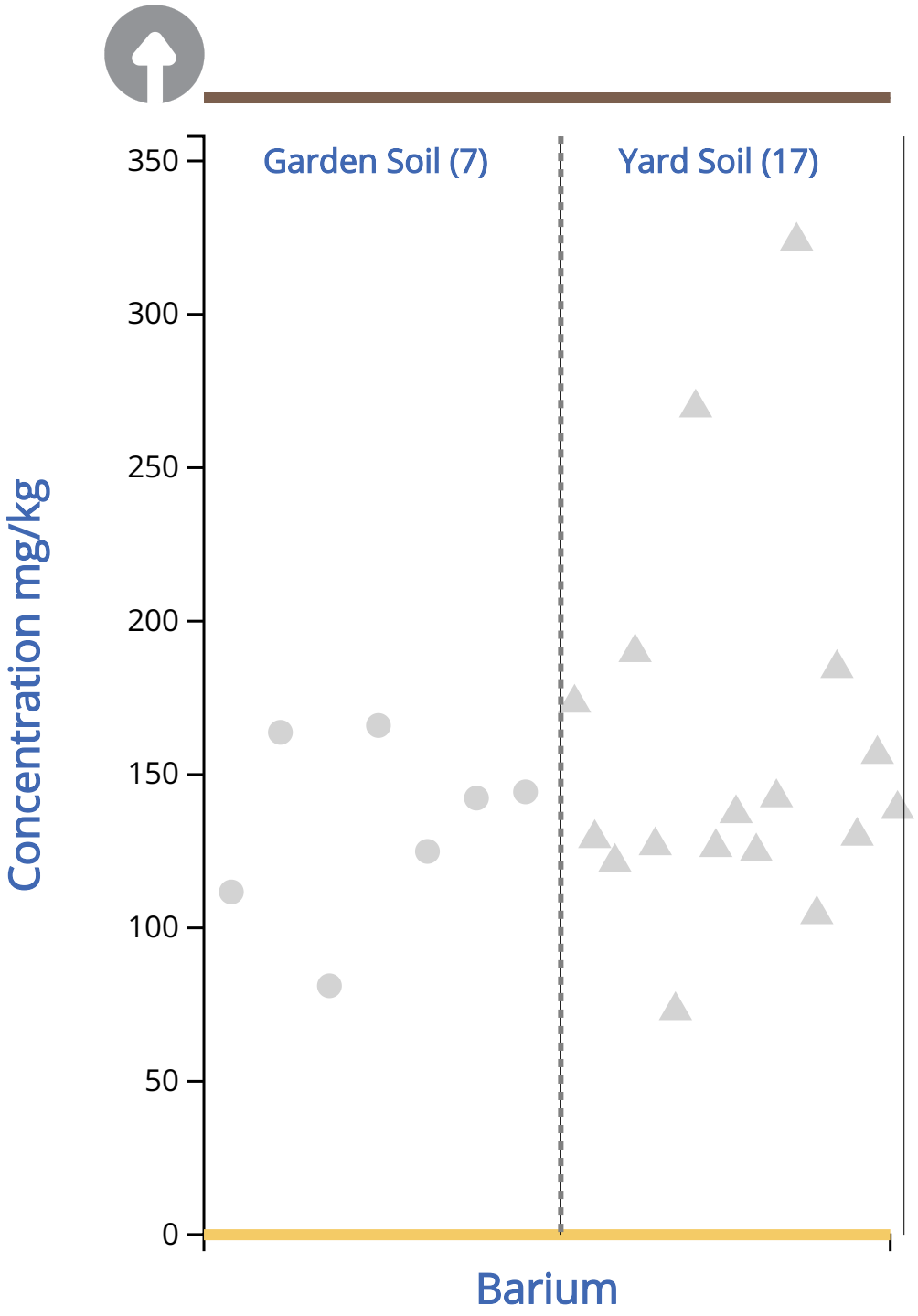
- Inorganic: Varying amounts of this poisonous (toxic forms) form can be found naturally in geologic materials (soils, rocks, aquifer materials) and in ground and surface water, which may also be impacted by mining and industrial wastes and arsenical pesticides).
- Organic (arsenic compounds that contain carbon): Varying amounts of this non-poisonous (low-toxicity) form can be found in sources such as animals, plants, fish and seafood. Fish and shellfish can accumulate arsenic; most of this arsenic is in an organic form called arsenobetaine that is much less harmful.

How can Arsenic affect my health?

Severe (acute) arsenic poisoning can cause vomiting, abdominal pain, and diarrhea. This can be followed by numbness and tingling of the extremities, muscle cramping, and death in extreme cases. Ingesting or breathing low levels of inorganic arsenic for a long time (chronic) can cause non-cancer health effects, like a darkening of the skin and the appearance of small "warts" on the palms, soles, and torso. Other non-cancer health effects linked to long-term ingestion of arsenic include developmental effects, diabetes, pulmonary disease, and cardiovascular disease. Ingestion of inorganic arsenic can increase the risk of skin cancer and cancer in the liver, bladder, and lungs. Inhalation of inorganic arsenic can cause increased risk of lung cancer.

Where can I get more information on Arsenic?

- Agency for Toxic Substances and Disease Registry. ToxFAQsTM for Arsenic. Last Updated on March 12, 2015. www.atsdr.cdc.gov/toxfaqs/tf.asp?id=19&tid=3 (https://www.atsdr.cdc.gov/toxfaqs/tf.asp?id=19&tid=3)


Garden Soil (7)
Yard Soil (17)
350
300
250
200
150
100
50
0
Concentration mg/kg
Barium

Arizona Department of Environmental Quality Soil Remediation Level

Lower Limit of Detection (2019-2020, only for Superior)

Standard values are higher than data shown

Garden Soil (Other participant samples)

Yard Soil (Other participant samples)

Barium

Contaminant Name: Barium (Ba)
Contaminant Type: Alkaline Earth Metal

What is Barium?

Barium is a silvery-white metal and combines with other chemicals such as sulfur or carbon and oxygen to form barium compounds. Barium compounds are used by the oil and gas industries to make drilling muds. They are also used to make paint, bricks, ceramics, glass, and rubber. Barium sulfate is sometimes used by doctors to perform medical tests and to take x-rays of the gastrointestinal tract.

What happens when Barium enters the environment?

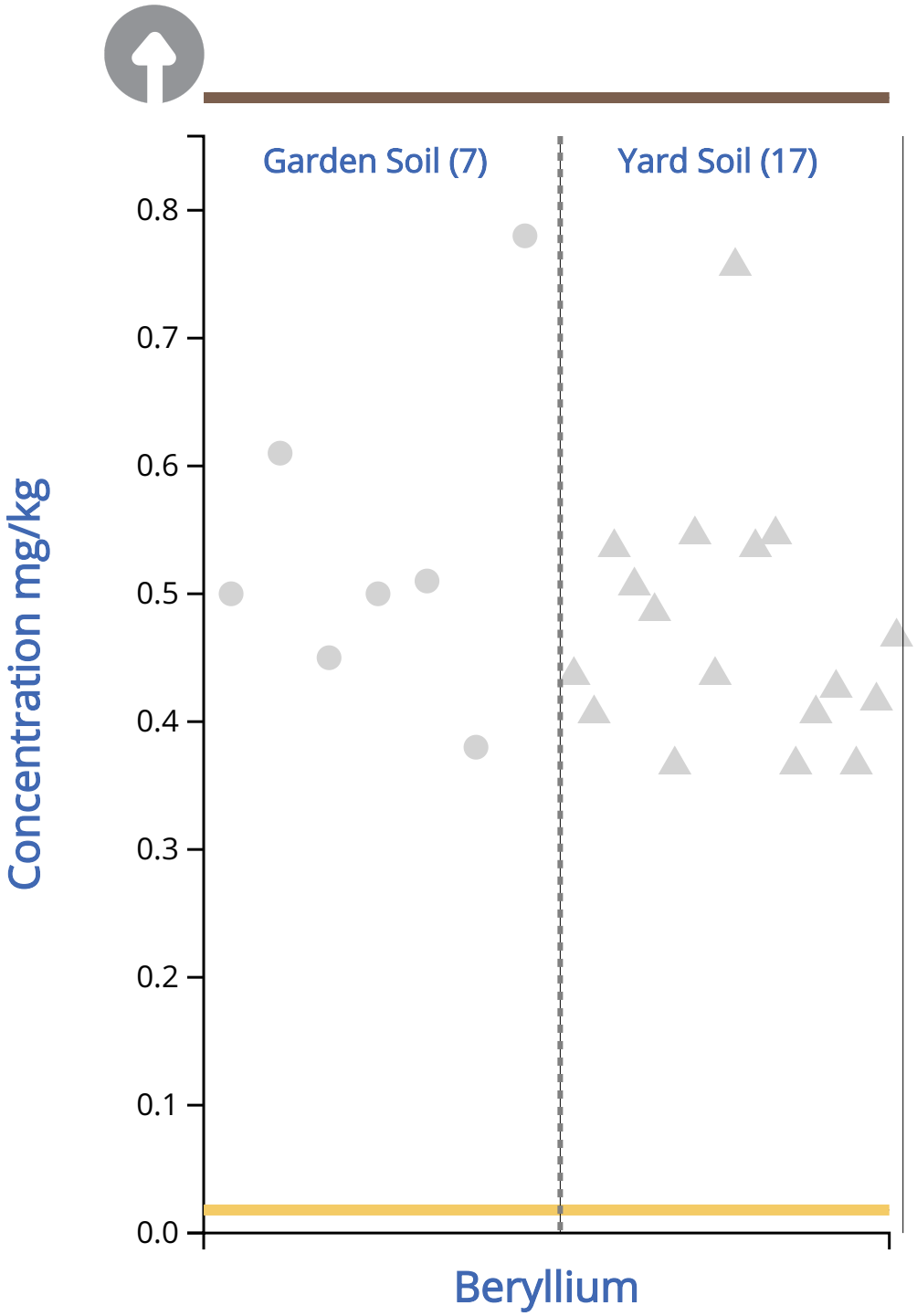
Barium gets into the air during the mining, refining, and production of barium compounds, and from the burning of coal and oil. The length of time that barium will last in air, land, water, or sediments depends on the form of barium released. Barium compounds, such as barium sulfate and barium carbonate, which do not dissolve well in water, can last a long time in the environment. Fish and aquatic organisms can accumulate barium.

How can Barium affect my health?

People with the greatest known risk of exposure to high levels of barium are those working in industries that make or use barium compounds. Exposure near hazardous waste sites may occur by breathing dust, eating soil or plants, skin contact, or drinking water that is polluted with barium. Some people who eat or drink amounts of barium above background levels found in food and water for a short period may experience vomiting, abdominal cramps, diarrhea, difficulties in breathing, increased or decreased blood pressure, numbness around the face, and muscle weakness. When barium is ingested, it is not likely to cause cancer in humans. There is not enough information to determine if it will cause cancer in humans when inhaled.

Where can I get more information on Barium?

- Agency for Toxic Substances and Disease Registry. ToxFAQsTM for Barium. Last Updated on July 27, 2015. www.atsdr.cdc.gov/toxfaqs/tf.asp?id=326&tid=57 (https://www.atsdr.cdc.gov/toxfaqs/tf.asp?id=326&tid=57)


Garden Soil (7)
Yard Soil (17)
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
Concentration mg/kg
Beryllium

Arizona Department of Environmental Quality Soil Remediation Level

Lower Limit of Detection (2019-2020, only for Superior)

 Standard values are higher than data shown

Garden Soil (Other participant samples)

Yard Soil (Other participant samples)

Beryllium

Contaminant Name: Beryllium (Be)
Contaminant Type: Alkaline Earth Metal

What is Beryllium?

Beryllium is found in minerals, rocks, coal, soil, and volcanic dust. Beryllium compounds are commercially mined, and purified for use in nuclear weapons and reactors, aircraft and space vehicle structures, instruments, x-ray machines, and mirrors. Beryllium ores are used to make specialty ceramics for electrical and high-technology applications. Beryllium alloys are used in automobiles, computers, sports equipment (golf clubs and bicycle frames), and dental bridges.

What happens when Beryllium enters the environment?

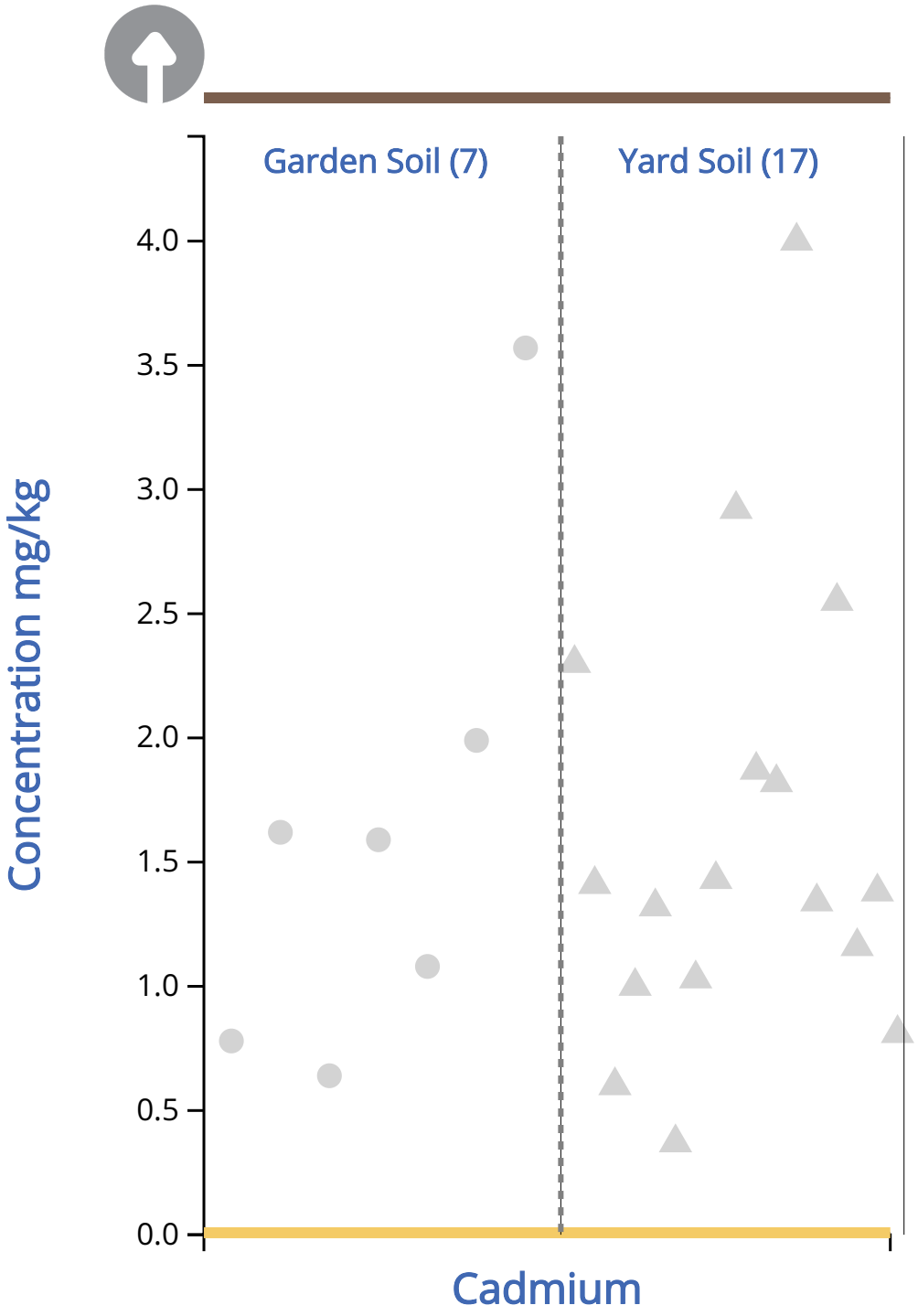
Beryllium dust enters the air from burning coal and oil. It enters water from erosion of rocks and soil, and from industrial waste. Some beryllium compounds will dissolve in water, but most stick to particles and settle to the bottom. Most beryllium in soil does not dissolve in water and remains bound to soil. Beryllium does not accumulate in the food chain.

How can Beryllium affect my health?

Beryllium can be harmful if you breathe it. People working in industries where beryllium is mined, processed, machined, or converted into metal, alloys, and other chemicals may be exposed to high levels of beryllium. People living near these industries or near uncontrolled hazardous waste sites may also be exposed to higher than normal levels of beryllium in air. Beryllium and beryllium compounds can cause cancer in humans.

Where can I get more information on Beryllium?

- Agency for Toxic Substances and Disease Registry. ToxFAQsTM for Beryllium. Last Updated on June 3, 2015. www.atsdr.cdc.gov/toxfaqs/tf.asp?id=184&tid=33 (https://www.atsdr.cdc.gov/toxfaqs/tf.asp?id=184&tid=33)


Garden Soil (7)
Yard Soil (17)
Concentration mg/kg
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Cadmium

Arizona Department of Environmental Quality Soil Remediation Level

Lower Limit of Detection (2019-2020, only for Superior)

Standard values are higher than data shown

Garden Soil (Other participant samples)

Yard Soil (Other participant samples)

Cadmium

Contaminant Name: Cadmium (Cd)
Contaminant Type: Heavy Metal

What is Cadmium?

Cadmium is found in the Earth's crust. Most cadmium used in the U.S. is extracted as a byproduct during the production of other metals such as zinc, lead, or copper. Cadmium is also recovered from used batteries. Cadmium is used for the following: batteries, pigments, coatings and platings, stabilizers for plastics, photovoltaic (solar power materials) devices, and other uses.

What happens when Cadmium enters the environment?

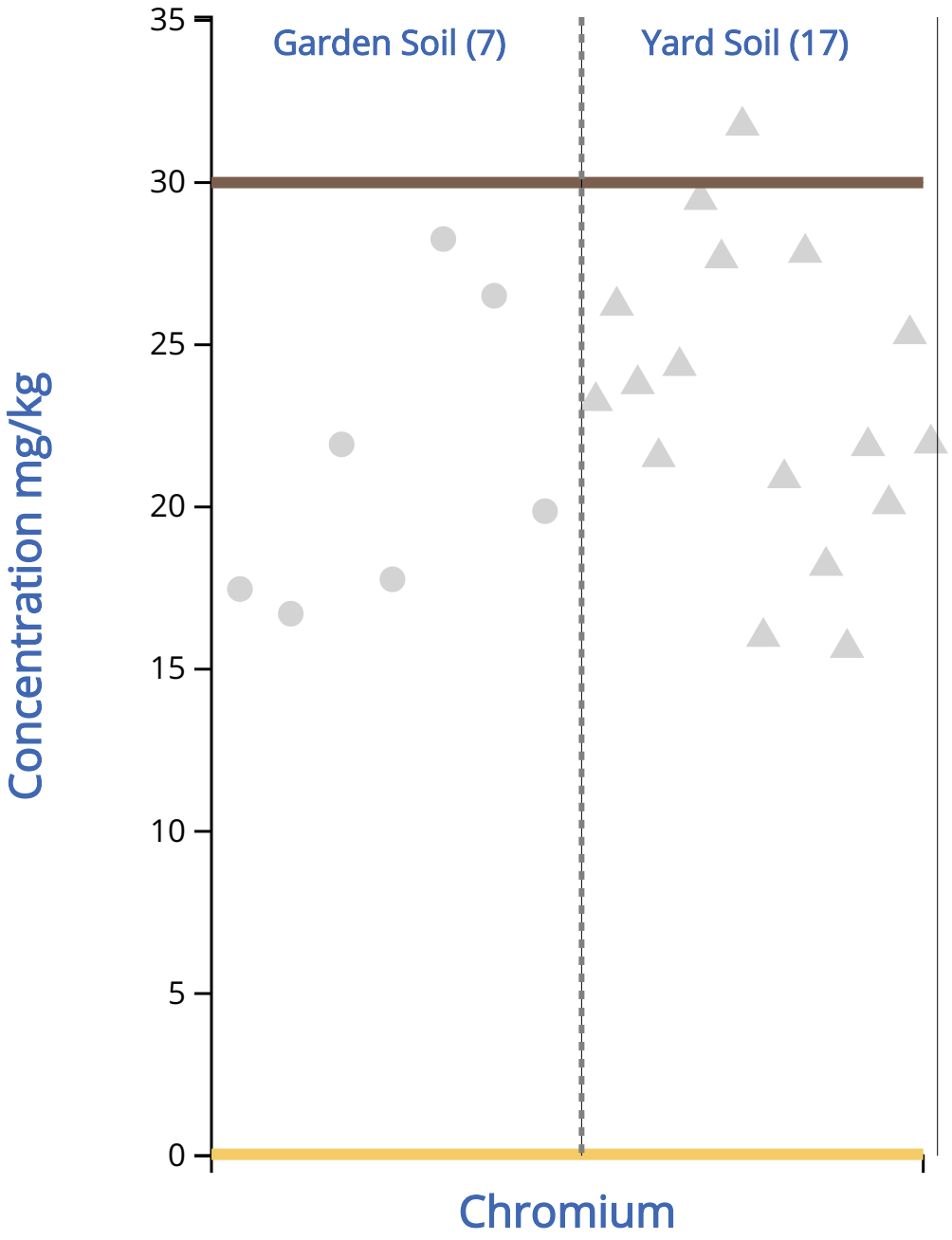
Cadmium is emitted to soil, water, and air by metal mining and refining, manufacture and application of phosphate fertilizers, fossil fuel combustion, and waste incineration and disposal. Generally, cadmium binds strongly to organic matter where it can stay in soil and be taken up by plant life, eventually entering the food supply.

How can Cadmium affect my health?

Cigarette smoking is a major exposure route to cadmium. Tobacco may have been grown in contaminated soils, or pesticides/fungicides or additives were applied during the growing and manufacturing process.Exposure to cadmium can occur through breathing contaminated workplace air, drinking contaminated water, or living near industrial facilities that release cadmium into the air. Eating food or drinking water with very high levels severely irritates the stomach, leading to vomiting and diarrhea. Long-term exposure to lower levels of cadmium in air, food, or water leads to a buildup of cadmium in the kidneys and possible kidney disease. Other long-term effects include lung damage and fragile bones. Low levels of cadmium are found in all foods (highest levels are found in shellfish, liver, and kidney meats). In the U.S., for nonsmokers the primary source of cadmium exposure is from the food supply. Breathing high levels of cadmium can severely damage the lungs. Cadmium and cadmium compounds are known to cause cancer in humans.

Where can I get more information on Cadmium?

- Agency for Toxic Substances and Disease Registry. ToxFAQsTM for Cadmium. Last Updated on March 12, 2015. www.atsdr.cdc.gov/toxfaqs/tf.asp?id=47&tid=15 (https://www.atsdr.cdc.gov/toxfaqs/tf.asp?id=47&tid=15)


Garden Soil (7)
Yard Soil (17)
35
30
25
20
15
10
5
0
Concentration mg/kg
Chromium

Arizona Department of Environmental Quality Soil Remediation Level

Lower Limit of Detection (2019-2020, only for Superior)

Garden Soil (Other participant samples)

Yard Soil (Other participant samples)

Chromium

Contaminant Name: Chromium (Cr)
Contaminant Type: Metal

What is Chromium?

Chromium is a naturally-occurring element found in rocks, animals, plants, and soil, where it exists in combination with other elements to form various compounds. The three main forms of chromium are: chromium(0), chromium(III), and chromium(VI). Small amounts of chromium(III) are needed for human health. Chromium(VI) is known to be highly toxic, when compared to Cr-III. Chromium is widely used in manufacturing processes to make various metal alloys such as stainless steel

What happens when Chromium enters the environment?

Chromium can be found in air, soil, and water after release from industries that use chromium, such as industries involved in electroplating, leather tanning, textile production, and the manufacture of chromium-based products. Chromium can also be released into the environment from the burning of natural gas, oil, or coal. Chromium does not usually remain in the atmosphere, but is deposited into the soil and water.

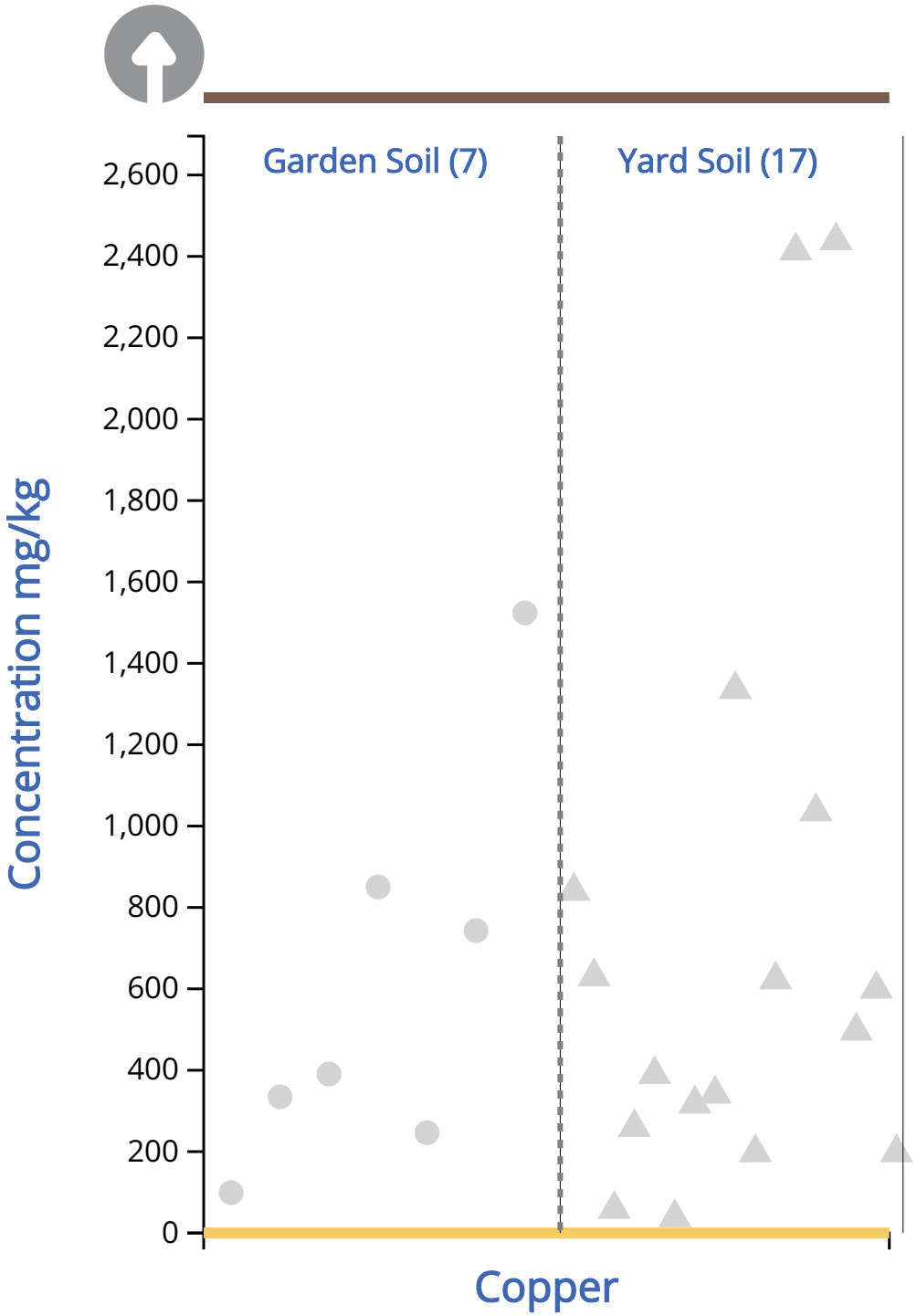
How can Chromium affect my health?

The highest potential human exposure occurs in the metallurgy and tanning industries where workers may be exposed to high air concentrations. Inhalation of chromium compounds can result in irritation of the nasal passages, breathing problems, and other upper respiratory conditions. Chromium(VI) has the potential to affect the male reproductive system and/or the small intestine, and chromium(VI) compounds are known to cause cancer in humans.

Where can I get more information on Chromium?

- Agency for Toxic Substances and Disease Registry. ToxFAQsTM for Chromium. Last Updated on September 28, 2016.

  www.atsdr.cdc.gov/toxfaqs/tf.asp?id=61&tid=17 (https://www.atsdr.cdc.gov/toxfaqs/tf.asp?id=61&tid=17)


Garden Soil (7)
Yard Soil (17)
2,600
2,400
2,200
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
Concentration mg/kg
Copper

Arizona Department of Environmental Quality Soil Remediation Level

Lower Limit of Detection (2019-2020, only for Superior)

Standard values are higher than data shown

Garden Soil (Other participant samples)

Yard Soil (Other participant samples)

Copper

Contaminant Name: Copper (Cu)
Contaminant Type: Metal

What is Copper?

Copper is a metal that occurs naturally throughout the environment, in rocks, soil, water, and air. Copper is an essential element in plants, animals, and humans, which means it is necessary for us to live. Copper is used to make many different kinds of products like wire, cars, plumbing pipes, and sheet metal. Copper is also combined with other metals to make brass and bronze pipes and faucets. Copper compounds are commonly used in agriculture to treat plant diseases like mildew, for water treatment and, as preservatives for wood, leather, and fabrics.

What happens when Copper enters the environment?

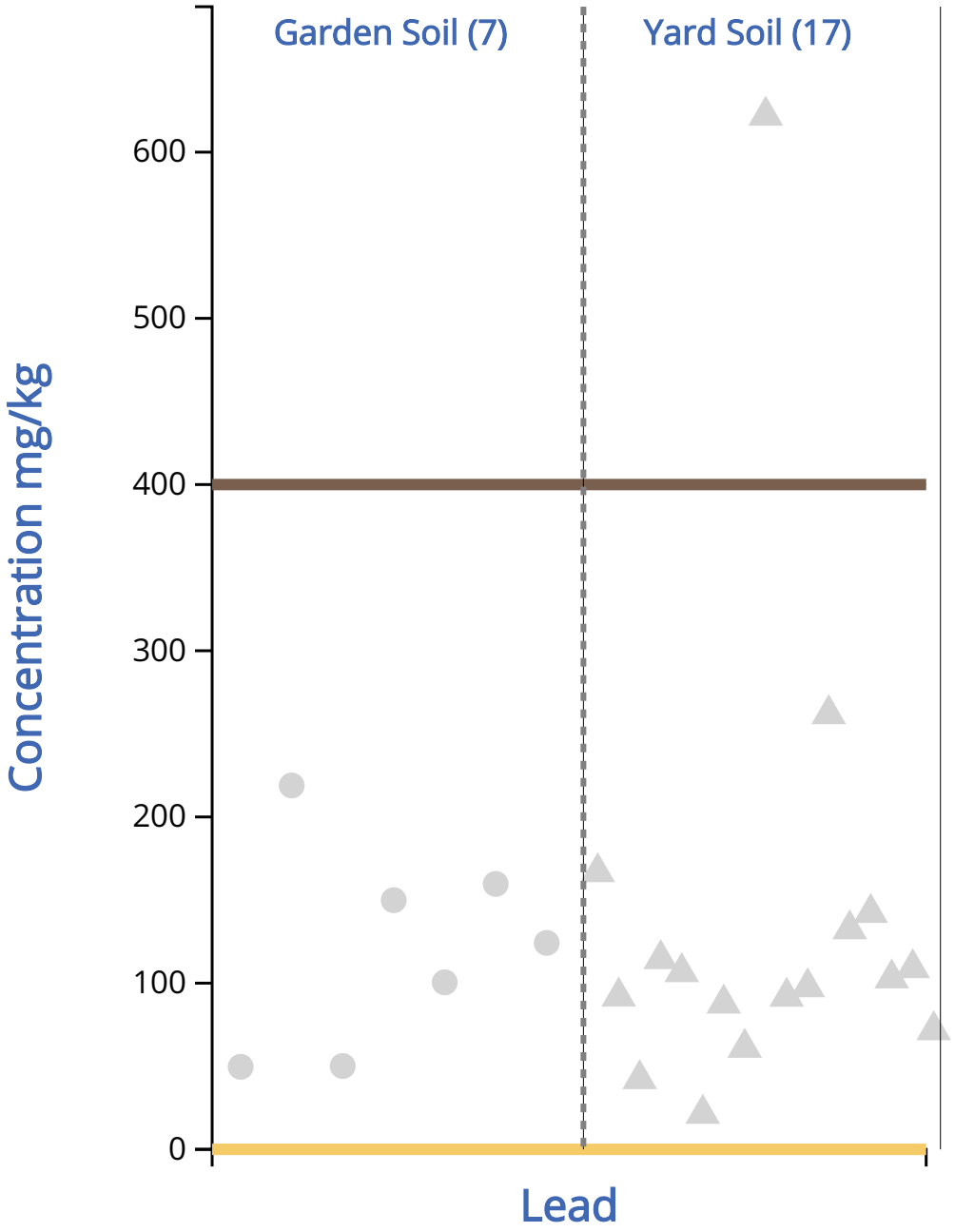
Copper is released into the environment by mining, farming, and manufacturing operations and through waste water releases into rivers and lakes. Copper is also released from natural sources, like volcanoes, windblown dusts, decaying vegetation, and forest fires. Copper released into the environment usually attaches to particles made of organic matter, clay, soil, or sand.

How can Copper affect my health?

Copper is essential for good health, but high levels of copper can be harmful. You may be exposed to copper by ingesting copper-containing fungicides or if you live near or work in a copper mine. Breathing high levels of copper can cause irritation of your nose and throat. Ingesting high levels of copper can cause nausea, vomiting, and diarrhea. Very-high doses of copper can cause damage to your liver and kidneys, and can even cause death.

Where can I get more information on Copper?

- Agency for Toxic Substances and Disease Registry. ToxFAQsTM for Chromium. Last Updated on September 28, 2016. www.atsdr.cdc.gov/phs/phs.asp?id=204&tid=37 (https://www.atsdr.cdc.gov/phs/phs.asp?id=204&tid=37)


Garden Soil (7)
Yard Soil (17)
600
500
400
300
200
100
0
Concentration mg/kg
Lead

Arizona Department of Environmental Quality Soil Remediation Level

Lower Limit of Detection (2019-2020, only for Superior)

Garden Soil (Other participant samples)

Yard Soil (Other participant samples)

Lead

Contaminant Name: Lead (Pb)
Contaminant Type: Heavy Metal

What is Lead?

Lead is a metal in the Earth's crust that is normally found with other metals such as zinc, silver, and copper. Lead has many uses including manufacturing of paints, batteries, and fishing weights. Lead-based solder, which had been used to connect copper water pipes, was banned in the 1980s, but may still be a source of lead in drinking water in older homes. In the United States, lead was used as a gasoline additive, but was banned beginning in 1973 and eliminated by 1996.

What happens when Lead enters the environment?

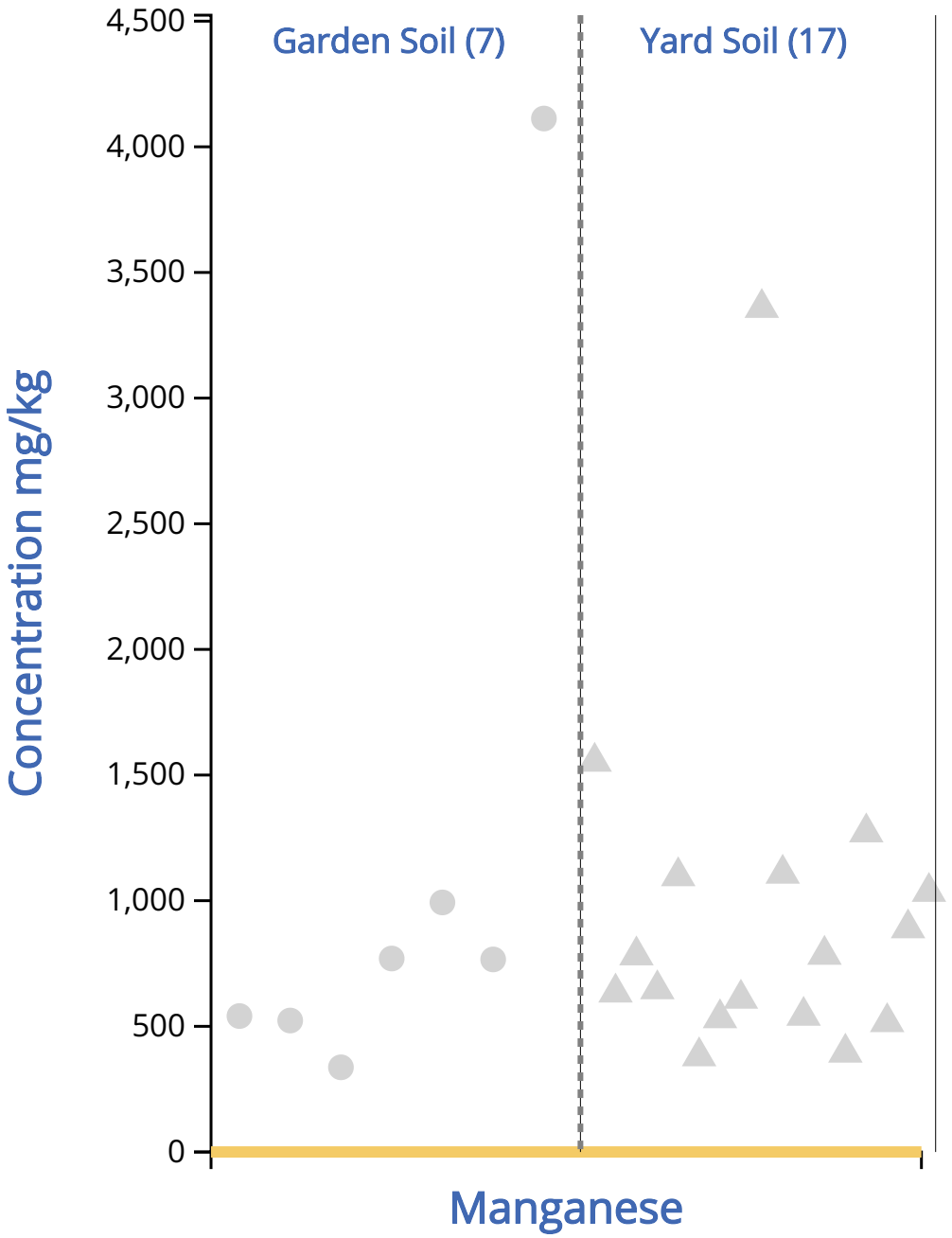
Lead itself does not break down, but lead compounds are changed by sunlight, air, and water. When lead is released to the air, it may travel long distances before settling to the ground. Once lead falls onto soil, it usually sticks to soil particles. Ingestion (soil, food, water) is the main route of exposure in humans. Children are most impacted by lead exposure because they often put their hands and/or toys in their mouths. Pregnant women can also expose their unborn child to lead via ingestion. Adults can be exposed via lifestyle choices (e.g., cigarette smoking) or through their occupation (e.g., plumbing, soldering, manufacturing plants, construction/remodeling companies, smelters, and auto repair shops). There are other sources of potential lead exposure which include: paints, glazed clay pots, wine, food, leaded glass (crystal), stained glass, dyes, and home remedies (e.g., azarcon or greta used to treat digestive illness).

How can Lead affect my health?

Lead can affect almost every organ and system in your body, both in adults and children. Exposure to lead can seriously harm a child's health. It can damage the brain and nervous system, slow growth and development, cause learning, behavior, hearing, and speech problems. It causes lower IQ, decreased ability to pay attention, and underperformance in school. Lead exposure also causes small increases in blood pressure, particularly in middle-aged and older people and can cause anemia. In pregnant women, high levels of exposure to lead may cause miscarriage. High-level exposure in men can damage the organs responsible for sperm production.

Where can I get more information on Lead?

- Agency for Toxic Substances and Disease Registry. ToxFAQsTM for Lead. Last Updated on August 24, 2016. www.atsdr.cdc.gov/toxfaqs/tf.asp?id=93&tid=22 (https://www.atsdr.cdc.gov/toxfaqs/tf.asp?id=93&tid=22)


Garden Soil (7)
Yard Soil (17)
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
Concentration mg/kg
Manganese

Lower Limit of Detection (2019-2020, only for Superior)

Garden Soil (Other participant samples)

Yard Soil (Other participant samples)

Manganese

Contaminant Name: Manganese (Mn)
Contaminant Type: Metal

What is Manganese?

Manganese is naturally occurring and found in rocks and soils. Manganese does not occur as a pure metal in nature, instead it is typically bound to elements like oxygen, sulfur, and chlorine. Manganese is used to strengthen metal alloys and can be found in fireworks, fertilizers, cosmetics, etc.

What happens when Manganese enters the environment?

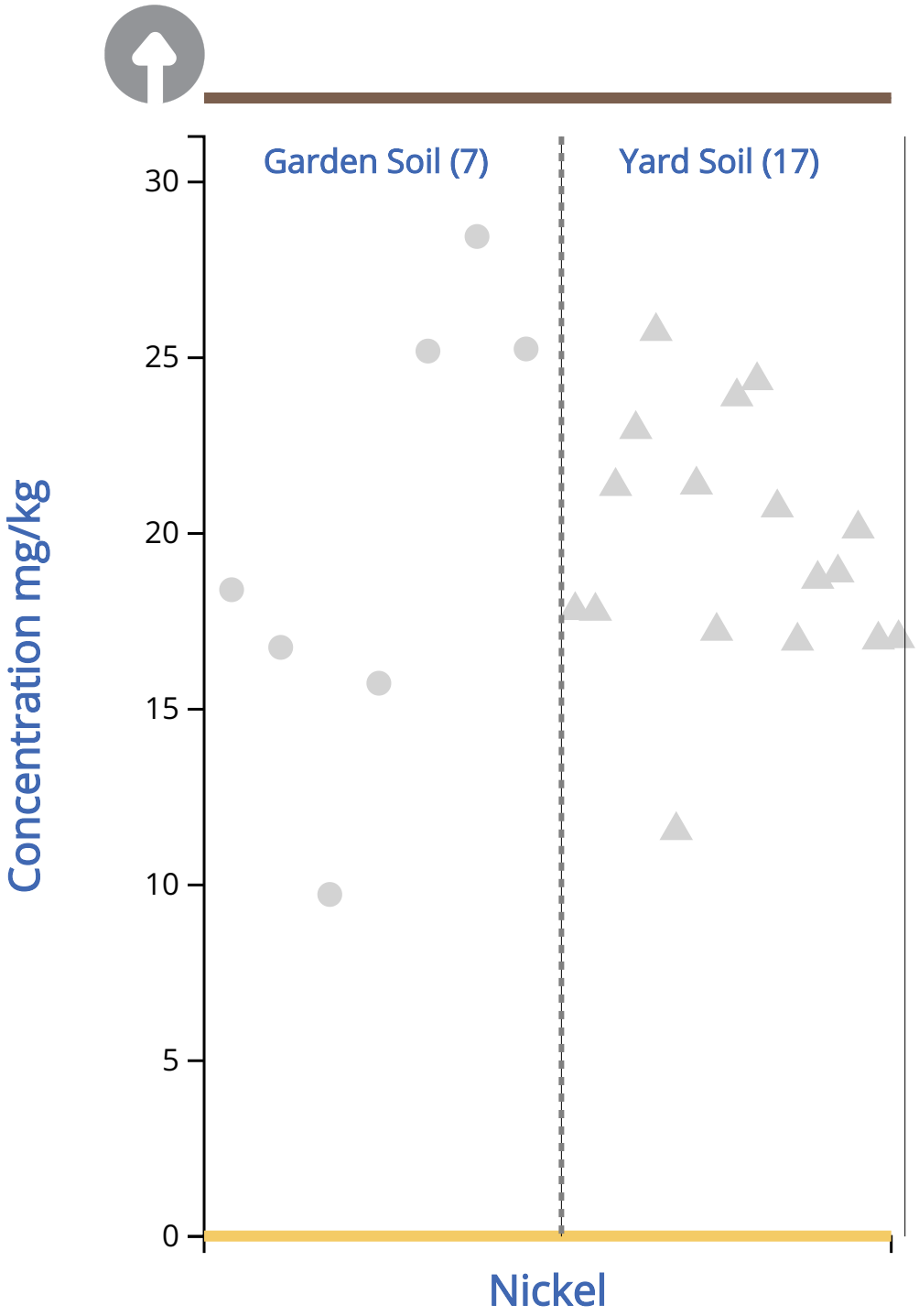
Manganese is naturally occurring in air, water, soil, and foods, but may also be released into the environment via manufacturing, and disposal of based products such as gasoline with manganese-additives. Manganese-containing additives can be broken down by sunlight.

How can Manganese affect my health?

Manganese is an essential nutrient, and eating a small amount of it each day is important to stay healthy.Manganese has the potential to cause lung irritation when inhaled. Manganese may also result in reproductive effects. Workers exposed to high levels of manganese have developed nervous system problems.

Where can I get more information on Manganese?

- Agency for Toxic Substances and Disease Registry. ToxFAQsTM for manganese. Last Updated on January 21, 2015. www.atsdr.cdc.gov/phs/phs.asp?id=100&tid=23 (https://www.atsdr.cdc.gov/phs/phs.asp?id=100&tid=23)


Garden Soil (7)
Yard Soil (17)
30
25
20
15
10
5
0
Concentration mg/kg
Nickel

Arizona Department of Environmental Quality Soil Remediation Level

Lower Limit of Detection (2019-2020, only for Superior)

Standard values are higher than data shown

Garden Soil (Other participant samples)

Yard Soil (Other participant samples)

Nickel

Contaminant Name: Nickel (Ni)
Contaminant Type: Metal

What is Nickel?

Nickel is a natural element. Nickel can be combined with other metals and is used to make coins, jewelry, and items such as valves and heat exchangers. Most nickel is used to make stainless steel. Many nickel compounds dissolve fairly easy in water and have a green color. Nickel compounds are used for nickel plating, to color ceramics, to make some batteries, and as substances known as catalysts that increase the rate of chemical reactions.

What happens when Nickel enters the environment?

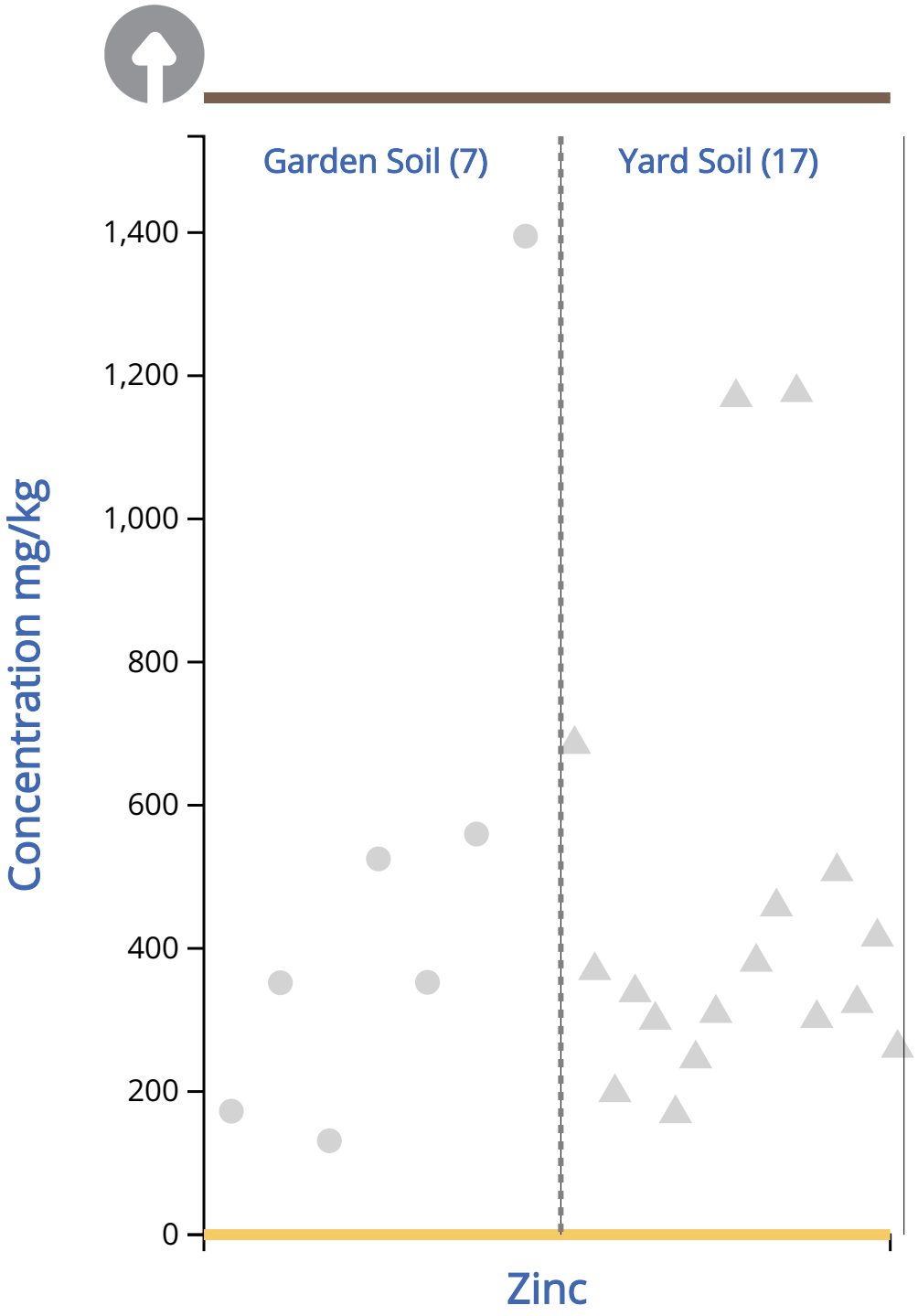
Nickel is released into the atmosphere by industries that make or use nickel, nickel alloys, or nickel compounds. Nickel is found in soil and is emitted from volcanoes. Nickel is also found in meteorites and on the ocean floor and It is also released into the atmosphere by oil-burning power plants, coal-burning power plants, and trash incinerators. In the air, it attaches to small particles of dust that settle to the ground or are taken out of the air in rain or snow; this usually takes many days. Nickel released in industrial waste-water ends up in soil or sediment where it strongly attaches to particles containing iron or manganese. Nickel does not appear to accumulate in fish or in other animals used as food.

How can Nickel affect my health?

You can be exposed to Nickel through food (major source of exposure), skin contact with soil, bath or shower water, metals containing nickel, smoking tobacco containing nickel, and by handling coins or touching jewelry containing nickel. The most common heath effect is an allergic reaction, usually a rash due to skin contact. People working in nickel refineries or nickel-processing plants have experienced chronic bronchitis and reduced lung function by breathing air containing nickel; however, such reactions are the result of breathing amounts of nickel much higher than levels found normally in the environment. Cancers of the lung and nasal sinus have resulted when workers breathed dust containing high levels of nickel compounds.

Where can I get more information on Nickel?

- Agency for Toxic Substances and Disease Registry. ToxFAQsTM for nickel. Last Updated on January 21, 2015. www.atsdr.cdc.gov/phs/phs.asp?id=243&tid=44 (https://www.atsdr.cdc.gov/phs/phs.asp?id=243&tid=44)


Garden Soil (7)
Yard Soil (17)
1,400
1,200
1,000
800
600
400
200
0
Concentration mg/kg
Zinc

Arizona Department of Environmental Quality Soil Remediation Level

Lower Limit of Detection (2019-2020, only for Superior)

Standard values are higher than data shown

Garden Soil (Other participant samples)

Yard Soil (Other participant samples)

Zinc

Contaminant Name: Zinc (Zn)
Contaminant Type: Transitional Metal

What is Zinc?

Zinc is found in the Earth's crust. Zn is commonly used as a coating for steel, iron, and other metals to prevent rusting. Zinc compounds are widely used to make paint, rubber, dyes, wood preservatives, and ointments.

What happens when Zinc enters the environment?

Some zinc is released into the environment by natural processes, but most comes from human activities like mining, steel production, coal burning, and burning of waste. It attaches to soil, sediments, and dust particles in the air. Rain and snow remove zinc dust particles from the air. Depending on the type of soil, some zinc compounds can move into the groundwater and into lakes, streams, and rivers. Most of the zinc in soil stays bound to soil particles and does not dissolve in water. It builds up in fish and other organisms, but it does not build up in plants.

How can Zinc affect my health?

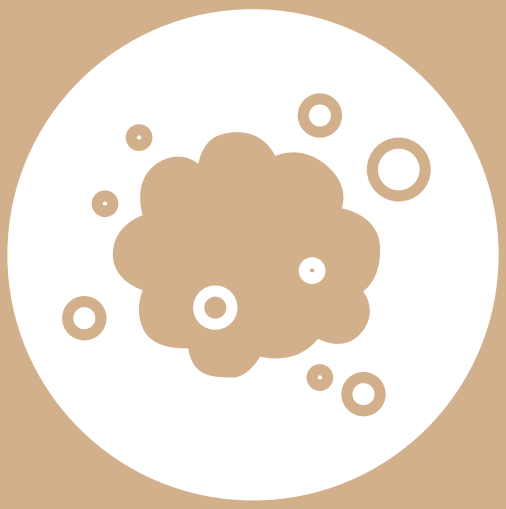
Zinc is an essential element in our diet. Too little zinc can cause problems, but too much zinc is also harmful. People can be exposed to zinc by:

- Drinking contaminated water or a beverage that has been stored in metal containers or flows through pipes that have been coated with zinc to resist rust.
- Eating too many dietary supplements that contain zinc.
- Working in any of the following jobs: construction, painting, automobile mechanics, mining, smelting, and welding; manufacture of brass, bronze, or other zinc-containing alloys; manufacture of galvanized metals; and manufacture of machine parts, rubber, paint, linoleum, oilcloths, batteries, some kind of glass, ceramics, and dyes.

Harmful effects generally begin at levels 10-15 times higher than the amount needed for good health. Large doses taken by mouth even for a short time can cause stomach cramps, nausea, and vomiting. Taken longer, it can cause anemia and decrease the levels of your good cholesterol. Inhaling large amounts of zinc (as dusts or fumes) can cause a specific short-term disease called metal fume fever. Long-term effects of breathing high levels of zinc are currently unknown.

Where can I get more information on Zinc?

- Agency for Toxic Substances and Disease Registry. ToxFAQsTM for nickel. Last Updated on January 21, 2015. www.atsdr.cdc.gov/phs/phs.asp?id=300&tid=54 (https://www.atsdr.cdc.gov/phs/phs.asp?id=300&tid=54)



DUST

Standards and/or reference values for DUST

Use the color below to guide your interpretation.

Department of Housing and Urban Development's Porch Floor Lead Clearance Action Level for Lead

Different standards/advisories were selected based on:

- Availability of useful standards or advisories.

Please note: Not all pollutants measured in Gardenroots have standards, advisories, and/or guidelines.

Department of Housing and Urban Development's Porch Floor Lead Clearance Action Level

The Office of Lead Hazard Control and Healthy Homes within the Department of Housing and Urban Development has developed lead clearance action levels based on human exposure assessments. This porch floor lead Clearance Action Level is used for lead-based paint hazard risk assessments and for clearing or "passing" housing units after a lead reduction intervention. These action levels are used to determine if the home lead abatement activities were completed to satisfaction.

The porch floor lead clearance action level is designed to protect children from lead exposure. Since dust containing lead on porch floors can expose children either by direct contact or through tracking the dust into the home, a porch floor clearance action level was established to further assess whether home lead abatement activities were completed to satisfaction.

Lead Clearance Action Level

Inorganic element	Clearance Action Level (µg/ft² - micrograms per square feet)	My dust is above this action level, what does this mean?
Lead (Pb)	40	To reduce the amount of soil and dust in your home and what you may incidentally ingest: • Keep shoes outside, or have a pair of shoes you only wear outside to avoid tracking dust into your home • Use mops and wet wipes to clean instead of sweeping and dry dusting. • Use a vacuum with a HEPA filter • Vacuum rugs instead of shaking them. • Wash child's toys • Avoid gardening on windy days. • Keep your soil moist while you are gardening.

Where can I get more information on the Department of Housing and Urban Development Lead Clearance Action Levels?

- The Office of Lead Hazard Control and Healthy Homes Lead Dust Clearance Policy sheet:

https://www.hud.gov/sites/documents/LEADDUSTCLEARANCE.PDF

Where can I get more information on the Department of Housing and Urban Development Lead Clearance Action Levels?

- The Office of Lead Hazard Control and Healthy Homes Lead Dust Clearance Policy sheet:

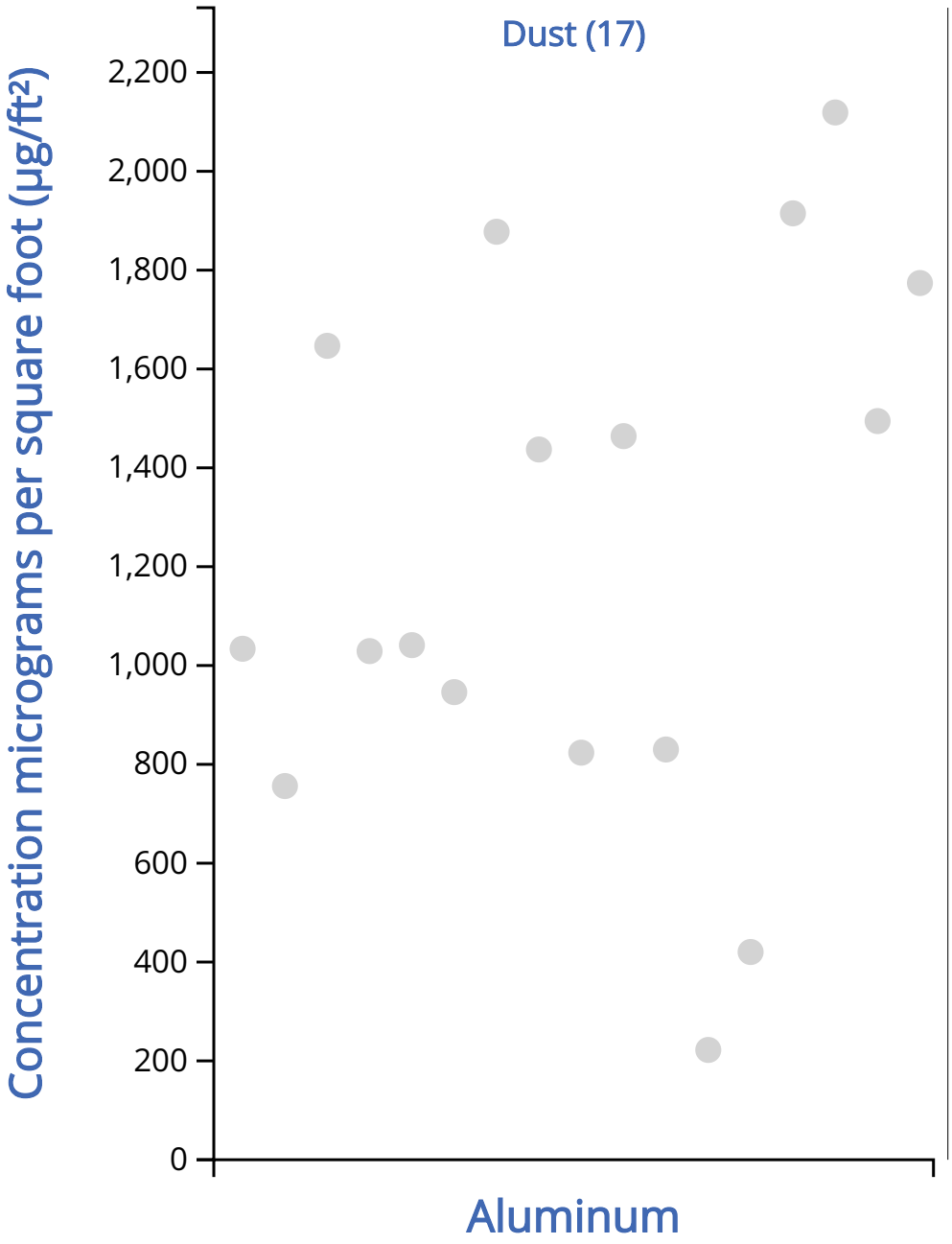
https://www.hud.gov/sites/documents/LEADDUSTCLEARANCE.PDF

Where can I get more information on lead?

- Lead Poisoning, Arizona Department of Health Services

https://www.azdhs.gov/preparedness/epidemiology-disease-control/lead-poisoning/index.php#brochures-handouts

Aluminum


Dust (17)
Concentration micrograms per square foot (µg/ft²)
2,200
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
Aluminum

Dust (Other participant samples)

Aluminum

Contaminant Name: Aluminum (Al)
Contaminant Type: Metalloid

What is Aluminum?

Aluminum is the most abundant element in the earth's crust. It is generally found combined with other elements such as oxygen, silicon, and fluorine. Aluminum is used for beverage cans, pots and pans, airplanes, siding and roofing, and foil. It is also found in antacids, astringents, buffered aspirin, food additives, cosmetics, and antiperspirants.

What happens when Aluminum enters the environment?

Aluminum may be released into the environment through mining and processing of aluminum ores and the production of aluminum metal, alloys, and compounds. In air, aluminum particles settle to the ground or are washed out by rain. However, very small aluminum particles can stay in the air for many days. Most aluminum-containing compounds do not dissolve very well in water unless the water is acidic or very alkaline.

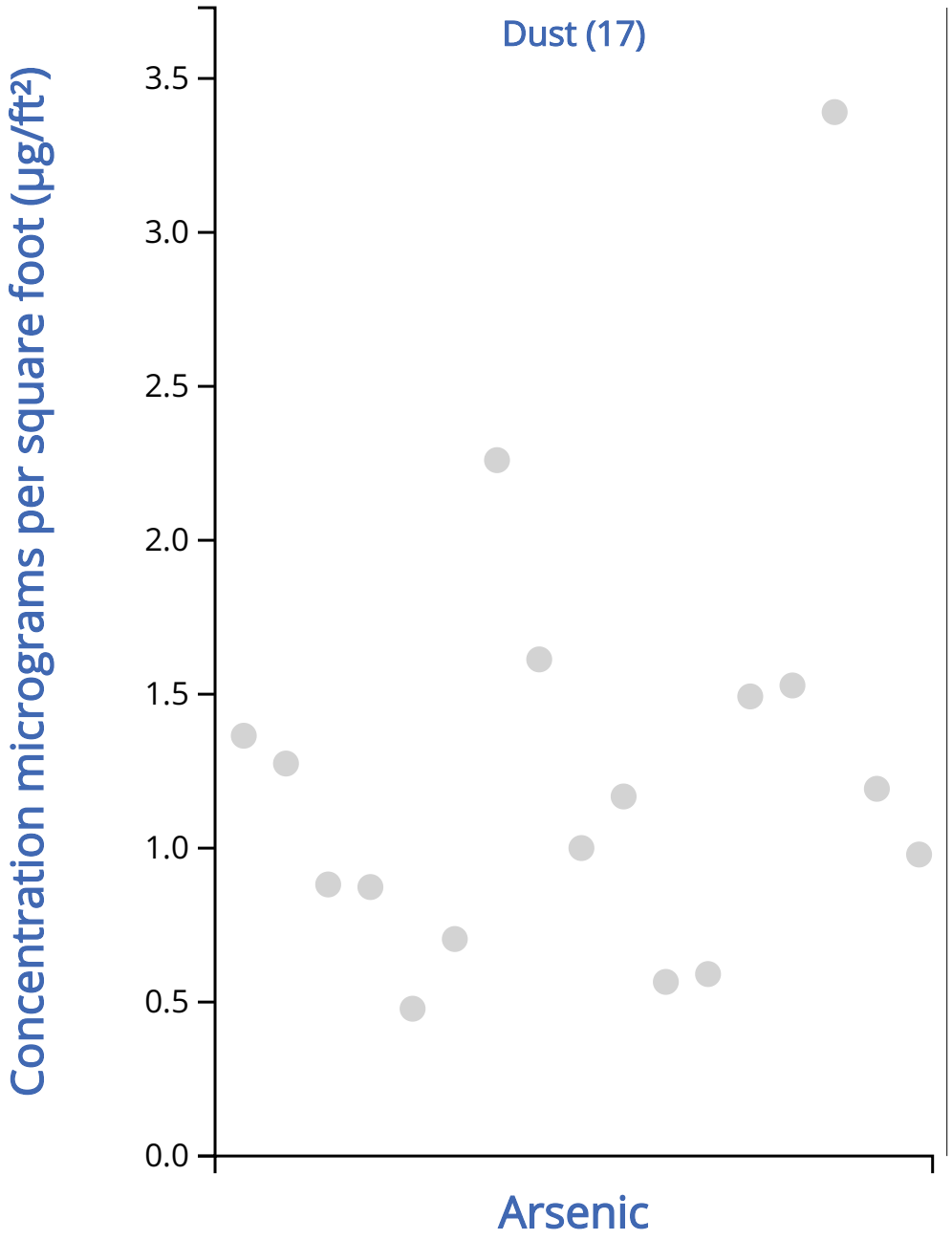
How can Aluminum affect my health?

Exposure to aluminum is usually not harmful, but exposure to high levels can affect your health. Breathing in aluminum, typically in work-related settings, may result lung problems, such as coughing or abnormal chest X-rays. Aluminum has not been shown to cause cancer in animals.

Where can I get more information on Aluminum?

- Agency for Toxic Substances and Disease Registry. ToxFAQsTM for Aluminum. Last Updated on March 12, 2015. www.atsdr.cdc.gov/toxfaqs/tf.asp?id=190&tid=34#bookmark06 (https://www.atsdr.cdc.gov/toxfaqs/tf.asp?id=190&tid=34#bookmark06)

Arsenic


Dust (17)
Concentration micrograms per square foot (µg/ft²)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Arsenic

Dust (Other participant samples)

Arsenic

Contaminant Name: Arsenic (As)
Contaminant Type: Metalloid

What is Arsenic?

Arsenic naturally exists in the Earth's crust and can be found in sediments, soils, and groundwater. Arsenic may also be released into the environments via mining, ore smelting, and industrial use of the element.

What happens when Arsenic enters the environment?

In the environment, people can be exposed to arsenic in two chemical forms:

- Inorganic: Varying amounts of this poisonous (toxic forms) form can be found naturally in geologic materials (soils, rocks, aquifer materials) and in ground and surface water, which may also be impacted by mining and industrial wastes and arsenical pesticides).
- Organic (arsenic compounds that contain carbon): Varying amounts of this non-poisonous (low-toxicity) form can be found in sources such as animals, plants, fish and seafood. Fish and shellfish can accumulate arsenic; most of this arsenic is in an organic form called arsenobetaine that is much less harmful.

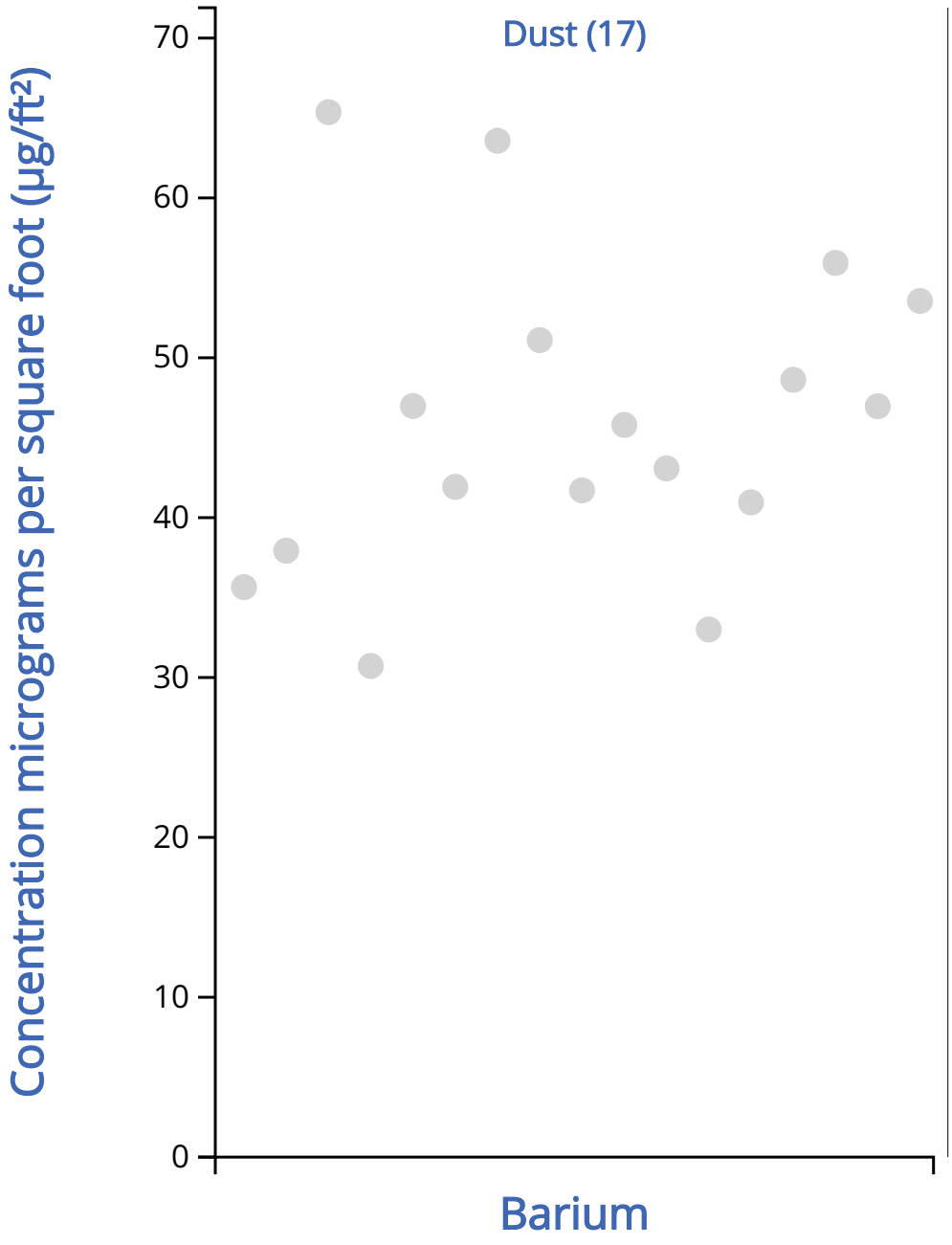
How can Arsenic affect my health?

Severe (acute) arsenic poisoning can cause vomiting, abdominal pain, and diarrhea. This can be followed by numbness and tingling of the extremities, muscle cramping, and death in extreme cases. Ingesting or breathing low levels of inorganic arsenic for a long time (chronic) can cause non-cancer health effects, like a darkening of the skin and the appearance of small "warts" on the palms, soles, and torso. Other non-cancer health effects linked to long-term ingestion of arsenic include developmental effects, diabetes, pulmonary disease, and cardiovascular disease. Ingestion of inorganic arsenic can increase the risk of skin cancer and cancer in the liver, bladder, and lungs. Inhalation of inorganic arsenic can cause increased risk of lung cancer.

Where can I get more information on Arsenic?

- Agency for Toxic Substances and Disease Registry. ToxFAQsTM for Arsenic. Last Updated on March 12, 2015. www.atsdr.cdc.gov/toxfaqs/tf.asp?id=19&tid=3 (https://www.atsdr.cdc.gov/toxfaqs/tf.asp?id=19&tid=3)

Barium


Dust (17)
Concentration micrograms per square foot (µg/ft²)
70
60
50
40
30
20
10
0
Barium

Dust (Other participant samples)

Barium

Contaminant Name: Barium (Ba)
Contaminant Type: Alkaline Earth Metal

What is Barium?

Barium is a silvery-white metal and combines with other chemicals such as sulfur or carbon and oxygen to form barium compounds. Barium compounds are used by the oil and gas industries to make drilling muds. They are also used to make paint, bricks, ceramics, glass, and rubber. Barium sulfate is sometimes used by doctors to perform medical tests and to take x-rays of the gastrointestinal tract.

What happens when Barium enters the environment?

Barium gets into the air during the mining, refining, and production of barium compounds, and from the burning of coal and oil. The length of time that barium will last in air, land, water, or sediments depends on the form of barium released. Barium compounds, such as barium sulfate and barium carbonate, which do not dissolve well in water, can last a long time in the environment. Fish and aquatic organisms can accumulate barium.

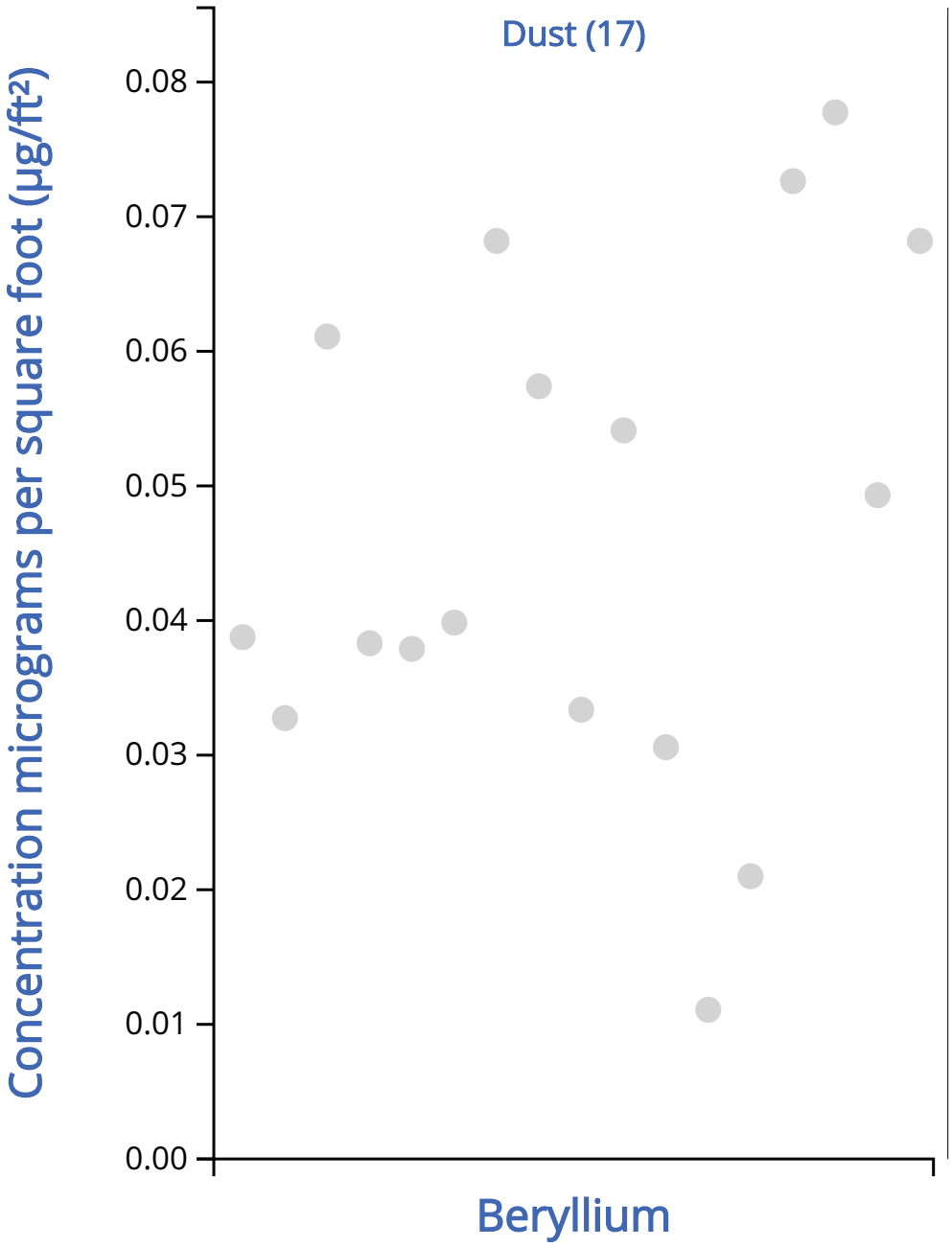
How can Barium affect my health?

People with the greatest known risk of exposure to high levels of barium are those working in industries that make or use barium compounds. Exposure near hazardous waste sites may occur by breathing dust, eating soil or plants, skin contact, or drinking water that is polluted with barium. Some people who eat or drink amounts of barium above background levels found in food and water for a short period may experience vomiting, abdominal cramps, diarrhea, difficulties in breathing, increased or decreased blood pressure, numbness around the face, and muscle weakness. When barium is ingested, it is not likely to cause cancer in humans. There is not enough information to determine if it will cause cancer in humans when inhaled.

Where can I get more information on Barium?

- Agency for Toxic Substances and Disease Registry. ToxFAQsTM for Barium. Last Updated on July 27, 2015. www.atsdr.cdc.gov/toxfaqs/tf.asp?id=326&tid=57 (https://www.atsdr.cdc.gov/toxfaqs/tf.asp?id=326&tid=57)

Beryllium


Dust (17)
Concentration micrograms per square foot (µg/ft²)
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
Beryllium

Dust (Other participant samples)

Beryllium

Contaminant Name: Beryllium (Be)
Contaminant Type: Alkaline Earth Metal

What is Beryllium?

Beryllium is found in minerals, rocks, coal, soil, and volcanic dust. Beryllium compounds are commercially mined, and purified for use in nuclear weapons and reactors, aircraft and space vehicle structures, instruments, x-ray machines, and mirrors. Beryllium ores are used to make specialty ceramics for electrical and high-technology applications. Beryllium alloys are used in automobiles, computers, sports equipment (golf clubs and bicycle frames), and dental bridges.

What happens when Beryllium enters the environment?

Beryllium dust enters the air from burning coal and oil. It enters water from erosion of rocks and soil, and from industrial waste. Some beryllium compounds will dissolve in water, but most stick to particles and settle to the bottom. Most beryllium in soil does not dissolve in water and remains bound to soil. Beryllium does not accumulate in the food chain.

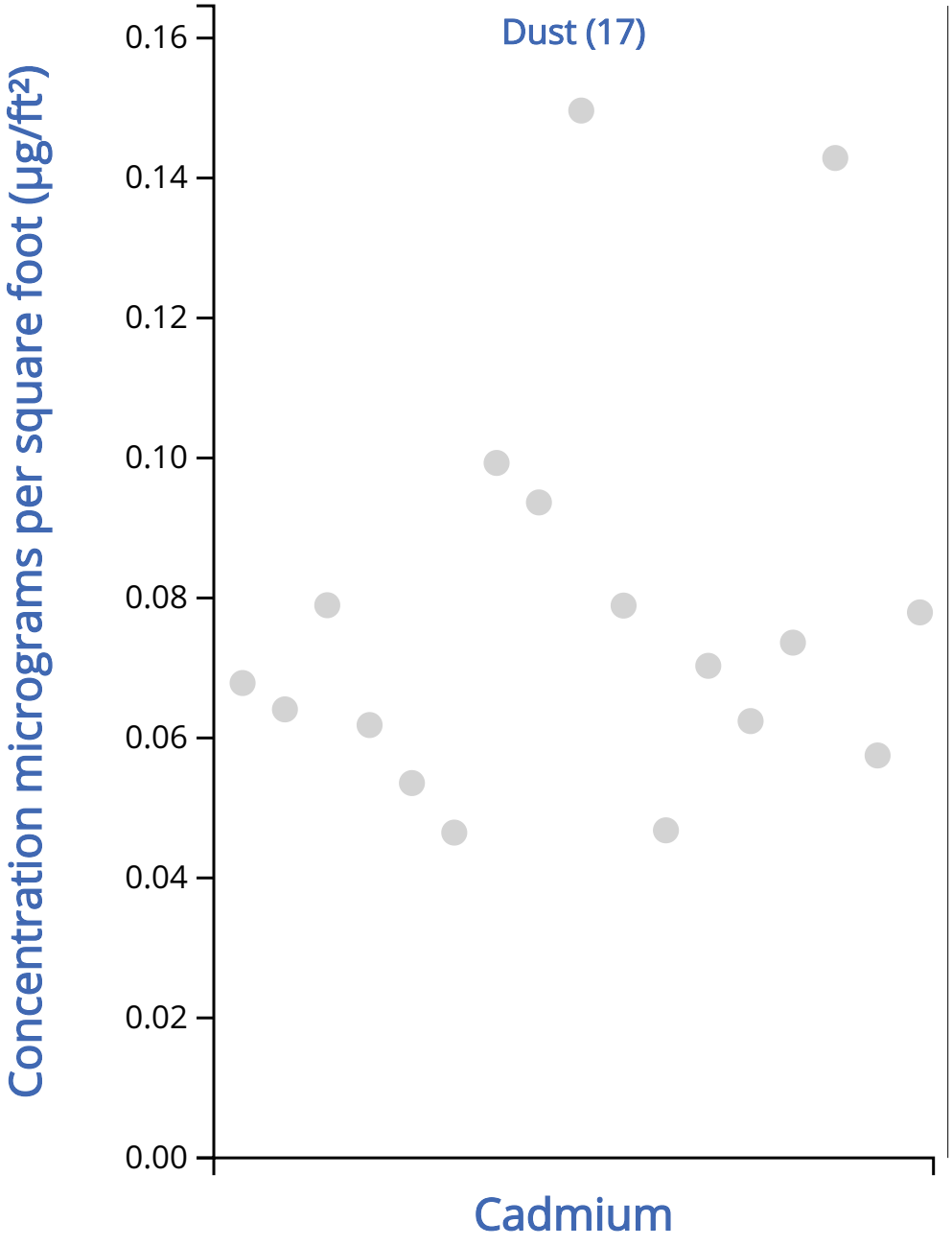
How can Beryllium affect my health?

Beryllium can be harmful if you breathe it. People working in industries where beryllium is mined, processed, machined, or converted into metal, alloys, and other chemicals may be exposed to high levels of beryllium. People living near these industries or near uncontrolled hazardous waste sites may also be exposed to higher than normal levels of beryllium in air. Beryllium and beryllium compounds can cause cancer in humans.

Where can I get more information on Beryllium?

- Agency for Toxic Substances and Disease Registry. ToxFAQsTM for Beryllium. Last Updated on June 3, 2015. www.atsdr.cdc.gov/toxfaqs/tf.asp?id=184&tid=33 (https://www.atsdr.cdc.gov/toxfaqs/tf.asp?id=184&tid=33)

Cadmium


Dust (17)
Concentration micrograms per square foot (µg/ft²)
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
Cadmium

Dust (Other participant samples)

Cadmium

Contaminant Name: Cadmium (Cd)
Contaminant Type: Heavy Metal

What is Cadmium?

Cadmium is found in the Earth's crust. Most cadmium used in the U.S. is extracted as a byproduct during the production of other metals such as zinc, lead, or copper. Cadmium is also recovered from used batteries. Cadmium is used for the following: batteries, pigments, coatings and platings, stabilizers for plastics, photovoltaic (solar power materials) devices, and other uses.

What happens when Cadmium enters the environment?

Cadmium is emitted to soil, water, and air by metal mining and refining, manufacture and application of phosphate fertilizers, fossil fuel combustion, and waste incineration and disposal. Generally, cadmium binds strongly to organic matter where it can stay in soil and be taken up by plant life, eventually entering the food supply.

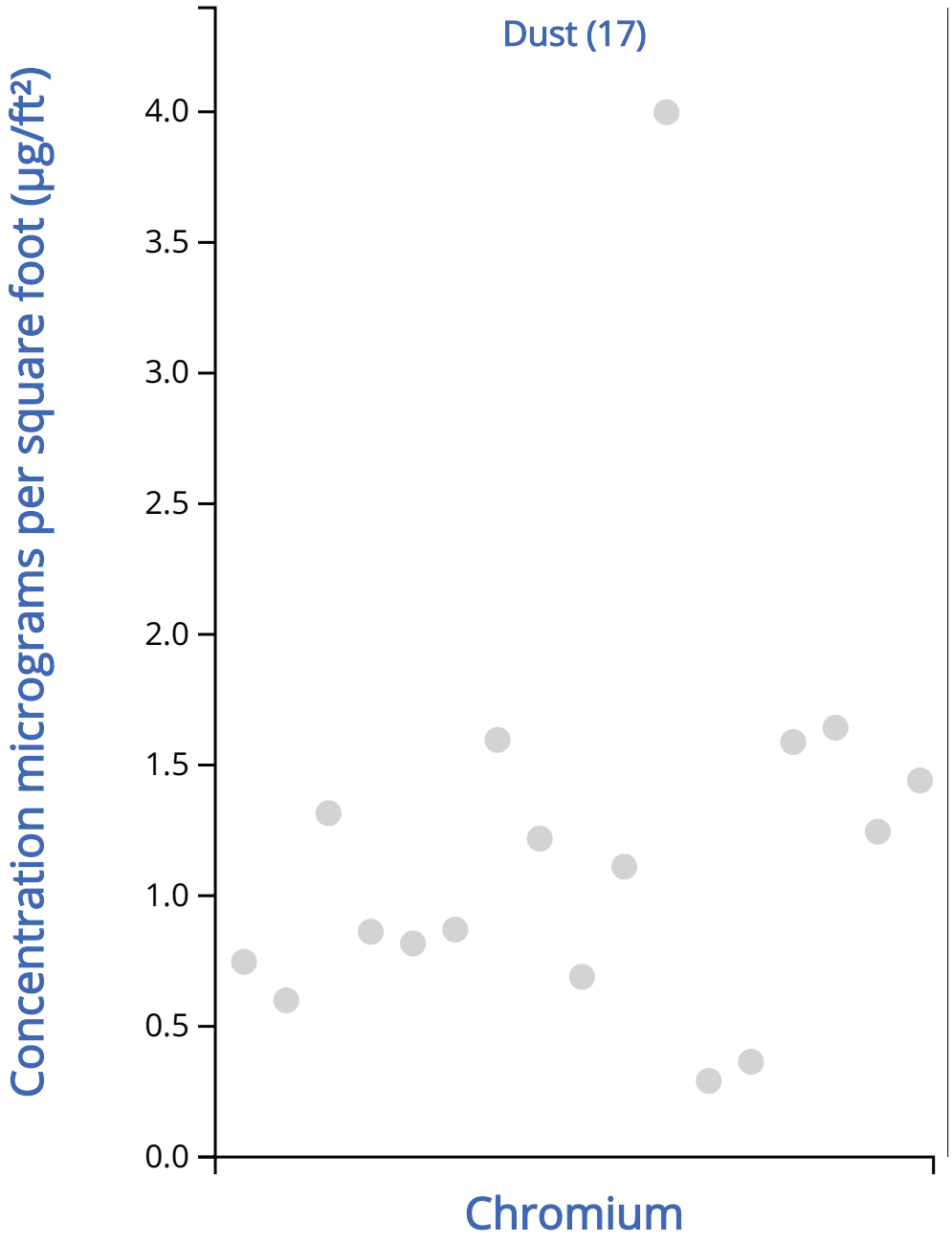
How can Cadmium affect my health?

Cigarette smoking is a major exposure route to cadmium. Tobacco may have been grown in contaminated soils, or pesticides/fungicides or additives were applied during the growing and manufacturing process.Exposure to cadmium can occur through breathing contaminated workplace air, drinking contaminated water, or living near industrial facilities that release cadmium into the air. Eating food or drinking water with very high levels severely irritates the stomach, leading to vomiting and diarrhea. Long-term exposure to lower levels of cadmium in air, food, or water leads to a buildup of cadmium in the kidneys and possible kidney disease. Other long-term effects include lung damage and fragile bones. Low levels of cadmium are found in all foods (highest levels are found in shellfish, liver, and kidney meats). In the U.S., for nonsmokers the primary source of cadmium exposure is from the food supply. Breathing high levels of cadmium can severely damage the lungs. Cadmium and cadmium compounds are known to cause cancer in humans.

Where can I get more information on Cadmium?

- Agency for Toxic Substances and Disease Registry. ToxFAQsTM for Cadmium. Last Updated on March 12, 2015. www.atsdr.cdc.gov/toxfaqs/tf.asp?id=47&tid=15 (https://www.atsdr.cdc.gov/toxfaqs/tf.asp?id=47&tid=15)

Chromium


Dust (17)
Concentration micrograms per square foot (µg/ft²)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Chromium

- Dust (Other participant samples)

Chromium

Contaminant Name: Chromium (Cr)
Contaminant Type: Metal

What is Chromium?

Chromium is a naturally-occurring element found in rocks, animals, plants, and soil, where it exists in combination with other elements to form various compounds. The three main forms of chromium are: chromium(0), chromium(III), and chromium(VI). Small amounts of chromium(III) are needed for human health. Chromium(VI) is known to be highly toxic, when compared to Cr-III. Chromium is widely used in manufacturing processes to make various metal alloys such as stainless steel

What happens when Chromium enters the environment?

Chromium can be found in air, soil, and water after release from industries that use chromium, such as industries involved in electroplating, leather tanning, textile production, and the manufacture of chromium-based products. Chromium can also be released into the environment from the burning of natural gas, oil, or coal. Chromium does not usually remain in the atmosphere, but is deposited into the soil and water.

How can Chromium affect my health?

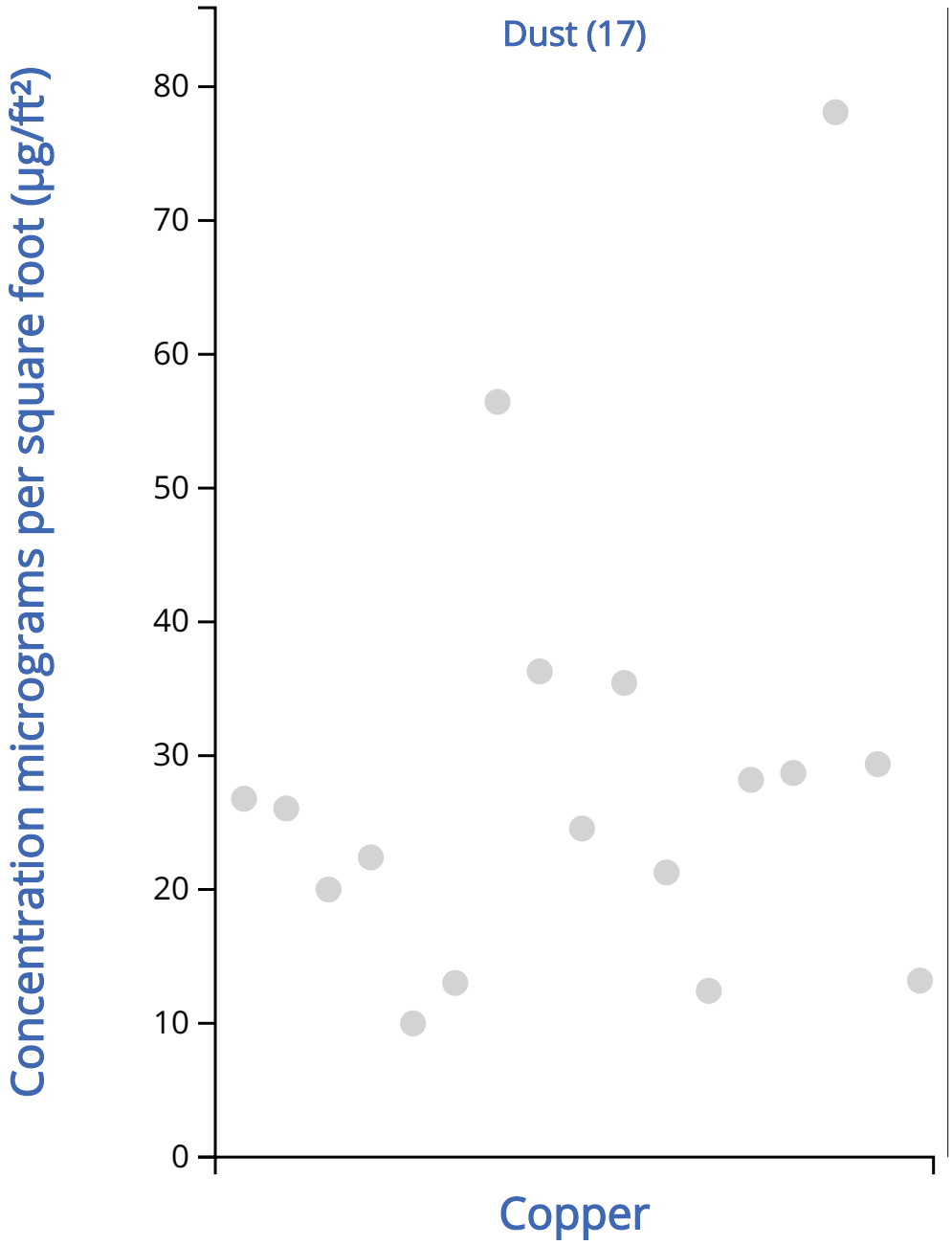
The highest potential human exposure occurs in the metallurgy and tanning industries where workers may be exposed to high air concentrations. Inhalation of chromium compounds can result in irritation of the nasal passages, breathing problems, and other upper respiratory conditions. Chromium(VI) has the potential to affect the male reproductive system and/or the small intestine, and chromium(VI) compounds are known to cause cancer in humans.

Where can I get more information on Chromium?

- Agency for Toxic Substances and Disease Registry. ToxFAQsTM for Chromium. Last Updated on September 28, 2016.

  www.atsdr.cdc.gov/toxfaqs/tf.asp?id=61&tid=17 (https://www.atsdr.cdc.gov/toxfaqs/tf.asp?id=61&tid=17)

Copper


Dust (17)
Concentration micrograms per square foot (µg/ft²)
80
70
60
50
40
30
20
10
0
Copper

Dust (Other participant samples)

Copper

Contaminant Name: Copper (Cu)
Contaminant Type: Metal

What is Copper?

Copper is a metal that occurs naturally throughout the environment, in rocks, soil, water, and air. Copper is an essential element in plants, animals, and humans, which means it is necessary for us to live. Copper is used to make many different kinds of products like wire, cars, plumbing pipes, and sheet metal. Copper is also combined with other metals to make brass and bronze pipes and faucets. Copper compounds are commonly used in agriculture to treat plant diseases like mildew, for water treatment and, as preservatives for wood, leather, and fabrics.

What happens when Copper enters the environment?

Copper is released into the environment by mining, farming, and manufacturing operations and through waste water releases into rivers and lakes. Copper is also released from natural sources, like volcanoes, windblown dusts, decaying vegetation, and forest fires. Copper released into the environment usually attaches to particles made of organic matter, clay, soil, or sand.

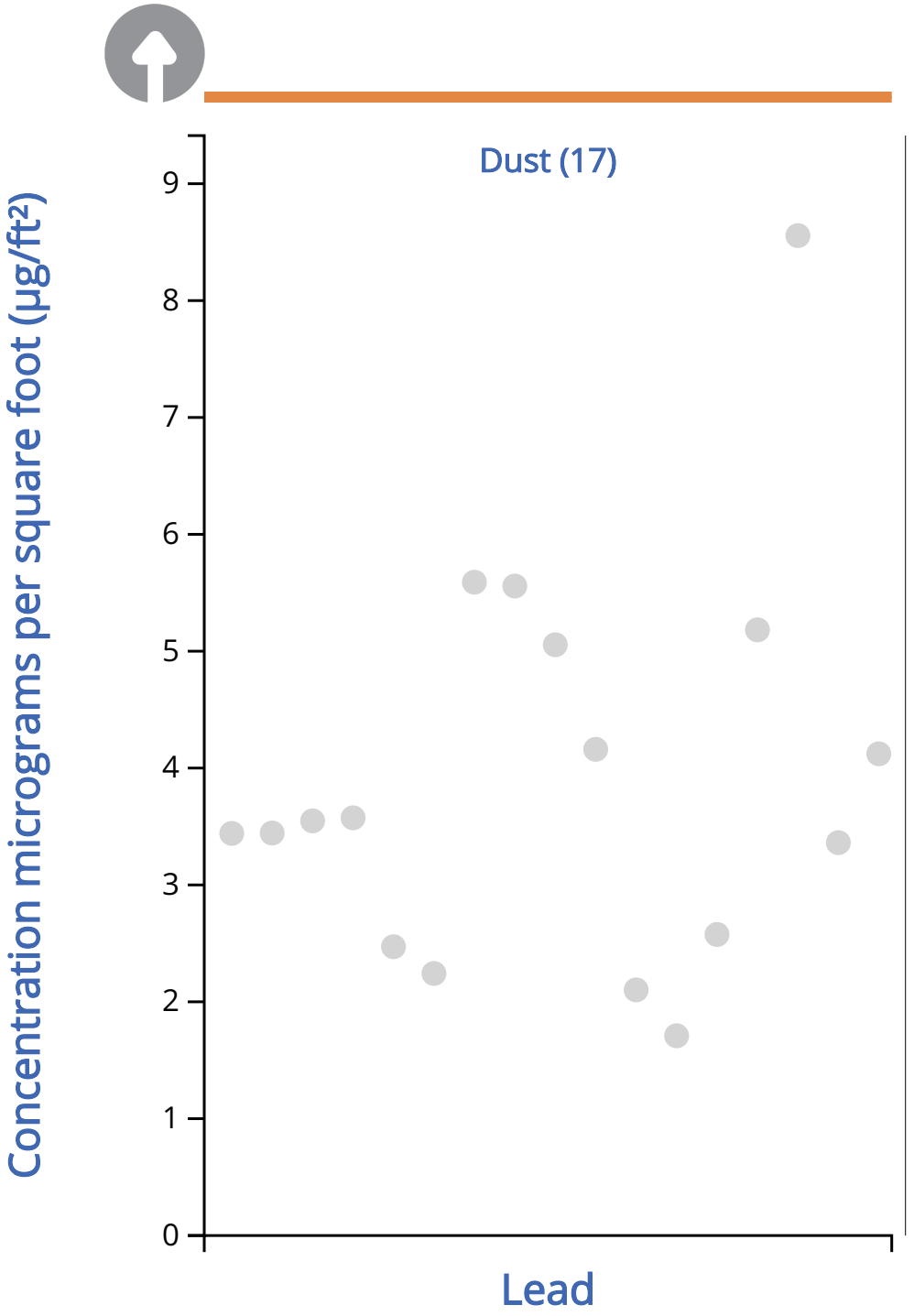
How can Copper affect my health?

Copper is essential for good health, but high levels of copper can be harmful. You may be exposed to copper by ingesting copper-containing fungicides or if you live near or work in a copper mine. Breathing high levels of copper can cause irritation of your nose and throat. Ingesting high levels of copper can cause nausea, vomiting, and diarrhea. Very-high doses of copper can cause damage to your liver and kidneys, and can even cause death.

Where can I get more information on Copper?

- Agency for Toxic Substances and Disease Registry. ToxFAQsTM for Chromium. Last Updated on September 28, 2016. www.atsdr.cdc.gov/phs/phs.asp?id=204&tid=37 (https://www.atsdr.cdc.gov/phs/phs.asp?id=204&tid=37)

Lead


Dust (17)
Concentration micrograms per square foot (µg/ft²)
0
1
2
3
4
5
6
7
8
9
Lead

Department of Housing and Urban Development's Porch Floor Clearance Action Level for Lead

Standard values are higher than data shown

Dust (Other participant samples)

Lead

Contaminant Name: Lead (Pb)
Contaminant Type: Heavy Metal

What is Lead?

Lead is a metal in the Earth's crust that is normally found with other metals such as zinc, silver, and copper. Lead has many uses including manufacturing of paints, batteries, and fishing weights. Lead-based solder, which had been used to connect copper water pipes, was banned in the 1980s, but may still be a source of lead in drinking water in older homes. In the United States, lead was used as a gasoline additive, but was banned beginning in 1973 and eliminated by 1996.

What happens when Lead enters the environment?

Lead itself does not break down, but lead compounds are changed by sunlight, air, and water. When lead is released to the air, it may travel long distances before settling to the ground. Once lead falls onto soil, it usually sticks to soil particles. Ingestion (soil, food, water) is the main route of exposure in humans. Children are most impacted by lead exposure because they often put their hands and/or toys in their mouths. Pregnant women can also expose their unborn child to lead via ingestion. Adults can be exposed via lifestyle choices (e.g., cigarette smoking) or through their occupation (e.g., plumbing, soldering, manufacturing plants, construction/remodeling companies, smelters, and auto repair shops). There are other sources of potential lead exposure which include: paints, glazed clay pots, wine, food, leaded glass (crystal), stained glass, dyes, and home remedies (e.g., azarcon or greta used to treat digestive illness).

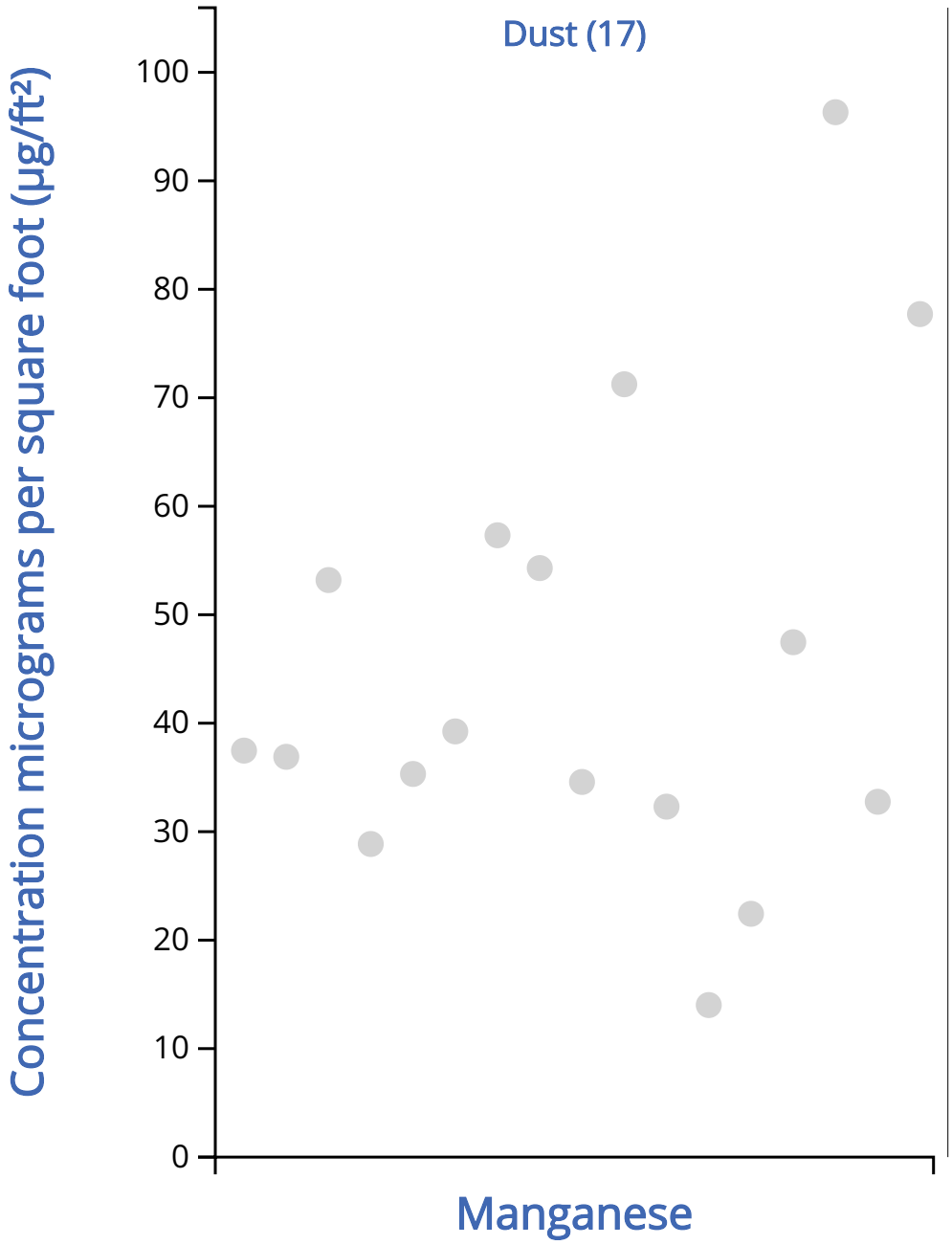
How can Lead affect my health?

Lead can affect almost every organ and system in your body, both in adults and children. Exposure to lead can seriously harm a child's health. It can damage the brain and nervous system, slow growth and development, cause learning, behavior, hearing, and speech problems. It causes lower IQ, decreased ability to pay attention, and underperformance in school. Lead exposure also causes small increases in blood pressure, particularly in middle-aged and older people and can cause anemia. In pregnant women, high levels of exposure to lead may cause miscarriage. High-level exposure in men can damage the organs responsible for sperm production.

Where can I get more information on Lead?

- Agency for Toxic Substances and Disease Registry. ToxFAQsTM for Lead. Last Updated on August 24, 2016. www.atsdr.cdc.gov/toxfaqs/tf.asp?id=93&tid=22 (https://www.atsdr.cdc.gov/toxfaqs/tf.asp?id=93&tid=22)

Manganese


Dust (17)
Concentration micrograms per square foot (µg/ft²)
100
90
80
70
60
50
40
30
20
10
0
Manganese

Dust (Other participant samples)

Manganese

Contaminant Name: Manganese (Mn)
Contaminant Type: Metal

What is Manganese?

Manganese is naturally occurring and found in rocks and soils. Manganese does not occur as a pure metal in nature, instead it is typically bound to elements like oxygen, sulfur, and chlorine. Manganese is used to strengthen metal alloys and can be found in fireworks, fertilizers, cosmetics, etc.

What happens when Manganese enters the environment?

Manganese is naturally occurring in air, water, soil, and foods, but may also be released into the environment via manufacturing, and disposal of based products such as gasoline with manganese-additives. Manganese-containing additives can be broken down by sunlight.

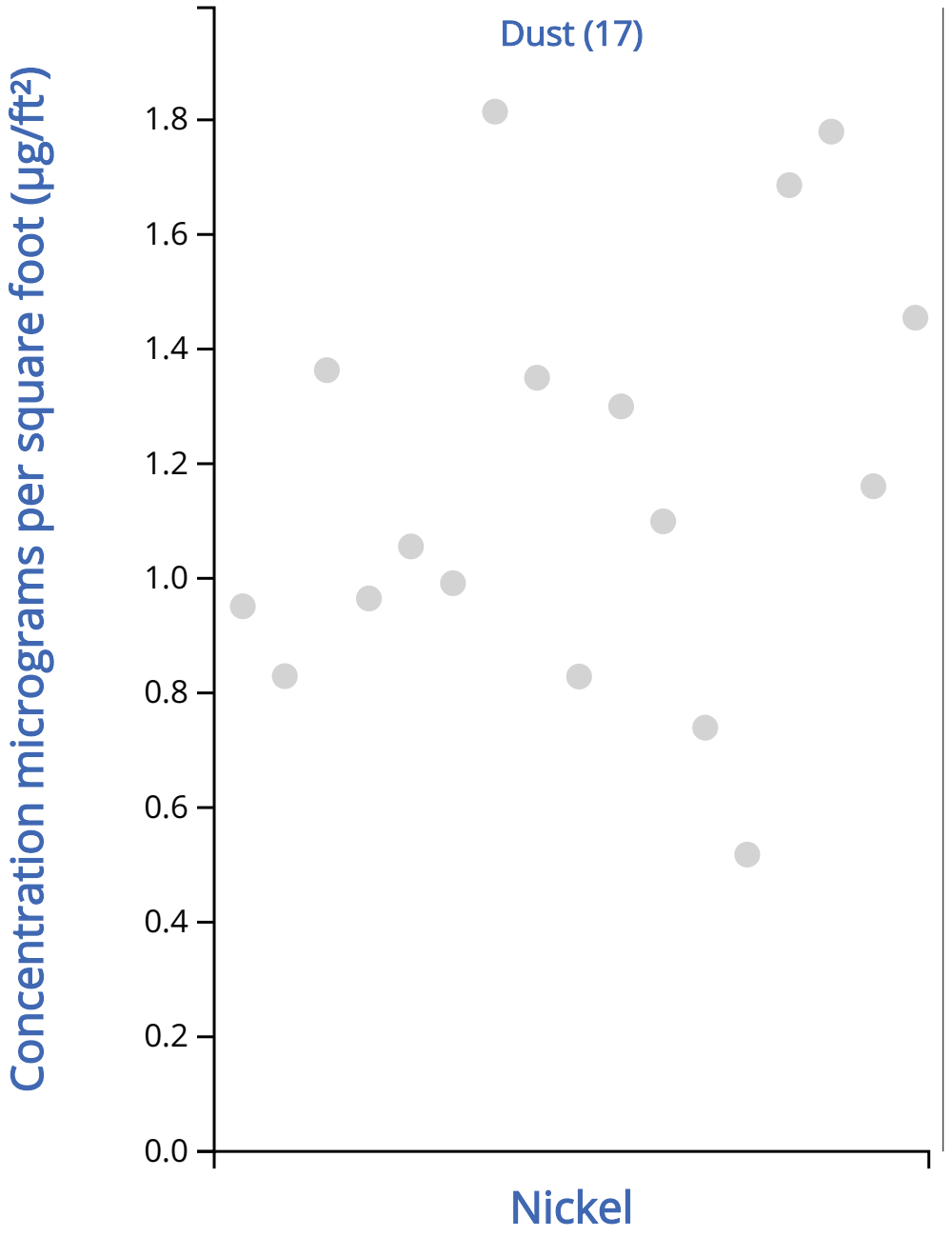
How can Manganese affect my health?

Manganese is an essential nutrient, and eating a small amount of it each day is important to stay healthy.Manganese has the potential to cause lung irritation when inhaled. Manganese may also result in reproductive effects. Workers exposed to high levels of manganese have developed nervous system problems.

Where can I get more information on Manganese?

- Agency for Toxic Substances and Disease Registry. ToxFAQsTM for manganese. Last Updated on January 21, 2015. www.atsdr.cdc.gov/phs/phs.asp?id=100&tid=23 (https://www.atsdr.cdc.gov/phs/phs.asp?id=100&tid=23)

Nickel


Dust (17)
Concentration micrograms per square foot (µg/ft²)
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
Nickel

Dust (Other participant samples)

Nickel

Contaminant Name: Nickel (Ni)
Contaminant Type: Metal

What is Nickel?

Nickel is a natural element. Nickel can be combined with other metals and is used to make coins, jewelry, and items such as valves and heat exchangers. Most nickel is used to make stainless steel. Many nickel compounds dissolve fairly easy in water and have a green color. Nickel compounds are used for nickel plating, to color ceramics, to make some batteries, and as substances known as catalysts that increase the rate of chemical reactions.

What happens when Nickel enters the environment?

Nickel is released into the atmosphere by industries that make or use nickel, nickel alloys, or nickel compounds. Nickel is found in soil and is emitted from volcanoes. Nickel is also found in meteorites and on the ocean floor and It is also released into the atmosphere by oil-burning power plants, coal-burning power plants, and trash incinerators. In the air, it attaches to small particles of dust that settle to the ground or are taken out of the air in rain or snow; this usually takes many days. Nickel released in industrial waste-water ends up in soil or sediment where it strongly attaches to particles containing iron or manganese. Nickel does not appear to accumulate in fish or in other animals used as food.

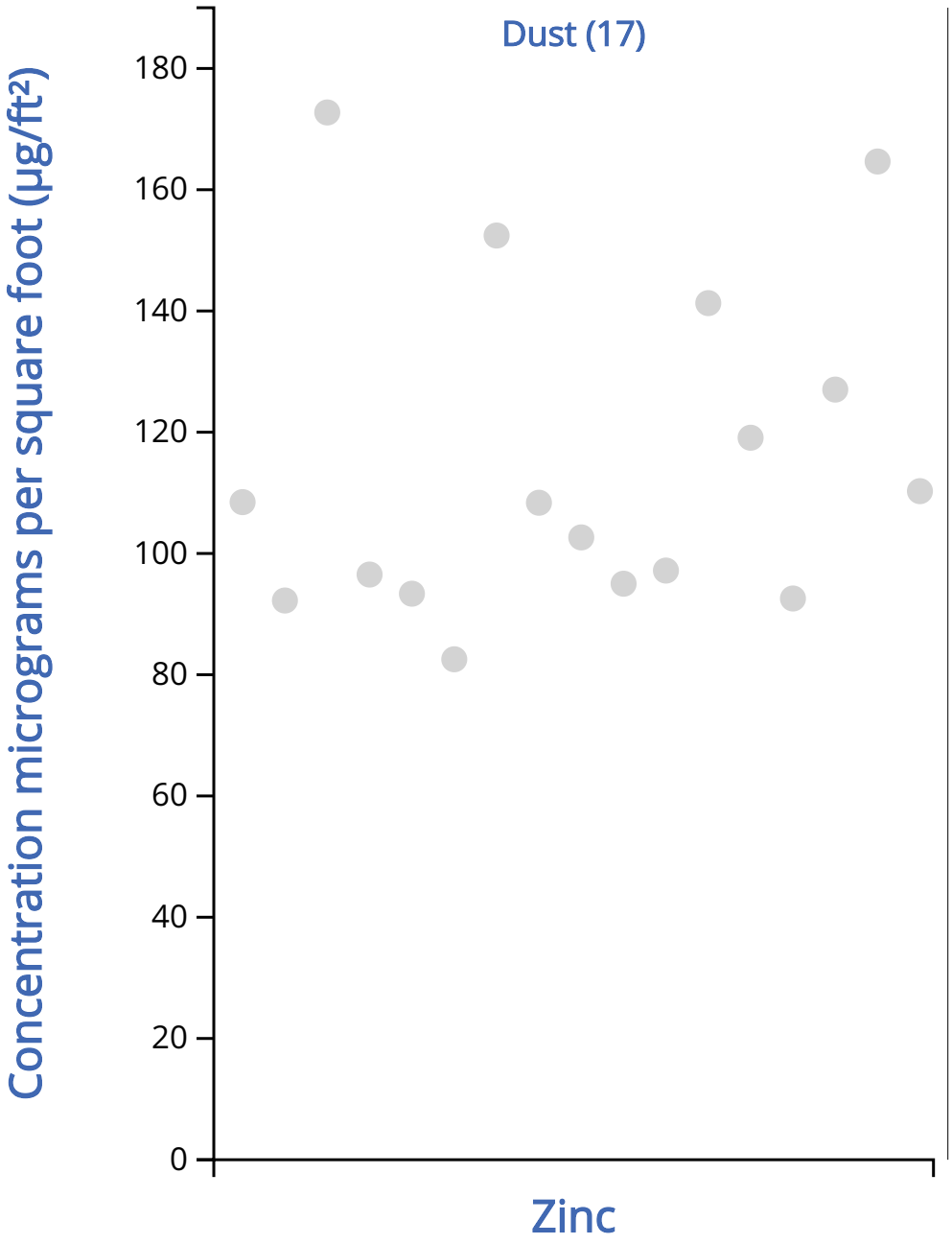
How can Nickel affect my health?

You can be exposed to Nickel through food (major source of exposure), skin contact with soil, bath or shower water, metals containing nickel, smoking tobacco containing nickel, and by handling coins or touching jewelry containing nickel. The most common heath effect is an allergic reaction, usually a rash due to skin contact. People working in nickel refineries or nickel-processing plants have experienced chronic bronchitis and reduced lung function by breathing air containing nickel; however, such reactions are the result of breathing amounts of nickel much higher than levels found normally in the environment. Cancers of the lung and nasal sinus have resulted when workers breathed dust containing high levels of nickel compounds.

Where can I get more information on Nickel?

- Agency for Toxic Substances and Disease Registry. ToxFAQsTM for nickel. Last Updated on January 21, 2015. www.atsdr.cdc.gov/phs/phs.asp?id=243&tid=44 (https://www.atsdr.cdc.gov/phs/phs.asp?id=243&tid=44)

Zinc


Dust (17)
Concentration micrograms per square foot (µg/ft²)
180
160
140
120
100
80
60
40
20
0
Zinc

Dust (Other participant samples)

Zinc

Contaminant Name: Zinc (Zn)
Contaminant Type: Transitional Metal

What is Zinc?

Zinc is found in the Earth's crust. Zn is commonly used as a coating for steel, iron, and other metals to prevent rusting. Zinc compounds are widely used to make paint, rubber, dyes, wood preservatives, and ointments.

What happens when Zinc enters the environment?

Some zinc is released into the environment by natural processes, but most comes from human activities like mining, steel production, coal burning, and burning of waste. It attaches to soil, sediments, and dust particles in the air. Rain and snow remove zinc dust particles from the air. Depending on the type of soil, some zinc compounds can move into the groundwater and into lakes, streams, and rivers. Most of the zinc in soil stays bound to soil particles and does not dissolve in water. It builds up in fish and other organisms, but it does not build up in plants.

How can Zinc affect my health?

Zinc is an essential element in our diet. Too little zinc can cause problems, but too much zinc is also harmful. People can be exposed to zinc by:

- Drinking contaminated water or a beverage that has been stored in metal containers or flows through pipes that have been coated with zinc to resist rust.
- Eating too many dietary supplements that contain zinc.
- Working in any of the following jobs: construction, painting, automobile mechanics, mining, smelting, and welding; manufacture of brass, bronze, or other zinc-containing alloys; manufacture of galvanized metals; and manufacture of machine parts, rubber, paint, linoleum, oilcloths, batteries, some kind of glass, ceramics, and dyes.

Harmful effects generally begin at levels 10-15 times higher than the amount needed for good health. Large doses taken by mouth even for a short time can cause stomach cramps, nausea, and vomiting. Taken longer, it can cause anemia and decrease the levels of your good cholesterol. Inhaling large amounts of zinc (as dusts or fumes) can cause a specific short-term disease called metal fume fever. Long-term effects of breathing high levels of zinc are currently unknown.

Where can I get more information on Zinc?

- Agency for Toxic Substances and Disease Registry. ToxFAQsTM for nickel. Last Updated on January 21, 2015. www.atsdr.cdc.gov/phs/phs.asp?id=300&tid=54 (https://www.atsdr.cdc.gov/phs/phs.asp?id=300&tid=54)

Government Agency References

Agency for Toxic Substances and Disease Registry Toxicological Profiles

The Agency for Toxic Substances and Disease Registry produces toxicological profiles, which summarize important studies on a wide range of contaminants, including metals.

https://www.atsdr.cdc.gov/substances/index.asp

Arizona Department of Environmental Quality

The Arizona Department of Environmental Quality's (ADEQ) mission is to protect and enhance public health and the environment. ADEQ core responsibilities include pollution control, environmental monitoring and assessment, compliance management, cleanups, outreach and assistance, and policy development.

www.azdeq.gov

Arizona Department of Health Services

The Arizona Department of Health Services (ADHS) promotes and protects the health of Arizona's children and adults. ADHS operates programs in behavioral health, disease prevention and control, health promotion, community public health, environmental health, maternal and child health, emergency preparedness and regulation of childcare and assisted living centers, nursing homes, hospitals, other health care providers and emergency services.

www.azdhs.gov

Arizona Department of Environmental Quality

Arizona Department of Environmental Quality (ADEQ) mission is to protect and enhance public health and the environment in Arizona. To achieve this, we administer the state's environmental laws and delegated federal programs to prevent air, water and land pollution and ensure cleanup.

http://www.azdeq.gov/

University of Arizona Superfund Research Program - Community Information Sheets

The University of Arizona Superfund Research Program (UASRP) uses an interdisciplinary approach to study hazardous waste issues in the U.S. Southwest (including Arizona-Sonora border and Native Nations). Their mission is to advance science and to use the research conducted by our program for the improvement of human health and the environment. The information sheets are designed to provide a basic introduction to environmental issues for community members neighboring contaminated sites as well the general public.

http://superfund.arizona.edu/info-material

US Environmental Protection Agency

The US Environmental Protection Agency (EPA)'s mission is to protect human health and the environment by developing and enforcing regulations, giving grants, studying environmental issues, and educating people about the environment.

www.epa.gov

United States Food and Drug Administration

The United States Food and Drug Administration (USDA) is responsible for protecting the public health by ensuring the safety, efficacy, and security of human and veterinary drugs, biological products, and medical devices; and by ensuring the safety of our nation's food supply, cosmetics, and products that emit radiation.

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