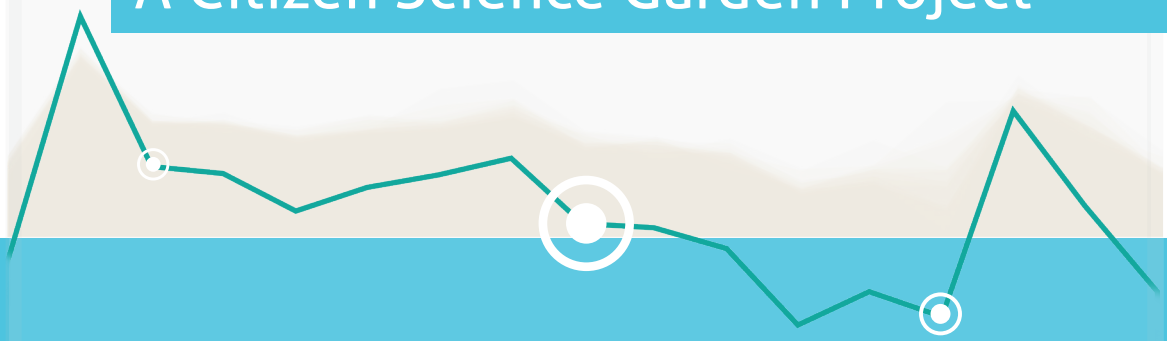
GARDENROOTS

A Citizen Science Garden Project



Results booklet

Cochise County


gardenroots
The Cochise County Garden Project

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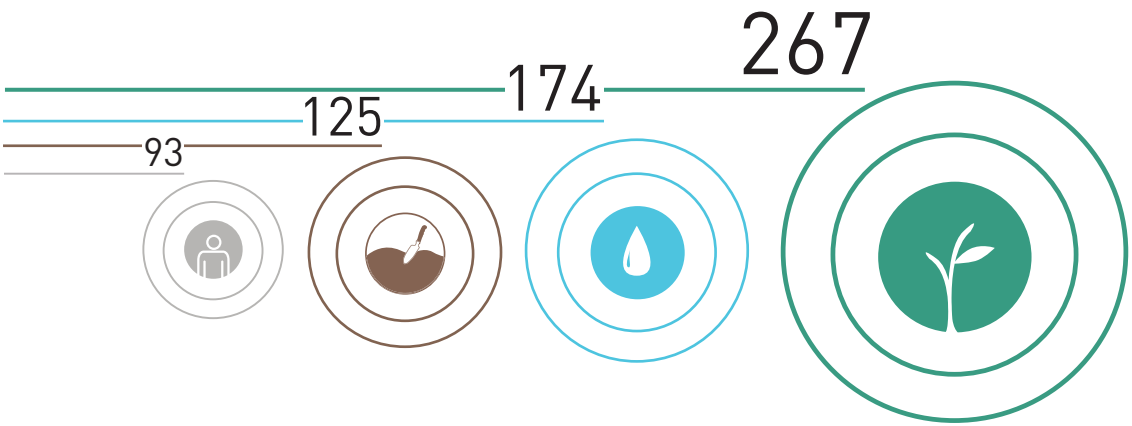
PROJECT OVERVIEW

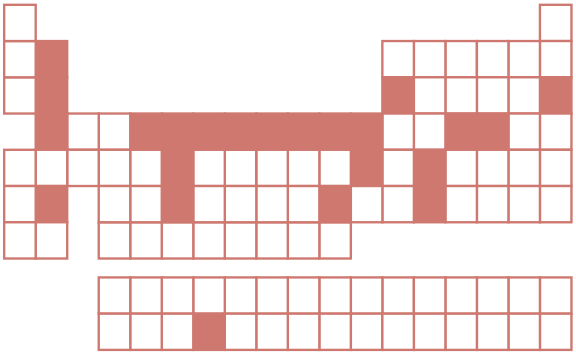
We did it! I would like to give a special thanks to all 54 of the Arizona Gardenroots participants for their efforts, motivation, and patience throughout this research project. Altogether, 93 community members were trained, and 125 soil, 174 water, and 267 plant samples were prepared and analyzed.



Seeing gardens as hubs for environmental health research and education, Gardenroots is trying to understand the state of environmental quality in rural communities. Results from this study are helping to determine whether people are exposed to metal contaminants through gardening and crop ingestion. Gardenroots is co-generating a robust environmental monitoring dataset, while informing the safe production of food sources in underserved communities.

In January 2015, efforts began by conducting environmental health needs assessments with Cooperative Extension agents and rural gardeners across Arizona. Based upon community feedback, Gardenroots was then launched in three Arizona counties (Apache, Cochise, Greenlee). Training sessions were held in summer 2015 (June – August) to instruct citizen-scientists in the collection of garden vegetables, as well as irrigation water, soil, and dust samples. Now, December 2016, Gardenroots is hosting community gathering and data sharing events in each county. For more information about the study, timeline, and safe gardening practices, please visit the new Gardenroots website: http://www.gardenroots.arizona.edu/.

This packet shows the test results of your home's irrigation water, soil (yard and garden), and plant tissue (edible portion only). Your values are then compared to other Gardenroots participants in your county as well as regulatory standards and/or reference values. Gardenroots samples have been tested for all, or a combination of, the twenty-two elements listed below:



- Aluminum
- Arsenic
- Barium
- Beryllium
- Cadmium
- Calcium
- Chromium
- Cobalt
- Copper
- Gold
- Lead
- Magnesium
- Manganese
- Molybdenum
- Nickel
- Potassium
- Selenium
- Tin
- Tungsten (Cochise County only)
- Uranium (Apache County only)
- Vanadium
- Zinc

It is important to note that, elements such as arsenic and lead occur naturally in soil and it is impossible to grow plants completely free of these and other trace elements like those listed above. Please refer to the recommended gardening best practices handouts for ways to reduce levels of harmful chemicals in your garden plot and in your vegetables.

IMPORTANT TERMS

Below is a set of terms that you will see throughout your results:

AZ SRL (Arizona Department of Environmental Quality Soil Remediation Level) – The AZ SRL is a yard soil screening level based on a health risk assessment. If a metal concentration in residential yard soil is above the AZ SRL, it suggests further study, but does not necessarily require cleanup. This level is set by the Arizona Department of Environmental Quality.

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), mg/kg (milligrams per kilogram), or µg/g (micrograms per gram).

Hazard Quotient (HQ) – An evaluation to quantify the non-cancer effects. This value represents a comparison between the calculated intake and the Reference Dose or acceptable daily intake (see definition below). A hazard quotient of less than 1 is typically considered to be of no concern, and a hazard quotient more than 1 is unacceptable and there might be potential non-cancer effects.

Incremental Excess Cancer Risk (IECR) – A lifetime cancer risk predicted to result from continuous exposure to a chemical at a certain concentration. The theoretical maximum number of excess cancer cases that are expected to develop due to that exposure and concentration.

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.

µg/L (Micrograms per Liter) – A measure of how many micrograms (one-thousandth of a milligram) of a substance (such as a metal) are in a liter of liquid (such as water). This measure is also referred to as parts per billion (ppb). For perspective, 1 µg/L or ppb is the equivalent to a drop of ink in a backyard swimming pool.

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). For perspective, 1 mg/kg or ppm is the equivalent to one penny in $10,000 in pennies.

µg/g (Micrograms per Gram) – A measure of how many micrograms of a substance (such as a metal) are in a gram of a solid (such as soil). This measure is also referred to as parts per million (ppm).

ND (None Detected) – Metals with a level of "ND" have a concentration below what our laboratory can measure or detect.

ppb (Parts per Billion) – A measure of how many units of a substance (such as a metal) are in a billion units of a substance (such as water). For liquids, ppb is the same as µg/L. 1 ppb is the equivalent to a drop of ink in a backyard swimming pool.

ppm (Parts per Million) – A measure of how many units of a substance (such as a metal) are in a million units of a substance (such as yard soil, or plant tissue). PPM is the same as mg/kg or µg/g. 1 ppm is the equivalent to one penny in $10,000.

Reference Dose (RfD) – Estimate of a daily intake of a chemical that is not likely to result in any significant negative health effects (including sensitive populations like children and elderly). It may be referred to as the acceptable daily intake.

Target Risk – Setting the lifetime cancer risk to values like 1/10,000 (greater risk), 1/100,000, and 1/1,000,000 (lesser risk) to estimate a vegetable intake rate that will result in that set lifetime cancer risk.

Results for Water

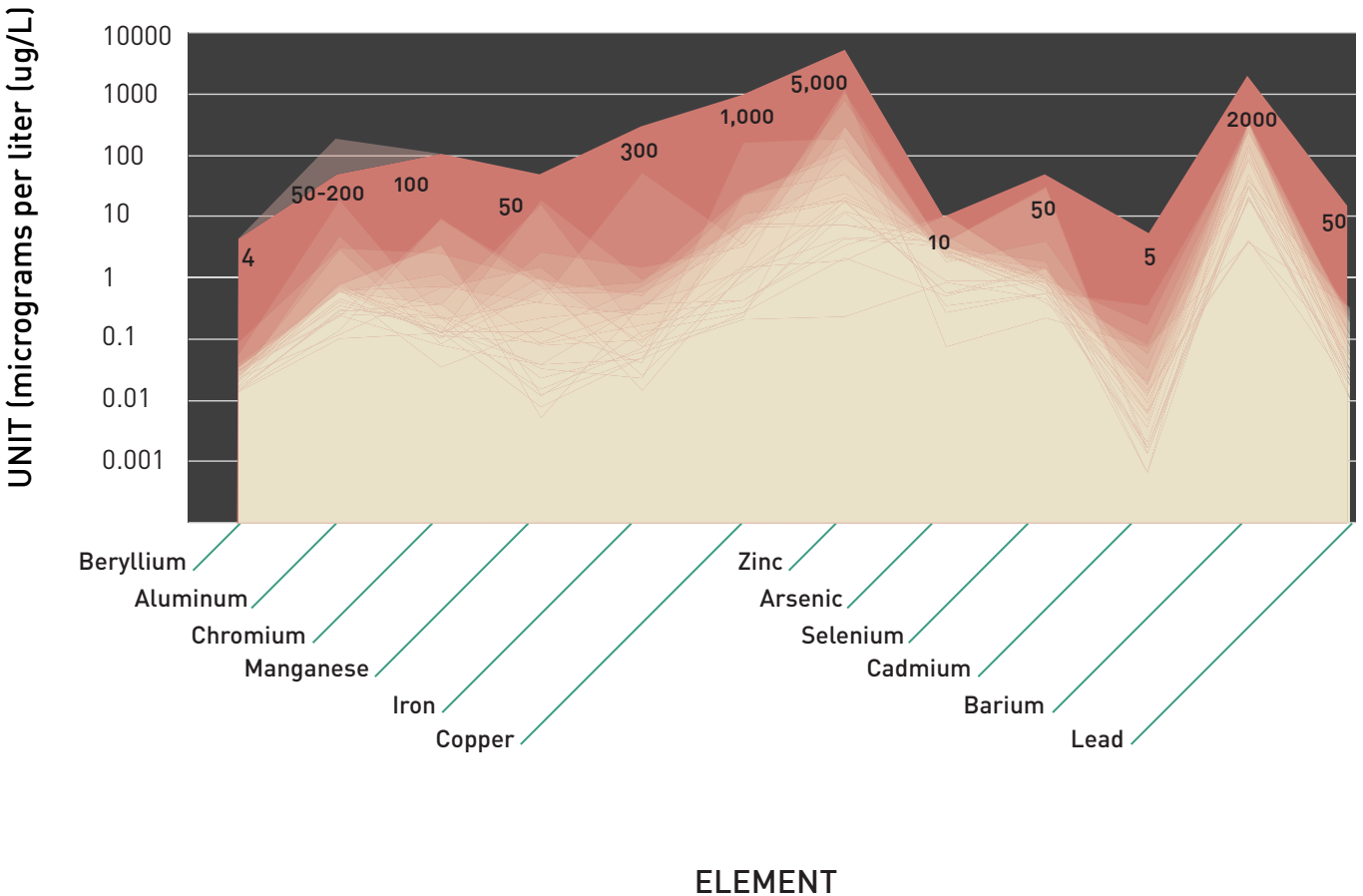
UNDERSTANDING YOUR RESULTS

Your household results are provided and were compared to others in your county as well as standards and reference values. In order to frame the results, we used the following reference values for comparison:

Maximum Contaminant Level

The Maximum Contaminant Level is 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 by the US Environmental Protection Agency.

Please visit https://www.epa.gov/ground-water-and-drinking-water/table-regulated-drinking-water-contaminants and click on or scroll down to the "Inorganic Chemicals" heading. Values used are in the "MCL or TT" column.


UNIT (micrograms per liter (ug/L)
10000
1000
100
10
1
0.1
0.01
0.001
4
50-200
100
50
300
1,000
5,000
10
50
5
2000
50
Beryllium
Aluminum
Chromium
Manganese
Iron
Copper
Zinc
Arsenic
Selenium
Cadmium
Barium
Lead
ELEMENT

Maximum Contaminant Level

Beryllium: 4
Aluminum: 50-200
Chromium: 100
Manganese: 50
Iron: 300
Copper: 1000
Zinc: 5000
Arsenic: 10
Selenium: 50
Cadmium: 5
Barium: 2000
Lead: 15

Other Samples in Area

Avg. Data

Beryllium: 0.03
Aluminum: 1.46
Chromium: 1.20
Manganese: 1.61
Iron: 2.09
Copper: 10.74
Zinc: 156.21
Arsenic: 2.73
Selenium: 3.06
Cadmium: 0.03
Barium: 133.75
Lead:0.09

Results for Soil

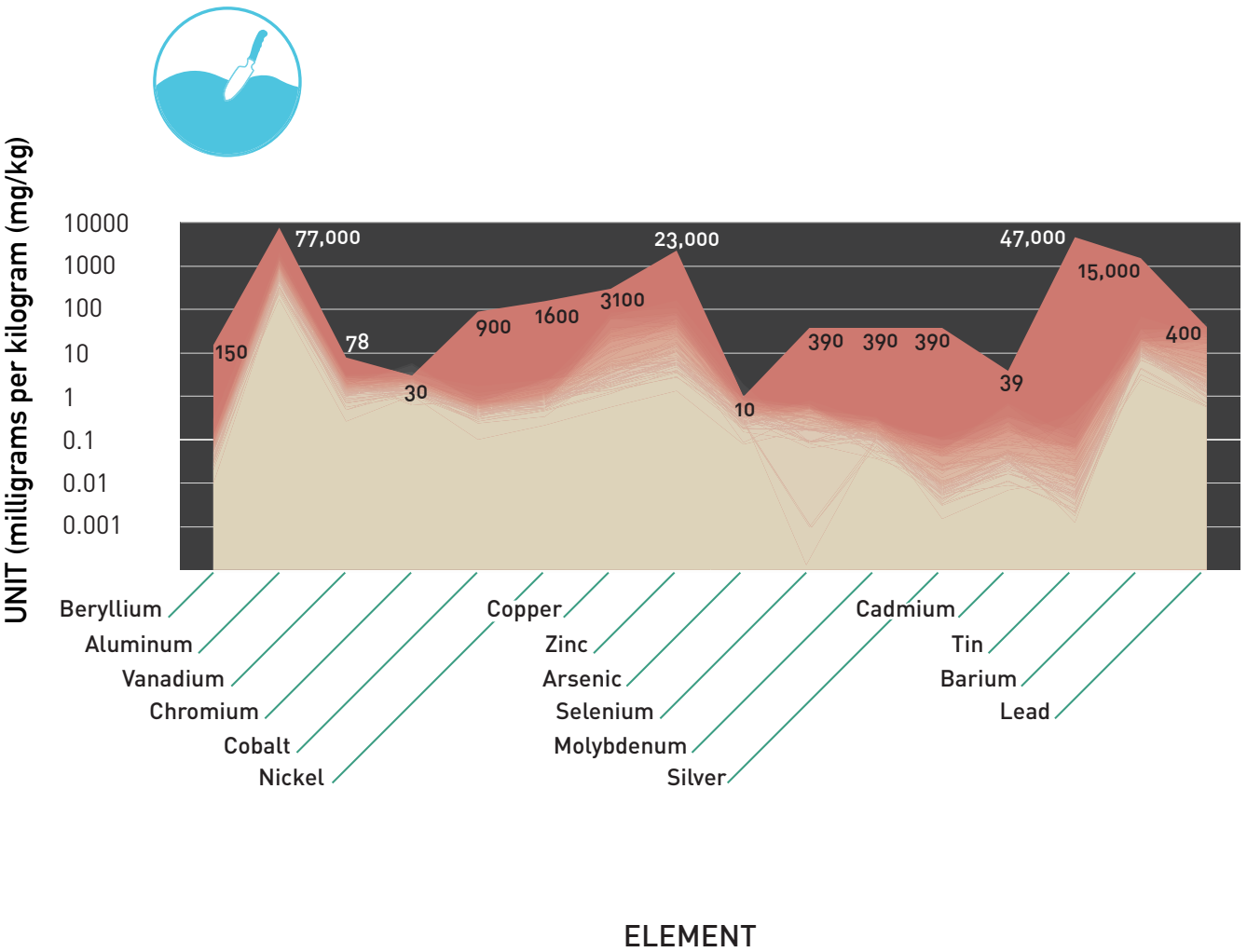
UNDERSTANDING YOUR RESULTS

Your household results are provided and were compared to others in your county as well as standards and/or reference values. In order to frame the results, we used the following reference values for comparison:

Arizona Department of Environmental Quality Soil Remediation Level

The Arizona Department of Environmental Quality Soil Remediation Level (AZ SRL) is a residential yard soil screening level based on a health risk assessment. If a metal concentration in residential yard soil is above the AZ SRL, it suggests further study, but does not necessarily require cleanup. This level is set by the Arizona Department of Environmental Quality.

Please visit http://apps.azsos.gov/public_services/Title_18/18-07.pdf and find the table underneath the section R18-7-210 - Notice of Remediation and Repository. Values from the "Residential (mg/kg), carcinogen 10-6. Risk" were used. If no value was listed under this category, then residential non-carcinogen was used.


UNIT (milligrams per kilogram (mg/kg)
10000
1000
100
10
1
0.1
0.01
0.001
150
77,000
78
30
900
1600
3100
23,000
10
390
390
390
39
47,000
15,000
400
Beryllium
Aluminum
Vanadium
Chromium
Cobalt
Nickel
Copper
Zinc
Arsenic
Selenium
Molybdenum
Silver
Cadmium
Tin
Barium
Lead
ELEMENT

Arizona Soil Remediation Level

Beryllium: 150
Aluminum: 77,000
Vanadium: 78
Chromium: 30
Cobalt: 900
Nickel: 1600
Copper: 3100
Zinc: 23,000
Arsenic: 10
Selenium: 390
Molybdenum: 390
Silver: 390
Cadmium: 39
Tin: 47,000
Barium: 15,000
Lead: 400

Other Samples in Area

Avg. Data

Beryllium: 0.74
Aluminum: 7554
Vanadium: 15.55
Chromium: 19.58
Cobalt: 5.50
Nickel: 9.89
Copper: 124
Zinc: 236
Arsenic: 4.52
Selenium: 2.91
Molybdenum: 1.51
Silver: 0.27
Cadmium: 0.98
Tin: 0.43
Barium: 149.70
Lead: 74.76

Results for Plants

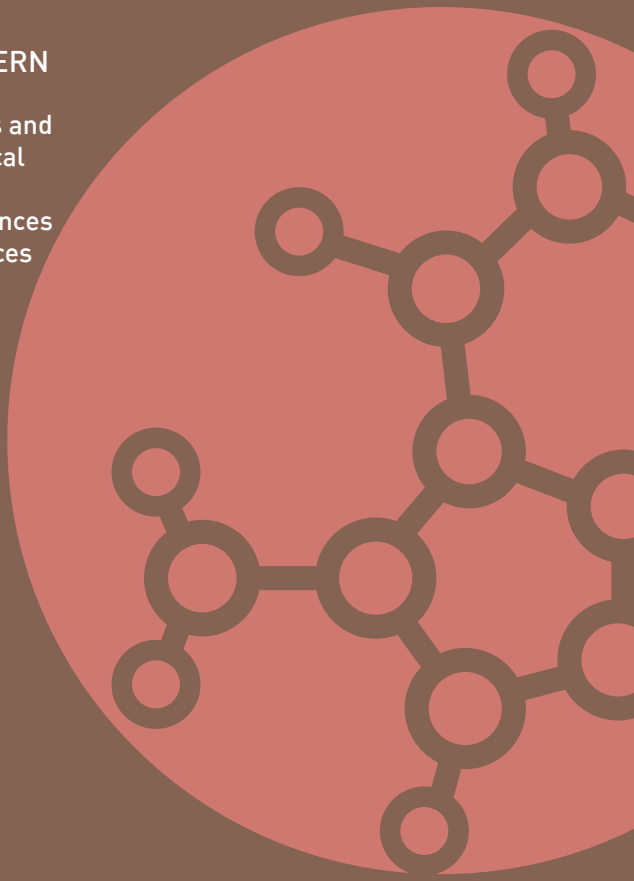
to be posted...

INFORMATION ON SELECTED CONTAMINANTS OF CONCERN

Source:
University of Arizona
Superfund Research Program - Community Information Sheets
The University of Arizona Superfund Research Program
MISSION:
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

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



CONTAMINANTS OF CONCERN

An overview

ARSENIC

As

What is Arsenic? Arsenic is a solid substance (metalloid) naturally existing in the Earth's crust and in crushed rock. Arsenic exposure is natural but can be aggravated by human activities. In the environment, arsenic is combined with oxygen, chlorine, and sulfur to form inorganic arsenic compounds. We are 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 wates 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

What happens to arsenic when it enters the environment? Arsenic occurs naturally in soil and minerals and may enter the air, water, and land from wind-blown dust and may get into water from runoff and leaching. Arsenic cannot be destroyed in the environment. It can only change its form. Rain and snow remove arsenic dust particles from the air. Many common arsenic compounds can dissolve in water. Most of the arsenic in water will ultimately end up in soil or sediment. Fish and shellfish can accumulate arsenic; most of this arsenic is in an organic form called arsenobetaine that is much less harmful.

How might I be exposed to arsenic? Ingesting small amounts present in your food and water or breathing air containing arsenic. Breathing sawdust or burning smoke from wood treated with arsenic. Living in areas with unusually high natural levels of arsenic in rock. Working in a job that involves arsenic production or use, such as copper or lead smelting, wood treating, or pesticide application.

How can arsenic affect my health? Breathing high levels of inorganic arsenic can give you a sore throat or irritated lungs. Ingesting very high levels of arsenic can result in death. Exposure to lower levels can cause nausea and vomiting, decreased production of red and white blood cells, abnormal heart rhythm, damage to blood vessels, and a sensation of "pins and needles" in hands and feet. Ingesting or breathing low levels of inorganic arsenic for a long time can cause a darkening of the skin and the appearance of small "corns" or "warts" on the palms, soles, and torso. Skin contact with inorganic arsenic may cause redness and swelling. Several studies have shown that 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.

BARIUM

Ba

What is Barium? Barium is a silvery-white metal which exists in nature only in ores containing mixtures of elements. It 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 to barium when it 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 might I be exposed to barium? People with the greatest known risk of exposure to high levels of barium are those working in industries that make or use barium compounds. Most of these exposed persons breathe air that contains barium sulfate or barium carbonate. Many hazardous waste sites contain barium compounds, and these sites may be a source of exposure for people living and working near them. Exposure near hazardous waste sites may occur by breathing dust, eating soil or plants, or drinking water that is polluted with barium. People near these sites may also get soil or water that contains barium on their skin.

How can barium affect my health? The health effects of the different barium compounds depend on how well the compound dissolves in water or in the stomach contents. Barium compounds that do not dissolve well, such as barium sulfate, are not generally harmful.
Barium has been found to potentially cause gastrointestinal disturbances and muscular weakness when people are exposed to it at levels above the EPA drinking water standards for relatively short periods of time. 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.

BERYLLIUM

Be

What is Beryllium? Beryllium is a hard, grayish metal naturally found in mineral rocks, coal, soil, and volcanic dust. Beryllium compounds are commercially mined, and the Beryllium is 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 to beryllium when it enters the environment? Beryllium dust enters the air from burning coal and oil. This beryllium dust will eventually settle over the land and water. 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 might I be exposed to beryllium? The general population is exposed to normally low levels of beryllium in air, food, and water. 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 may also be exposed to higher than normal levels of beryllium in air. People living near uncontrolled hazardous waste sites may be exposed to higher than normal levels of beryllium.

How can beryllium affect my health? Beryllium can be harmful if you breathe it. The effects depend on how much you are exposed to and for how long. If beryllium air levels are high enough, an acute condition can result. This condition resembles pneumonia and is called acute beryllium disease Occupational and community air standards are effective in preventing most acute lung damage. Some people (1-15%) become sensitive to beryllium. These individuals may develop an inflammatory reaction in the respiratory system. This condition is called chronic beryllium disease (CBD), and can occur many years after exposure to higher than normal levels of beryllium.

CADMIUM

Cd

What is cadmium? Cadmium is found in the earth's crust, associated with zinc, lead, and copper ores. Pure cadmium is a soft, silver-white metal. Cadmium chloride and cadmium sulfate are soluble in water. Most cadmium used in the United States 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 (83%), pigments (8%), coatings and platings (7%), stabilizers for plastics (1.2%), nonferrous alloys, photovoltaic devices, and other uses (0.8%).

What happens to cadmium when it enters the environment? Cadmium is emitted to soil, water, and air by non-ferrous metal mining and refining, manufacture and application of phosphate fertilizers, fossil fuel combustion, and waste incineration and disposal. Cadmium and its compounds may travel through soil, but its mobility depends on several factors such as pH and amount of organic matter, which will vary depending on the local environment. Generally, cadmium binds strongly to organic matter where it will be immobile in soil and be taken up by plant life, eventually, entering the food supply. Cadmium can accumulate in aquatic organisms and agricultural crops. In the United States, for nonsmokers the primary source of cadmium exposure is from the food supply. Tobacco leaves accumulate high levels of cadmium from the soil.

How might I be exposed to cadmium? Eating foods containing cadmium; low levels are found in all foods (highest levels are found in shellfish, liver, and kidney meats), smoking cigarettes or breathing cigarette smoke, breathing contaminated workplace air, drinking contaminated water, or living near industrial facilities which release cadmium into the air.

How can cadmium affect my health? Breathing high levels of cadmium can severely damage the lungs. 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 are lung damage and fragile bones.

CHROMIUM

Cr

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 is widely used in manufacturing processes to make various metal alloys such as stainless steel. Chromium can be found in many consumer products such as: wood treated with copper dichromate, leather tanned with chromic sulfate, and stainless steel cookware, and metal-on-metal hip replacements.

What happens to chromium when it 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. Chromium can change from one form to another in water and soil, depending on the conditions present.

How might I be exposed to chromium? You can be exposed to trace levels of chromium by breathing air containing it. Releases of chromium into the air can occur from: industries using or manufacturing chromium, living near a hazardous waste facility that contains chromium, and cigarette smoke. Rural or suburban air generally contains lower concentrations of chromium than urban air. A large number of workers are potentially exposed to chromium. The highest potential exposure occurs in the metallurgy and tanning industries, where workers may be exposed to high air concentrations. Chromium is occasionally detected in groundwater, drinking water, or soil samples. Some ways to be exposed to chromium include: drinking water containing chromium and bathing in water containing chromium. The general population is most likely to be exposed to trace levels of chromium in the food that is eaten. Low levels of chromium(III) occur naturally in a variety of foods, such as fruits, vegetables, nuts, beverages, and meats.

How can chromium affect my health? Chromium(III) is an essential nutrient that helps the body use sugar, protein, and fat. Breathing high levels of chromium(VI) can cause irritation to the lining of the nose, nose ulcers, runny nose, and breathing problems, such as asthma, cough, shortness of breath, or wheezing. The concentrations of chromium in air that can cause these effects may be different for different types of chromium compounds, with effects occurring at much lower concentrations for chromium(VI) compared to chromium(III).
The main health problems seen in animals following ingestion of chromium(VI) compounds are irritation and ulcers in the stomach and small intestine and anemia. Chromium(III) compounds are much less toxic and do not appear to cause these problems. Sperm damage and damage to the male reproductive system have also been seen in laboratory animals exposed to chromium(VI). In workers, inhalation of chromium(VI) has been shown to cause lung cancer. An increase in stomach tumors was observed in humans and animals exposed to chromium(VI) in drinking water.

LEAD

Pb

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 to lead when it 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. Movement of lead from soil into groundwater will depend on the type of lead compound and the characteristics of the soil.

How might I be exposed to lead? Lead effects are similar whether you are exposed by breathing or ingesting particles containing lead (e.g., soils or dust particles). Although, scientific studies have identified that ingestion 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 (e.g., water or food). Adults are exposed to lead through food, water, and air. In addition, adults can be exposed via lifestyle choices (e.g., cigarette smoking) or through their occupation (e.g., 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 and greta).

How can lead affect my health? The effects of lead are the same whether it enters the body through breathing or swallowing. Lead can affect almost every organ and system in your body. The main target for lead toxicity is the nervous system, both in adults and children. Long-term exposure of adults can result in decreased performance in some tests that measure functions of the nervous system. It may also cause weakness in fingers, wrists, or ankles. Lead exposure also causes small increases in blood pressure, particularly in middle-aged and older people and can cause anemia. Exposure to high lead levels can severely damage the brain and kidneys in adults or children and ultimately cause death. 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.

NICKEL

Ni

What is Nickel? Nickel is a very abundant natural element. Pure nickel is a hard, silvery-white metal. Nickel can be combined with other metals, such as iron, copper, chromium, and zinc, to form alloys. These alloys are used to make coins, jewelry, and items such as valves and heat exchangers. Most nickel is used to make stainless steel. Nickel can combine with other elements such as chlorine, sulfur, and oxygen to form nickel compounds. 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. Nickel is found in all soil and is emitted from volcanoes. Nickel is also found in meteorites and on the ocean floor. Nickel and its compounds have no characteristic odor or taste.

What happens to nickel when it enters the environment? Nickel is released into the atmosphere by industries that make or use nickel, nickel alloys, or nickel compounds. 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 might I be exposed to nickel? By eating food containing nickel, which is the major source of exposure for most people. By skin contact with soil, bath or shower water, or metals containing nickel, as well as by handling coins or touching jewelry containing nickel. By drinking water that contains small amounts of nickel. By breathing air or smoking tobacco containing nickel. Higher exposure may occur if you work in industries that process or use nickel.

How can nickel affect my health? The most common harmful health effect of nickel in humans is an allergic reaction. The most common reaction is a skin rash at the site of contact. The skin rash may also occur at a site away from the site of contact. Less frequently, some people who are sensitive to nickel have asthma attacks following exposure to nickel. Some sensitized people react when they consume food or water containing nickel or breathe dust containing it.

People working in nickel refineries or nickel-processing plants have experienced chronic bronchitis and reduced lung function. These persons breathed amounts of nickel much higher than levels found normally in the environment. Workers who drank water containing high amounts of nickel had stomach ache and suffered adverse effects to their blood and kidneys.

Cancers of the lung and nasal sinus have resulted when workers breathed dust containing high levels of nickel compounds while working in nickel refineries or nickel processing plants. The Department of Health and Human Services has determined that nickel metal may reasonably be anticipated to be a carcinogen and that nickel compounds are known human carcinogens.

SELENIUM

Se

What is selenium? Selenium is a naturally occurring mineral element that is distributed widely in nature in most rocks and soils. In its pure form, it exists as metallic gray to black hexagonal crystals, but in nature it is usually combined with sulfide or with silver, copper, lead, and nickel minerals. Most processed selenium is used in the electronics industry, but it is also used: as a nutritional supplement; in the glass industry; as a component of pigments in plastics, paints, enamels, inks, and rubber; in the preparation of pharmaceuticals; as a nutritional feed additive for poultry and livestock; in pesticide formulations; in rubber production; as an ingredient in antidandruff shampoos; and as a constituent of fungicides.

What happens to selenium when it enters the environment? Selenium occurs naturally in the environment and can be released by both natural and manufacturing processes. Selenium dust can enter the air from burning coal and oil. This selenium dust will eventually settle over the land and water. It also enters water from rocks and soil, and from agricultural and industrial waste. Some selenium compounds will dissolve in water, and some will settle to the bottom as particles. Insoluble forms of selenium will remain in soil, but soluble forms are very mobile and may enter surface water from soils. Selenium may accumulate up the food chain.

How might I be exposed to selenium? The general population is exposed to very low levels of selenium in air, food, and water. The majority of the daily intake comes from food. People working in or living near industries where selenium is produced, processed, or converted into commercial products may be exposed to higher levels of selenium in the air. People living in the vicinity of hazardous waste sites or coal burning plants may also be exposed to higher levels of selenium.

How can selenium affect my health? Selenium has both beneficial and harmful effects. Low doses of selenium are needed to maintain good health. However, exposure to high levels can cause adverse health effects. Short-term oral exposure to high concentrations of selenium may cause nausea, vomiting, and diarrhea. Chronic oral exposure to high concentrations of selenium compounds can produce a disease called selenosis. The major signs of selenosis are hair loss, nail brittleness, and neurological abnormalities (such as numbness and other odd sensations in the extremities). Studies of laboratory animals and people show that most selenium compounds probably do not cause cancer. In fact, studies in humans suggest that lower-than-normal selenium levels in the diet might increase the risk of cancer. Selenium sulfide, is a probable human carcinogen. Selenium sulfide is NOT present in foods and is a very different chemical from the organic and inorganic selenium compounds found in foods and in the environment.

ZINC

Zn

What is zinc? Zinc is one of the most common elements in the earth's crust. It is found in air, soil, and water, and is present in all foods. Pure zinc is a bluish-white shiny metal. Zinc has many commercial uses as coatings to prevent rust, in dry cell batteries, and mixed with other metals to make alloys like brass, and bronze. A zinc and copper alloy is used to make pennies in the United States. Zinc combines with other elements to form zinc compounds. Common zinc compounds found at hazardous waste sites include zinc chloride, zinc oxide, zinc sulfate, and zinc sulfide. Zinc compounds are widely used in industry to make paint, rubber, dyes, wood preservatives, and ointments.

What happens to zinc when it enters the environment? Some 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 might I be exposed to zinc? Ingesting small amounts present in your food and water. 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.

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. 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. We do not know the long-term effects of breathing high levels of zinc.. The Department of Health and Human Services and the International Agency for Research on Cancer have not classified zinc for carcinogenicity.

REFERENCES

Please visit these websites listed by subject to find additional information.

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

National Health and Nutrition Examination Survey (NHANES)

NHANES is a US Centers for Disease Control and Prevention program that annually examines about 5,000 people as young as 6 years of age across the United States to assess environmental exposures, health, and nutrition status.
www.cdc.gov/exposurereport/pdf/FourthReport.pdf

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). Our 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

CESM
Center for Environmentally Sustainable Mining

THE UNIVERSITY OF ARIZONA
College of Agriculture & Life Sciences
Soil, Water & Environmental Science

Srp
Superfund Research Program

Superfund Research Program
The University of Arizona

COLLEGE OF AGRICULTURE & LIFE SCIENCES
Cooperative Extension
Cochise County

gardenroots
The Cochise County Garden Project