

Metals Summaries

Condensed from CDC/ATSDR Tox FAQs: <http://www.atsdr.cdc.gov/toxfaqs/index.asp#S>

Antimony (Sb) is a metal that is frequently combined with oxygen to form antimony oxide, or mixed with other metals to form alloys. Antimony oxide is added to fabrics and plastics to make them fire-resistant. Antimony alloys are used in several products including batteries, solder, sheet and pipe metal, bearings, castings, ammunition and pewter. Antimony may also be released into the environment by incinerators and coal-burning. Exposure to antimony in the air may cause irritation to the eyes, skin and lungs, while breathing antimony for a prolonged amount of time may also cause problems with the heart and lungs, stomach pain, diarrhea, vomiting and stomach ulcers. It is unknown if antimony can cause cancer or birth defects, or affect reproduction in humans.

Arsenic (As) is a naturally occurring metalloid found in rocks and groundwater throughout the world, including on the Navajo Nation. Arsenic has been detected in concentrations greater than the national safe drinking water standard of 10 micrograms per liter ($\mu\text{g/l}$), or 0.01 milligrams per liter (mg/l) in about 17% of unregulated livestock wells tested. Arsenic occurs in elevated levels in mine wastes, and has been found in natural remedies, in foods grown in arsenic-rich areas or in foods treated with arsenic-based pesticides. The New Mexico Department of Health (NMDOH) requires reporting of arsenic in urine at levels greater than 50 $\mu\text{g/l}$. Long-term exposure to elevated levels of arsenic is associated with skin, lung and other cancers, skin sores, anemia and peripheral neuropathy (i.e., numbness in hands, arms, legs and feet).

Barium (Ba) is a naturally-occurring metal found in many different forms called compounds. Barium compounds are used in lubricants for oil and gas drills, paints, bricks, tiles, glass, rubber, ceramics, insect and rat poisons. Barium compounds are also components in sealants, paper manufacturing, sugar refining, and animal and vegetable oil refining. Certain barium compounds are sometimes used by doctors to perform medical tests and take photographs of the stomach and intestines. Certain barium compounds can cause changes in heart rhythm or paralysis in humans. Eating or drinking barium may cause vomiting, abdominal cramps, diarrhea, difficulty breathing, altered blood pressure, numbness around the face, and muscle weakness. No information exists about the effects of barium on human reproduction. Barium has not been shown to cause cancer in humans.

Beryllium (Be) is a naturally-occurring element that is present in rocks, coal, oil and soil. Very pure beryl is more commonly known as the gems aquamarine or emerald. Most beryllium is mined as ore and mixed with other metals to form alloys. These alloys are used to make electrical/electronic parts, machinery or molds for plastics. Beryllium alloys are also used in automobiles, computers, sports equipment and dental bridges. Pure beryllium metal is used in nuclear weapons and reactors, aircraft, space vehicle structures and instruments, x-ray machines and mirrors. Breathing beryllium may damage the lungs, depending on how much, and for how long, it is inhaled. Beryllium has been designated as a probable human carcinogen. It is unknown whether beryllium may affect reproduction or cause birth defects in humans.

Cadmium (Cd) is a naturally-occurring metal used in batteries, pigments, coatings and platings, and plastics. Cadmium is released into the environment by metal mining and refining, manufacture and application of certain fertilizers, combustion of fossil fuels, and waste incineration. Emissions from these industries containing cadmium may be inhaled. Water near cadmium-emitting industries may also have higher levels of cadmium. In the US, the primary sources of cadmium are through smoking and food. Leafy vegetables (e.g lettuce and spinach), potatoes, grains, peanuts, soybeans and sunflower seeds contain high levels of cadmium. Inhaling high levels of cadmium can damage the lungs. Breathing or ingesting lower levels of cadmium over a long period of time can lead to a build-up of cadmium in the kidneys and fragile bones. Some studies have found increases in lung cancer in workers exposed to cadmium. It is unknown whether cadmium causes birth defects.

Cobalt (Co) is usually mixed with other metals to form alloys. These alloys are used in aircraft engines, magnets, cutting tools and artificial hip and knee joints. Cobalt compounds are also used to color glass, ceramics and paints because of their distinct blue color. Food is usually the largest source of exposure to cobalt from accumulations in fruit, grain and seeds. Exposures to cobalt may be increased for people who work in metal mining, smelting and refining industries. Cobalt has both beneficial and harmful effects on human health. Cobalt is beneficial as a component of vitamin B12, which is essential to human health. Inhaling too much cobalt may result in respiratory difficulties (asthma, pneumonia, wheezing). Animal studies suggest that exposure to high amounts of nonradioactive cobalt may affect the health of developing babies. However, birth defects have not been found in children born to mothers treated with cobalt during their pregnancies. Non-radioactive cobalt has not been found to cause cancer.

Copper (Cu) is a metal that can enter the environment through the mining of copper and other metals. Copper is often found near mines, smelters, industrial buildings and landfills. Copper is common in the environment, so humans may be exposed by breathing air, drinking water, eating food or by skin contact with contaminated soil. Copper is both beneficial and harmful to human health. Copper is essential for good health in small quantities. Long-term exposure to copper dust can irritate the nose, mouth and eyes. Breathing copper dust, or drinking water with higher-than-normal levels of copper over a long period of time may cause headaches, dizziness, nausea and diarrhea. Very high intakes of copper can cause liver, kidney and brain damage. It is unknown whether copper causes birth defects or cancer in humans. Animal studies suggest that high levels of copper may decrease fetal growth.

Chromium (Cr) is a naturally occurring element found in rocks, animals, plants, and soil. It can exist in several different forms. Depending on the form it takes, it can be a liquid, solid, or gas. No taste or odor is associated with chromium compounds. The metal form of chromium is used for making steel. Other forms of chromium are used for chrome plating, dyes and pigments, leather tanning, and wood preserving. You can be exposed to chromium by eating food containing Cr, breathing workplace air or having skin contact in the workplace, drinking contaminated well water, or living near waste sites containing chromium. EPA has determined that chromium(VI) compounds are known human carcinogens because inhalation has caused lung cancer in some workers and in laboratory animals. While Cr(III) is an essential nutrient that helps the body use sugar, protein, and fat, breathing high levels of Cr(VI) can cause nose ailments and respiratory distress. Skin contact with certain chromium(VI) compounds can cause skin ulcers. While sperm damage and damage to the male reproductive system have been seen in laboratory animals exposed to Cr(VI), scientists do not if exposure to chromium will result in birth defects or other developmental effects in people.

Iron (Fe). Iron is a mineral that our bodies need for many functions. The body needs iron to make the proteins hemoglobin (in red blood cells) and myoglobin (in muscles). They help carry and store oxygen in the body. Iron is also part of many other proteins and enzymes in the body. Too little iron may cause iron deficiency anemia; too much iron may cause iron poisoning. (This information was summarized from MedlinePlus, the website of the National Institutes of Health: <http://www.nlm.nih.gov/medlineplus/iron.html>.)

Lead (Pb). In New Mexico and Arizona, all detectable levels of lead in blood are reportable to state health departments. Lead exposures occur from many sources. Lead once was used routinely in paint and gasoline. Although it has been removed from gasoline for several decades, and is no longer an ingredient in paint sold in the U.S., many houses still have old lead-based paint. When older house paint chips, it can be swallowed by children. Lead has also been used in pottery glazes, in vinyl blinds, and in other materials common in the home. Lead may be in solder used in silversmithing and other arts, crafts and hobbies, including making stained glass. Lead is also found in mine wastes and is released from the smelting of metals. Lead accumulates in the body, can damage the nervous system, produce anemia, and contribute to

other health problems. Because children's nervous systems are developing, exposures in children are of particular concern.

Manganese (Mn) is used mainly in steel production, but it is also found in fireworks, dry-cell batteries, fertilizer, paints, cosmetics, gasoline and medical imaging agents. Food is the main source of manganese. People who consume large quantities of grains, beans, nuts and tea may have higher manganese than the average population. Welders and those who work in steel factories may be exposed to high levels of manganese. Manganese is an essential nutrient, and a small amount is necessary for good health. Breathing high levels of manganese may cause hallucinations and slow/clumsy movements. Loss of sex drive and sperm damage have been observed in men exposed to high levels of manganese in workplace air. It cannot be determined at this time if excess manganese can cause cancer. No birth defects or changes in birth weight have been observed in children of workers exposed to high levels of manganese. Studies suggest that extremely high levels of manganese exposure in children may result in behavioral changes, and decreased learning and memory abilities.

Molybdenum (Mo) is used in metal alloys, particularly steel. Main sources of molybdenum include drinking water and foods, especially legumes, grains and organ meats. A certain level of molybdenum is required for human health. Deficiencies in molybdenum may affect neurological development in infants. High levels of exposure to molybdenum may be associated with diarrhea, anemia, gout, joint pain, and problems with the liver, kidneys and intestines. (Information from the World Health Organization Guidelines for Drinking-water Quality)

Mercury (Hg) is a naturally occurring element found in some coal. As coal is burned in electric power plants, mercury is routinely released in air emissions. Mercury may also be released in ashes left over from burning coal in indoor stoves. Concerns have been raised about eating certain kinds of fish (for example, tuna, mackerel and shark) because methyl mercury accumulates in predator fish. At high levels, mercury can damage the nervous system, and health professionals have raised concerns that exposures to the developing fetus can produce long-term developmental delays. NMDOH follows mercury in blood in concentrations greater than 5 µg/l.

Nickel (Ni) is a common natural element. It can be combined with other metals to form alloys. Most nickel is used to make stainless steel. Nickel alloys are also used to make coins, jewelry, valves and heat exchangers. Nickel can combine with other elements to form compounds. These compounds are used in nickel plating, batteries and ceramic coloring. Nickel is released into the atmosphere by oil-burning power plants, coal-burning power plants, and trash incinerators. The major source of nickel exposure for most people is by eating food or drinking water containing nickel. Touching soil, water, coins or jewelry containing nickel is another common way people are exposed to nickel. Avoiding jewelry containing nickel is the primary way families can reduce their exposure to nickel. The most common harmful health effect of nickel is an allergic reaction, which may include itchiness and skin rash, or in extreme cases, asthma attacks. Inhaling large quantities of nickel can cause lung problems such as bronchitis and lung cancer. It is not completely understood what effects nickel has on developing babies, but some studies have shown that nickel can be transferred from mother to infant through the placenta and through breast milk.

Platinum (Pt) is commonly used in electronics, thermometers, laboratory equipment, and jewelry. Short-term exposure to platinum salts may cause irritation to the eyes, nose and throat. Long-term exposures may cause skin and respiratory allergies. Since platinum is a rare element, data on the toxicity of platinum are limited.

Strontium (Sr) is a naturally occurring element found in rocks, soil, dust, coal, and oil. Strontium compounds are used in making ceramics and glass products, pyrotechnics, paint pigments, fluorescent

lights, and medicines. People can be exposed to low levels of strontium by breathing air, eating food, or drinking water. Food and drinking water are the largest sources of exposure to strontium. Exposure to low levels of stable strontium has not been shown to affect adult health, but may harm children. It is not known if exposure to strontium will result in birth defects or other developmental effects in people. Exposure to high levels of strontium can result in impaired bone growth in children.

Thallium (Tl) enters the environment primarily from coal-burning and smelting. Thallium is used in manufacturing electronic devices, switches, and closures for the semiconductor industry. It is also used in the manufacture of special glass and for medical procedures. Eating food contaminated with thallium may be a major source of exposure. People may be exposed to thallium by breathing workplace air in industries that use thallium or smoking cigarettes. In children, touching or eating soil or dust contaminated with thallium may be a major source of exposure. Exposure to high levels of thallium can result in harmful health effects including numbness in fingers and toes, vomiting, diarrhea, hair loss, and effects on the lungs, heart, liver and kidneys. It is not known what the effects are from ingesting low levels of thallium over a long time. Birth defects were not reported in the children of mothers exposed to low levels from eating vegetables and fruits contaminated with thallium. It is not known if breathing or ingesting thallium affects human reproduction.

Tin (Sn) is a natural element in the earth's crust. It is present in brass, bronze, pewter, and some soldering materials. Tin metal is used to line cans for food, beverages, and aerosols. Tin can combine with other chemicals to form compounds, which are used to make plastics, food packages, plastic pipes, pesticides, paints, and pest repellents. Tin is released into the environment by both natural processes and human activities, such as mining, coal and oil combustion, and the production and use of tin compounds. People may be exposed to tin and tin compounds by eating or drinking liquids from tin-lined cans, breathing or touching dusts that contain tin, or coming into contact with household products containing tin compounds, including some plastics. Studies show that ingestion of large amounts of inorganic tin compounds can cause stomachache, anemia, and liver and kidney problems. Breathing, swallowing, or skin contact with some tin compounds can interfere with the way the brain and nervous system work. It is not known whether tin or tin compounds affect human reproduction.

Tungsten (W) is a naturally occurring element. Tungsten is often mixed with other metals to make alloys. These alloys are used in x-ray tubes, light bulbs, high-speed tools, welding electrodes, turbine blades, golf clubs, darts, fishing weights, gyroscope wheels, phonograph needles, bullets, and armor penetrators. Tungsten compounds are used in ceramic pigments, as fire retardant coatings for fabrics, and as color-resistant dyes for fabrics. Exposure to very low levels of tungsten may occur by breathing air, eating food, or drinking water that contains tungsten. No specific health effects have been associated with exposure to tungsten in humans.

Uranium (U) occurs naturally in rocks and soils throughout the world, including in parts of the Navajo Nation and Colorado Plateau. In some rocks, uranium occurs in levels high enough to warrant extraction through mining. Mining and milling of uranium ore have left wastes throughout the Navajo Nation, and these wastes are sources of exposure. More than 10% of unregulated livestock wells that have been tested in recent years have unsafe levels of uranium, that is, levels exceeding the national safe-drinking water limit of 30 µg/l, or 0.03 mg/l. Uranium is considered to be toxic to the human kidneys, even at levels in drinking water below the EPA standard. Uranium is also a naturally occurring radioactive material that emits alpha particles. As an alpha-emitter, uranium may increase the risk of cancer but it is not classified as a human carcinogen. The DINEH Project, CDC and NMDOH have found that urine-uranium levels in the Southwest, including the Navajo Nation, tend to be higher than the rest of the country as reported in the National Health And Nutrition Examination Survey (NHANES).