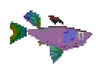
Source of Contaminants

Arsenic

Arsenic occurs naturally in the environment, being the twentieth most common element in the Earth's crust. Arsenic is also the twelfth most common element in the human body. Arsenic is added to the environment by weathering of rocks, burning of fossil fuels, smelting of ores and manufacturing. It is widely distributed in nature and is mainly transported in the environment by water.

For most people, the most significant route of exposure to arsenic is through food. It is a normal component of the diet. Studies by the Food and Drug Administration (FDA) have found that fish and seafood are higher in arsenic content than any other foods and account for the largest contribution to total arsenic intake in the typical adult diet.



Arsenic concentrations are generally highest in groundwater. Surface water concentrations, although generally low, also may be at levels of regulatory concern. Natural ore deposits of arsenopyrite (are-seen-oh-pie-right), a gold bearing mineral, may yield arsenic to ground water under anaerobic (ann-ah-robe-ick) (no oxygen) conditions. Evidence exists that long-term exposure to high arsenic levels increases the risk of cancer. When exposure is by ingestion, the clearest effect is increased risk of skin cancer. Evidence also exists that the risk of internal cancer (liver, lung, bladder, and kidney) is also increased through ingestion. Ingestion of drinking water can be a source of arsenic exposure. Several national surveys of drinking water systems have found arsenic in 3-39 percent of all samples averaging less than 10 ppb.

Arsenic is also a teratogen (tuh-rat-ah-gin) that is, an agent that is capable of crossing the placental membrane and into the metabolic system of the fetus during the first three months of pregnancy that induces abnormalities in a developing fetus.

The level of arsenic allowed in drinking water has been set by the State of Alaska Department of Environmental Conservation (ADEC) at 0.05 mg/l (milligrams per liter) or 50 ppb (parts per billion). At the present time the University of Alaska drinking water has only 8 ppb of arsenic present and we are working diligently on improving treatment methods which will reduce the level to below 1 ppb and aiming for a goal of having 0.00 ppb.

The actual toxicity of arsenic to humans varies depending on such factors as general health and diet. Arsenic is a cumulative substance, which slowly passes out of the body through the hair, fingernails and toenails.

Arsenic can be removed from water by a number of available technologies, the choice of which depends on the amount of water to be treated, the amount of arsenic present, and the presence of other contaminants. At low concentrations in water with few other contaminants present, such as the UAF drinking water, a simple home sized system approved by ADEC is available. The "arsenic filter", an activated alumina filter originally designed for fluoride removal, was extensively tested by the Environmental Protection Agency (EPA) with the cooperation of the ADEC, with follow up testing in homes in Fairbanks, Alaska by Northern Testing Laboratories, Inc. The activated alumina filter requires no electricity or chemicals, and operates at a very high efficiency, removing nearly all of the arsenic. A quality assurance monitoring program should be followed which will verify the performance of the filter and is useful to estimate the remaining useful life of the filter for the homeowner. Another effective arsenic removal treatment technology is reverse osmosis.

Barium

What is barium?
(Pronounced bar'e-um)

Barium is a silvery-white metal found in nature. It occurs combined with other chemicals such as sulfur or carbon and oxygen.

These combinations are called compounds. Barium compounds can also be produced by industry.

Barium compounds are used by the oil and gas industries to make drilling muds. Drilling muds make it easier to drill through rock by keeping the drill bit lubricated. They are also used to make paint, bricks, tiles, glass, and rubber.

A barium compound (barium sulfate) is sometimes used by doctors to perform medical tests and to take x-rays of the stomach.

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.
Some barium compounds dissolve easily in water and are found in lakes, rivers, and streams.
Barium is found in most soils and foods at low levels.
Fish and aquatic organisms accumulate barium.

How might I be exposed to barium?

- Breathing very low levels in air, drinking water, and eating food
- Breathing higher levels in air while working in industries that make or use barium compounds
- Drinking water containing high levels of barium from natural sources
- Breathing air near barium mining or processing plants.

How can barium affect my health?

The health effects of the different barium compounds depend on how well the

compound dissolves in water. Barium compounds
that do not dissolve well in water are not generally harmful and are often used by doctors for medical purposes.

Those barium compounds that dissolve well in water may cause harmful health effects in people. Ingesting high levels of barium compounds that dissolve well in water over the short term has resulted in

- Difficulties in breathing
- Increased blood pressure
- Changes in heart rhythm
- Stomach irritation
- Brain swelling
- Muscle weakness
- Damage to the liver, kidney, heart, and spleen.

We don't know the effects in people of ingesting low levels of barium over the long term. Animal studies have found increased blood pressure and changes in the heart from ingesting barium over a long time. We don't know the effects of barium from breathing it or from touching it.

How likely is barium to cause cancer?

The Department of Health and Human Services, the International Agency for Research on Cancer, and the Environmental Protection Agency (EPA) have not classified barium as to its human carcinogenicity.

Barium has not been classified because there are no studies in people and the two available animal studies were inadequate to determine whether or not barium causes cancer.

Is there a medical test to show whether I've been exposed to barium?

There is no routine medical test to show whether you have been exposed to barium. However, doctors can measure barium in the blood, bones, urine, and feces, using very complex instruments. Due to the complexity of the tests, these tests are usually done only for cases of severe barium poisoning and for medical research.

Benzene

Structure: C_6H_6 Six carbon atoms arranged in the form of a regular hexagon.
Benzene is a highly flammable liquid that is colorless, a hydrocarbon and is an

aromatic compound that has a sweet odor. It evaporates into the air very quickly and dissolves slightly in water.
It is formed from both natural processes and human activities.
Solubility: Benzene is lighter than water and is almost insoluble in it.

Benzene is widely used in the United States; it ranks in the top 20 chemicals for production volume.
Benzene is also a natural part of crude oil, gasoline, and cigarette smoke. Because benzene is found in cigarettes, women who smoke pass even more benzene to their children through their breast milk.
In general, Benzene comes from a point source such as an industrial plant where it is used as a starter to help create other chemicals. It is used to make plastics, synthetic detergent, nylon, synthetic rubber, styrofoam, and aniline dyes. The benzene ring arrangement is also found in fuel for internal combustion engines, in benzaldehyde (an oil made from bitter almonds), and in TNT, aspirin, oil of wintergreen, and some amino acids. Benzene is sometimes called "benzol" when found in these substances.
Every time a gasoline pump is activated benzene is discharged into the air.
Benzene is also released into the environment as a result of natural occurrences such as volcanoes and forest fires.

How might I be exposed to benzene?

- Outdoor air contains low levels of benzene from tobacco smoke, automobile service stations, exhaust from motor vehicles, and industrial emissions.
- Indoor air generally contains higher levels of benzene from products that contain it such as glues, paints, furniture wax, and detergents.
- Air around hazardous waste sites or gas stations will contain higher levels of benzene.
- Leakage from underground storage tanks or from hazardous waste sites containing benzene can result in benzene contamination of well water.
- People working in industries that make or use benzene may be exposed to the highest levels of it.

Benzene's Effects on the Human Body

Breathing lower levels of benzene over a long period of time can harm blood cells and damage bone marrow. This can lead to anemia of excessive bleeding or cancer of the white blood cells (leukemia).
Breathing higher levels (50,000 times the average levels) can cause temporary drowsiness, dizziness, rapid heart rate, headaches,tremors, confusion, and unconsciousness.
Brief exposures of 5-10 minutes to benzene in air at very high levels (500,000 times the average levels) can cause death.

Eating or drinking high levels of benzene can cause:

* Vomiting or irritation of the stomach

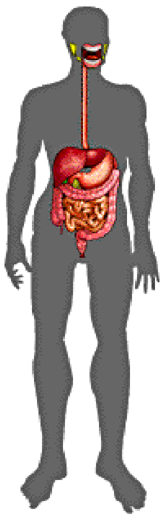
* Dizziness, sleepiness, or convulsions

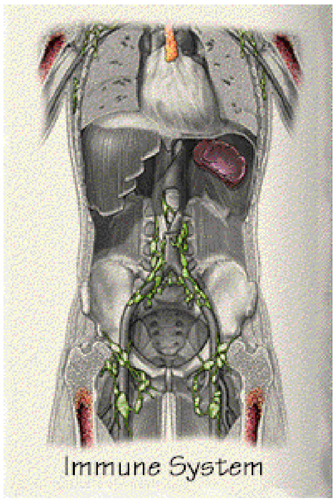
* Rapid heart rate, coma, and death

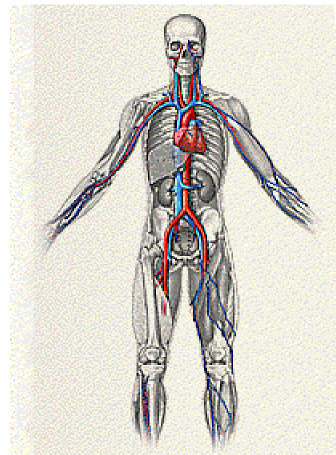
Direct contact with the skin may cause redness and sores. It can also damage your eyes.

Animal studies indicate that benzene may damage genes and may affect the ability to have healthy children.

Benzene affects the circulatory system by increasing heart rate. Benzene affects the digestive system by causing vomiting or irritation of the stomach.







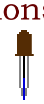
Benzene also harms the immune system. This increases chances of infection and reduces the body's ability to fight off diseases.

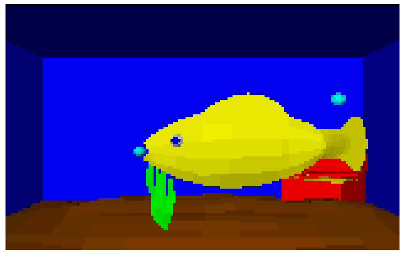
The federal government has made recommendations to protect human health. The Environmental Protection Agency (EPA) sets a maximum permissible level of benzene in drinking water at 5 parts of benzene per billion parts of water (5 ppb) per day for a lifetime of exposure. EPA sets a goal of 0 ppb benzene in drinking water and in rivers and lakes. The maximum permissible level of benzene in water for short-term exposures (10 days) for children is 235 ppb.

We are pleased to report to you that the test results for benzene in the UAF drinking water over the past 10 years have consistently shown that the benzene level is below the detection limit of 0.02 mg/l (milligrams per liter) or 2 parts per billion.

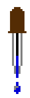
The water any water system delivers to you must meet strict rules of purity. Here are two picture examples to help you understand better what a part per million and part per billion really are.

One part per million, or one milligram per liter, would be equal to putting ONE drop of water, or any contaminant, into 10 gallons of water.





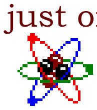
One part per billion, or one microgram per liter, would be equal to adding one drop of water to a 10,000 gallon swimming pool. (A part per billion is 1,000 times smaller than a part per million.)



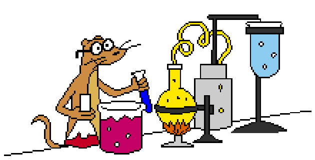
We are very confident that there is 0 ppb of benzene in the water being produced at the UAF water treatment plant because of the extensive treatment being done to produce a high quality drinking water and from the bi-weekly samples being taken, however, we can only report that the level of Benzene is below the laboratories detection limit.

Chlorine

Chlorine is commonly found in nature, but almost always in combination with other building blocks. Chlorine's structure makes it very reactive (its outer shell is missing just one electron), which makes it attractive to other atoms and molecules. Because it



is so reactive, it is very useful to chemists, engineers and other people involved in making things we use every day. When combined with other chemical building blocks, chlorine can change the nature of a substance, and build or improve a product.

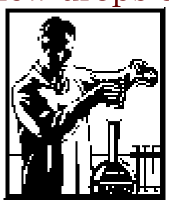


Chlorine is one of 90 natural elements, the basic building blocks of our planet.

To be useful, an element must be relatively abundant or have extremely desirable

properties. Chlorine has both characteristics.
As a result -- over the course of many decades of careful research and development -- scientists have learned to use chlorine and the products of chlorine chemistry to make drinking water safe, destroy life-threatening germs, produce life-saving drugs and medical equipment, shield police and fire fighters in the line of duty, and ensure a plentiful food supply.

Chlorine chemistry is deeply woven into the fabric of our lives. In 1774, in his smallexperimental laboratory, Swedish pharmacist Carl Wilhem Scheele released a few drops of



hydrochloric acid onto a piece of manganese dioxide. Within seconds, a greenish-yellow gas arose.
Although he had no idea at the time, he had just discovered chlorine.

The fact that the greenish-yellow gas was actually an element was only recognized several decades later by English chemist Sir Humphrey Davy. Until that time, people were convinced that the gas was a compound of oxygen. Davy gave the element its name on the basis of the Greek word khloros, for greenish-yellow. In 1810 he suggested the name "chloric gas" or "chlorine."

One of the most effective and economical germ-killers, chlorine also destroys and deactivates a wide range of dangerous germs in homes, hospitals, swimming pools, hotels, restaurants, and other public places.

Chlorine's powerful disinfectant qualities come from its ability to bond with and destroy the outer surfaces of bacteria and viruses.

First used as a germicide to prevent the spread of "child bed fever" in the maternity wards of Vienna General Hospital in Austria in 1846, chlorine has been one of society's most potent weapons against a wide array of life-threatening infections, viruses, and bacteria for 150 years.
Chlorine opens doors to thousands of social and public health benefits. Each time you drive your car, drink a glass of water, wear vinyl rain gear, take vitamins or put on perfume, chlorine is working for you. Some people are surprised to learn that chlorine works for the environment, too.

- Chlorine is an important component in the development and manufacture of materials that make vehicles lighter -- thereby increasing gasoline mileage.
- Crop protection chemicals that depend on chlorine result in far higher crop yields -- thereby relieving pressures to convert to agricultrual use rainforests and other ecologically important lands.
- Chlorine even plays an important role in harnessing solar energy -- purifying the silicon found in grains of sand and helping transform them into solar panel chips.

In so many ways, chlorine is part of the bedrock of sustainable development efforts and other central tenets of modern environmental protection.

Properties
Because it is highly reactive, chlorine is usually found in nature bound with other elements like sodium, potassium, and magnesium. When chlorine is isolated as a free element, chlorine is a greenish yellow gas, which is 2.5 times heavier than air. It turns to a liquid state at -34°C (-29°F), and it becomes a yellowish crystalline solid at -103°C (-153°F).

Order Free Materials from the Chlorine Chemistry Council®, These easy-to-read, full-color brochures illustrate chlorine's beneficial role in our everyday lives with vivid text and photographs.
Please click on the links below to go to their page, you'll be glad you did.

Teacher Education Materials

The Chlorine Chemistry Council® (CCC) is proud of its commitment to science education. Through our partners we have supported the development of several modules and classroom activities that can help teachers when discussing chemical elements and the environment in their classrooms.

The History of Chlorine

Chlorination has played a critical role in protecting America's drinking water supply from waterborne infectious diseases for 90 years. One of the first known uses of chlorine for water disinfection was by John Snow in 1850, when he attempted to disinfect the Broad Street Pump water supply in London after an outbreak of cholera......................

Natural Chlorine? You Bet!

Most people know that table salt, a natural mineral essential for the proper functioning of our nervous and muscular systems, is sodium chloride. But many would be surprised to know that..........

Heres a riddle

This 13-page booklet provides an overview of the following six brochures that highlight the different aspects of chlorine chemistry's societal benefits. An all-purpose, general tool to communicate several benefits of chlorine chemistry, the brochure also provides useful quotations from physicians and health officials on the significance of chlorine chemistry.

Chlorine and Drinking Water: Here's to Your Health

Chlorine's water disinfection capabilities are unmatched. This brochure describes chlorine's key role in providing safe drinking water, in addition to facts about chlorine's role in cleaning up natural disasters.

Chlorine Enhancing Everyday Life

Many people are unaware of the many products made with the help of chlorine chemistry. From microprocessors and wires in computers to vinyl siding, windows and plumbing pipes in homes, this brochure depicts chlorine's diverse role in producing hundreds of products we rely on every day.

Chlorine: An Essential Element of Modern Life

This brochure highlights the role chlorine plays in our day-to-day lives.

Chlorine Can Bring Chemistry to Life

This teachers' manual introduces educators and students to chemistry without tackling the whole periodic table of elements at once. The materials include chemistry background information, student activity sheets and a chlorine chemistry product tree.

Chromium

What is chromium?
(Pronounced kro' me-um)

Chromium is a naturally occurring element found in rocks, soil, plants, animals, and in volcanic dust and gases.
Chromium has three main forms chromium(0), chromium(III), and chromium(VI).
Chromium(III) compounds are stable and occur naturally, in the environment.
Chromium(0) does not occur naturally and chromium (VI) occurs only rarely.
Chromium compounds have no taste or odor.

Chromium(III) is an essential nutrient in our diet, but we need only a very small amount. Other forms of chromium are not needed by our bodies.

Chromium is used for making steel and other alloys, bricks in furnaces, and dyes and pigments, and for chrome plating, leather tanning, and wood preserving. What happens to chromium when it enters the environment?

Manufacturing, disposal of products or chemicals containing chromium, or burning of fossil fuels release chromium to the air, soil, and water.
Chromium particles settle from air in less than 10 days.
Chromium sticks strongly to soil particles.
Most chromium in water sticks to dirt particles that fall to the bottom; only a small amount dissolves.
Small amounts move from soil to groundwater.
Fish don't take up or store chromium in their bodies.

How might I be exposed to chromium?

Breathing contaminated workplace air (stainless steel welding, chromate or chrome pigment production, chrome plating, leather tanning)
Handling or breathing sawdust from chromium treated wood
Breathing contaminated air, or ingesting water, or food from soil near waste sites or industries that use chromium. Very small amounts of chromium(III) are in everyday foods

How can chromium affect my health?

All forms of chromium can be toxic at high levels, but chromium(VI) is more toxic than chromium(III).

Breathing very high levels of chromium(VI) in air can damage and irritate your nose, lungs, stomach, and intestines. People who are allergic to chromium may also have asthma attacks after breathing high levels of either chromium(VI) or (III).

Long term exposures to high or moderate levels of chromium(VI) cause damage to the nose (bleeding, itching, sores) and lungs, and can increase your risk of non-cancer lung diseases.

Ingesting very large amounts of chromium can cause stomach upsets and ulcers, convulsions, kidney and liver damage, and even death.

We don't know if chromium harms the fetus or our ability to reproduce. Mice that ingested large amounts of chromium had reproductive problems and offspring with birth defects.

Skin contact with liquids or solids containing chromium(VI) may lead to skin ulcers. Some people have allergic reactions including severe redness and swelling.

How likely is chromium to cause cancer?

The Department of Health and Human Services has determined that certain chromium(VI) compounds are known carcinogens.
This is based on increased lung cancer in some workers who were exposed to chromium. Animal studies also indicate chromium(VI) is a carcinogen. We do not have enough data to determine if chromium(0) or chromium(III) are carcinogens.

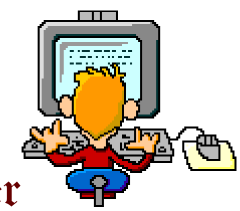
Is there a medical test to show whether I've been exposed to chromium?

Chromium can be measured in the hair, urine, serum, red blood cells, and whole blood.

Tests for chromium exposure are most useful for people exposed to high levels. These tests cannot determine the exact levels of chromium you were exposed to or predict how the levels in your tissues will affect your health.

Skin patch tests may indicate if you are allergic to chromium.

Copper



Copper

Flouride

What are fluorides, hydrogen fluoride, and fluorine?
(Pronounced flo o-rides, hy'dro-jen flo o-ride, flo' o-reen)

Fluorides, hydrogen fluoride, and fluorine are chemically related. Fluorine is a pale, yellow-green gas that has a strong, sharp odor. It combines with hydrogen to make hydrogen fluoride, a colorless gas. Hydrogen fluoride dissolves in water to form hydrofluoric acid.

Fluorine also combines with metals to make fluorides like sodium fluoride and calcium fluoride, both white solids. Sodium fluoride dissolves easily in water, but calcium fluoride doesn't.

Fluorine is used in rocket fuels, glass, enamel, and bricks. Hydrogen fluoride is used mainly to make aluminum and chlorofluorocarbons (CFCs). Fluorides are used in making steel, chemicals, ceramics, lubricants, dyes, plastics, and pesticides (for ants and roaches).

Toothpaste and mouth rinses have fluorides added to prevent cavities. If drinking water supplies are low in fluoride, many communities add fluorides to help prevent cavities. Some skin medicines and cancer treatment drugs also contain fluorides.

What happens to fluorides, hydrogen fluoride, and fluorine when they enter the environment?

Fluorine forms salts with minerals in soil, and doesn't evaporate back into air as a gas.
Fluorides in released to the air from volcanoes and industry are carried by wind and rain to nearby water, soil, and food sources.
They erode from rocks into soil and water, and leach from phosphorus fertilizers into food and water supplies.
Some plants take up and store fluorides in their leaves and stems.

How might I be exposed to fluorides, hydrogen fluoride, and fluorine?

Breathing workplace air where fluorides are used or released
Eating food from soil with high natural levels or high levels from fertilizers or nearby waste sites
Eating toothpaste that contains fluorides
Drinking contaminated water
Ingesting contaminated soil particles.

How can fluorides, hydrogen fluoride, and fluorine affect my health?

Fluorides are everywhere throughout the environment, but at very low levels that are not believed to be harmful.

At high levels, fluorine gas and hydrogen fluoride gas can harm the lungs and heart and can cause death. Even at low levels, these gases can irritate your eyes, skin, and lungs. Contact with hydrofluoric acid can burn the eyes and skin. This mainly happens in the workplace.

Small amounts of sodium fluoride help reduce tooth cavities, but high levels can harm your health. In children whose teeth are forming, high fluoride exposure can cause dental fluorosis with visible changes in the teeth. In adults, high fluoride over a long time can lead to skeletal fluorosis with denser bones, joint pain, and a limited joint movement. This is extremely rare in the U.S.

We don't know the effects of fluoride on reproduction or developing fetuses. Cows and various birds are known to have reproductive problems when they eat or drink large amounts of fluoride. The results from laboratory studies in animal are mixed.

How likely are fluorides, hydrogen fluoride, and fluorine to cause cancer?

Fluorine, hydrogen fluoride, and fluorides have not been classified for carcinogenic effects. Studies in people have not shown fluorides to be carcinogenic, and the studies in animals are mixed. More research is in progress.

Is there a medical test to show whether I've been exposed to fluorides, hydrogen fluoride, and fluorine?

Tests are available to determine recent high exposures to fluorides. The test measures fluorides in the urine. This test cannot predict any specific health effects from fluoride exposure. Most laboratories that test for chemical exposure can perform the test. Bone sampling is done in special cases to measure a long-term exposure to fluorides. Because fluorine, hydrogen fluoride,
and fluorides all enter the body as fluoride, these tests do not distinguish the source of the fluoride

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Fuel Oils

What are fuel oils?
(Pronounced fyool oilz)

Fuel oils are a variety of yellowish to light brown liquid mixtures that come from crude petroleum. Some chemicals found in fuel oils may evaporate easily, while others may more easily dissolve in water.

Fuel oils are produced by different petroleum refining processes, depending on their intended uses. Fuel oils may be used as fuel for engines, lamps, heaters, furnaces, and stoves, or as solvents.

Some commonly found fuel oils include kerosene, diesel fuel, jet fuel, range oil, and home heating oil. These fuel oils differ from one another by their hydrocarbon compositions, boiling point ranges, chemical additives, and uses.

What happens to fuel oils when they enter the environment?

Some chemicals found in fuel oils may evaporate into the air from open containers or contaminated soil or water.
Some chemicals found in fuel oils may dissolve in water after spills to surface waters or leaks from underground storage tanks.
Some chemicals found in fuel oils may stick to particles in water, which will eventually cause them to settle to the bottom sediment.
Some of the chemicals found in fuel oils may be broken down slowly in air, water, and soil by sunlight or small organisms.
Some of the chemicals found in fuel oils may build up significantly in plants and animals.

How might I be exposed to fuel oils?

Using a home kerosene heater or stove, or using fuel oils at work
Breathing air in home or building basements that has been contaminated with fuel oil vapors entering from the soil
Drinking or swimming in water that has been contaminated with fuel oils from a spill or a leaking underground storage tank
Touching soil contaminated with fuel oils
Using fuel oils to wash paint or grease from skin or equipment

How can fuel oils affect my health?

Animal testing is sometimes necessary to find out how toxic substances might harm people or to treat those who have been exposed. Laws today protect the welfare of research animals and scientists must follow strict guidelines.

Little information is available about the health effects that may be caused by fuel oils. People who use kerosene stoves for cooking do not seem to have any health problems related to their exposure.

Breathing some fuel oils for short periods may cause nausea, eye irritation, increased blood pressure, headache, light-headedness, loss of appetite, poor coordination, and difficulty concentrating. Breathing diesel fuel vapors for long periods may cause kidney damage and lower your blood's ability to clot.

Drinking small amounts of kerosene may cause vomiting, diarrhea, coughing, stomach swelling and cramps, drowsiness, restlessness, painful breathing, irritability, and unconsciousness. Drinking large amounts of kerosene may cause convulsions, coma, or death. Skin contact with kerosene for short periods may cause itchy, red, sore, or peeling skin.

How likely are fuel oils to cause cancer?

The International Agency for Research on Cancer (IARC) has determined that some fuel oils (heavy) may possibly cause cancer in humans, but for other fuel oils (light), there is not enough information to make a determination. IARC has also determined that occupational exposures to fuel oils during petroleum refining are probably carcinogenic in humans.

Some studies with mice have suggested that repeated contact with fuel oils may cause liver or skin cancer. However, other mouse studies have found this not to be the case. No studies are available in other animals or in people on the carcinogenic effects of fuel oils.

Is there a medical test to show whether I've been exposed to fuel oils?

There is no medical test that shows if you have been exposed to fuel oils. Tests are available to determine if some of the chemicals commonly found in fuel oils are in your blood. However, the presence of these chemicals in blood may not necessarily mean that you have been exposed to fuel oils.

Lead

What is lead?
(Pronounced led)

Lead is a naturally occurring bluish-gray metal found in small amounts in the earth's crust. It has no special taste or smell. Lead can be found in all parts of our environment. Most of it came from human activities like mining, manufacturing, and the burning of fossil fuels.

Lead has many different uses, most importantly in the production of batteries. Lead is also in ammunition, metal products (solder and pipes), roofing, and devices to shield x-rays.

Because of health concerns, lead from gasoline, paints and ceramic products, caulking, and pipe solder has been dramatically reduced in recent years.

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 released to the air from industry or burning of fossil fuels or waste, it stays in air about 10 days.
Most of the lead in soil comes from particles falling out of the air.
City soils also contain lead from landfills and leaded paint.
Lead sticks to soil particles.
It does not move from soil to underground water or drinking water unless the water is acidic or "soft".
It stays a long time in both soil and water.

How might I be exposed to lead?

Breathing workplace air (lead smelting, refining, and manufacturing industries)
Eating lead-based paint chips
Drinking water that comes from lead pipes or lead soldered fittings
Breathing or ingesting contaminated soil, dust, air, or water near waste sites
Breathing tobacco smoke
Eating contaminated food grown on soil containing lead or food covered with lead-containing dust
Breathing fumes or ingesting lead from hobbies that use lead (leaded-glass, ceramics)

How can lead affect my health?

Lead can affect almost every organ and system in your body. The most sensitive is the central nervous system, particularly in children. Lead also damages kidneys and the immune system. The effects are the same whether it is breathed or swallowed.

Exposure to lead is more dangerous for young and unborn children. Unborn children can be exposed to lead through their mothers. Harmful effects include premature births, smaller babies, decreased mental ability in the infant, learning difficulties, and reduced growth in young children. These effects are more common after exposure to high levels of lead.

In adults, lead may decrease reaction time, cause weakness in fingers, wrists, or ankles, and possibly affect the memory. Lead may cause anemia, a disorder of the blood. It can cause abortion and damage the male reproductive system. The connection between these effects and exposure to low levels of lead is uncertain.

How likely is lead to cause cancer?

The Department of Health and Human Services (DHHS) has determined that lead acetate and lead phosphate may reasonably be anticipated to be carcinogens based on studies in animals. There is inadequate evidence to clearly determine lead's carcinogenicity in humans.

Is there a medical test to show whether I've been exposed to lead?

A blood test is available to measure the amount of lead in your blood and to estimate the amount of your exposure to lead.
Blood tests are commonly used to screen children for potential chronic lead poisoning. The Centers for Disease Control and Prevention (CDC) considers children to have an elevated level of lead if the amount in the blood is at least 10 micrograms per deciliter (10 µg/dL). Lead in teeth and bones can be measured with X-rays, but this test is not as readily available.

Nitrate

Nitrate (NO_3) is a naturally occurring form of nitrogen (N) which is very mobile in water. Because nitrate is tasteless and odorless, water must be chemically tested to determine nitrate contamination.
Nitrogen is essential for plant growth and is often added to the soil in fertilizer to improve plant productivity.
Nitrate is easily dissolved in water, which means that it is difficult to remove from water.
Water moving down through the soil after a rainfall or irrigation carries with it dissolved nitrate down into the ground water table. This is one way that nitrate enters the water supplies of many homeowners who use wells or springs, and many of these residential wells contain nitrate at levels exceeding the safe drinking water standards.

Sources:
Potential sources of nitrate include septic systems, animal waste, commercial fertilizer, and decaying organic matter. Often the nitrate is in the form of ammonia or protein first, which through contact with oxygen and certain bacteria, converts it to the oxidized form we know as nitrate. Sources of nitrate from wastewater include urea, ammonia cleaners, food solids and bacterial cells. It may also result from the breakdown of organic matter buried in the soil. Surface water which comes in contact with a source of nitrate and then moves downward through the soil will carry nitrate into the groundwater. Shallow wells are very susceptible to nitrate contamination because there is less soil and rock to serve as a natural filter between the soil surface and the ground water supply. Nitrate contamination levels may also vary with the time of year depending on the source of the pollutant.

The best method for limiting nitrate in well water is source control. Several measures may be taken to protect your well from direct contamination by surface water.

- Earth berms should be built to divert surface runoff away from the wellhead. The well casing should extend above the ground. If the casing was cut off below ground, an extension may be welded onto the the top of the existing casing. Proper well protection also includes grouting around the outside of the well casing and placing a concrete slab around the wellhead.
- Avoiding overdosing of fertilizer near the well and maintaining the required separation distances between septic tank leach fields and the well.
- Ideally, drinking water supplies (wells or springs) should be up hill and at least 100 feet away from all possible sources of contamination. Remember that any fertilizers or organic materials which are placed near a well are potential contamination sources for your water. It takes only a very small quantity of nitrate entering your water supply to raise the concentration to an unsafe level.

Treatment:

Due to its solubility in water and negative ionic charge, nitrate is not readily removed by filtration and other common home water treatment systems, such as softening or iron filtration. The source of nitrate contamination should be identified and eliminated whenever possible because the treatment of drinking water to remove nitrate is expensive. Take into consideration not only the initial purchase price of the treatment system, but also the cost of regular maintenance to that system.
Nitrate can be removed by a special anion exchange filter which contains a media with a strong affinity for negatively charged ions in water, or by a reverse osmosis treatment system or distillation.

- Ion exchange introduces another substance, normally chloride, to "trade places" with nitrate in water.
- Reverse osmosis forces water under pressure through a membrane to filter out contaminants.

- Distillation boils water, then catches and condenses the steam while nitrate and other minerals remain in the boiling tank.

Simple household treatment procedures such as boiling, filtration, disinfection, and water softening do not remove nitrate from water.
For more information on well protection, water quality testing and water treatment systems, contact your local Alaska Department of Environmental Conservation (ADEC) office.

Health effects

Nitrate is generally not toxic to adults or children over the age of two or three years, however,
infants under six months of age are susceptible to nitrate poisoning. This is due to the bacteria that live in the digestive tracts of newborn babies. These bacteria convert the nitrate (NO_3) to nitrite (NO_2) which can pass through the intestinal wall and into the blood stream. There the nitrite reacts and combines with the hemoglobin (he-moe-globe-bin) and interferes with the ability of the blood to carry oxygen and thus forms methemoglobin (meth-theme-oh-globe-in).
Methemoglobin cannot carry oxygen, thus the affected baby suffers oxygen

deficiency. The resulting condition is referred to as methemoglobinemia (meth-theme-moe-globe-in-knee-me-ah) commonly called "blue baby syndrome."

The most noticeable symptom of nitrate poisoning is a bluish skin coloring, called cyanosis, particularly around the eyes and mouth. A baby with bluish skin should be taken to a medical facility immediately and tested for nitrate poisoning. The blood sample of an affected baby is chocolate brown instead of the normal bright red due to lack of hemoglobin. Methemoglobinemia is relatively simple to treat, and in most reported cases, the affected baby makes a full recovery.

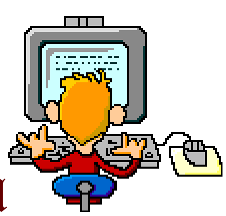
Within several months after birth, the increasing level of hydrochloric acid in a baby's stomach kills most of the bacteria which convert nitrate to nitrite. By the age of six months, the digestive system is fully developed, and the risk of nitrate-induced methemoglobinemia is greatly reduced.

Consumption of high-nitrate water by pregnant women and nursing mothers is not as likely to be harmful to babies as direct consumption. The health effects in these cases are not completely understood, so it is recommended that pregnant women and nursing mothers limit nitrate consumption. Possible connections between nitrate and other health problems such as nervous system disorders, cancer, and heart damage are not well documented and are currently being researched.

ADEC limits the concentration of nitrate in public drinking water supplies to 10 ppm (parts per million or mg/l milligrams per liter) or 10,000 parts per billion µg/l (micrograms per liter) as nitrate-nitrogen (NO_3-N).

Ruminant animals (cattle and sheep) and infant monogastrics (baby pigs and baby chickens) are also susceptible to nitrate poisoning because of bacteria living in their digestive tracts. Horses, even though they are monogastric, are susceptible to nitrate poisoning throughout their lives. Livestock may be exposed to large quantities of nitrate in their feed as well as in contaminated water. Animals which are treated in time can recover fully from nitrate poisoning. Scientific studies indicate that water with greater than 25 mg/L NO_3-N can be harmful to animals.

THM



THM's (Trihalomethanes - try-hal-oh-meth-thanes)

Turbidity

Turbidity

NTU - This means Nephelometric (neff-fell-o-metric) Turbidity Units. This is a standard measurement of cloudiness in water, more sensitive than even your eye can see. We monitor turbidity because it is a good indicator of the effectiveness of our water plant's filtration system. High turbidity can hinder the effectiveness of disinfectants.

Iron & Manganese

Iron and manganese are two of the most common contaminants present in groundwater wells. These two metals have many similar chemical properties and are often removed in the same treatment processes.

Natural ore deposits of iron and manganese bearing minerals yield these metals to groundwater. When drawn from the tap dissolved iron and manganese will often be invisible to the eye but detectable by taste. Both iron and manganese undergo oxidation when exposed to the air in which they become visible as a colored sediment which can settle out in the glass:

Iron can also be added to the water from a rusting plumbing system or from corrosion of pumps, water meters, fittings or an unlined pressure tank. Neither of these metals are considered to be toxic, but are listed by the ADEC, (Alaska Department of Environmental Conservation) as secondary (aesthetic) parameters, affecting the appearance and palatability of the water. Iron produces the familiar rust ring in bathtub fixtures and sinks and orange or yellow stains on clothing, while manganese produces black stains. ADEC limits the amount of iron to 0.3 ppm and manganese to 0.05 ppm in public water supplies.

In low concentrations iron and manganese can be removed by water softeners. At higher levels the softener media may become permanently fouled with iron, so an iron filter with greensand media and potassium permanganate as a regenerant is used. Potassium permanganate is either added as a continuous feed ahead of the iron filter or in the backwash cycle to recharge the media and restore its treatment capacity.

High concentrations of iron or manganese can also be treated by aeration, converting the dissolved iron and manganese to a precipitate form such as described above. The precipitate is removed by a sediment or sand filter. Frequent replacement of the cartridge style filters or backwashing of the sand filters is required to maintain the flow of water through the treatment system.

Several methods are available for testing iron and manganese, with the most accurate being atomic absorption spectrophotometry. Northern Testing Laboratories uses Perkin Elmer Atomic Absorption equipment for the analysis of iron and manganese. NTL's detection limits are in the ppb level for these metals. Because of the very low detection level they can attain, it is recommended that you collect the samples in one of their specially prepared acid washed bottles. To determine the concentration of iron and manganese in the well water, it is highly recommend sampling as near the well as possible. Collecting a sample from a cold water tap in the house would determine the amount of iron or manganese in your finished drinking water supply after treatment such as softeners or reverse osmosis units.

Zinc

What is zinc?
(Pronounced zeenk)

Zinc is one of the most common elements in the earth's crust. It's 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, dye, 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 activities of people 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.
Zinc compounds can move into the groundwater and into lakes, streams, and rivers.
Most of the zinc in soil stays bound to soil particles.
It builds up in fish and other organisms, but it doesn't build up in plants.

How might I be exposed to zinc?

Ingesting small amounts present in your food and water
Drinking contaminated water near manufacturing or waste sites
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
Breathing zinc particles in the air at manufacturing sites.

How can zinc affect my health?

Zinc is an essential element in our diet. Too little zinc can cause health problems, but too much zinc is also harmful.

The recommended dietary allowance (RDA) for zinc is 15 milligrams a day for men (15 mg/day); 12 mg/day for women; 10 mg/day for children; and 5 mg/day for infants. Not enough zinc in your diet can result in a loss of appetite, a decreased sense of taste and smell, slow wound healing and skin sores, or a damaged immune system. Young men who don't get enough zinc may have poorly developed sex organs and slow growth. If a pregnant woman doesn't get enough zinc, her babies may have growth retardation.

Too much zinc, however, can also be damaging to your health. Harmful health effects

generally begin at levels from 10-15 times the RDA (in the 100 to 250 mg/day range). Eating large amounts of zinc, even for a short time, can cause stomach cramps, nausea, and vomiting. Taken longer, it can cause anemia, pancreas damage, and lower levels of high density lipoprotein
cholesterol (the good form of cholesterol).

Breathing large amounts of zinc (as dust or fumes) can cause a specific short-term disease called metal fume fever. This is believed to be an immune response affecting the lungs and body temperature. We do not know the long-term effects of breathing high levels of zinc.

It is not known if high levels of zinc affect human reproduction or cause birth defects. Rats that were fed large amounts of zinc became infertile or had smaller babies. Irritation was also observed on the skin of rabbits, guinea pigs, and mice when exposed to some zinc compounds. Skin irritation will probably occur in people.

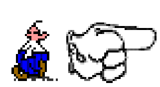
How likely is zinc to cause cancer?

The Department of Health and Human Services, the International Agency for Research on Cancer, and the Environmental Protection Agency (EPA) have not classified zinc for carcinogenicity.

Is there a medical test to show whether I've been exposed to zinc?

Zinc can be measured in your blood or feces. This can tell you how much zinc you have been exposed to. Zinc can also be measured in urine, saliva, and hair. The amount of zinc in your hair tells us something about long-term exposure, but the relationship between levels in your hair and the amount that you were exposed to is not clear. These tests are not routinely performed at doctors' offices, but your doctor can take samples and send them to a testing laboratory.

I'll take you back to the Water Analysis Results and Table Page

This is the way back to the Water Quality Report Opening page 

And of course ...HOH will take you back to the Water Plant

Home page

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This page was last updated on 10/15/00
by HWB & ATB

Webpages originally created and maintained
by Howard (HOH) Burton and his son Anthony
with very special thanks to Rebecca and Shawn