

Chemical Encyclopedia



cadmium

Also Known As:

cadmium oxide, cadmium carbonate, cadmium chloride, cadmium nitrate, cadmium sulfide, cadmium sulfate, cadmium selenium sulfide, cadmium telluride

Description

Cadmium is a heavy metal that occurs naturally in some soils and rocks. It is known to cause cancer in humans. Cadmium levels build up in the body over time and remain in the body.

Cadmium is used in various types of compounds. Cadmium sulfide is the most widely used cadmium compound and is used mainly in pigments. Cadmium is also used in batteries, photovoltaic cells, and infrared windows, metal coatings and electroplating, electrical components, paints, plastics (primarily polyvinyl chloride, or vinyl), ceramic glazes, and textile dyes. It is also an additive used in Teflon[®]. Fertilizers used to grow food may contain cadmium. Shellfish, liver, and kidney can accumulate high levels of cadmium.

Cadmium is released into the environment by the burning of coal, diesel fuel, gasoline and other fossil fuels, incineration of municipal waste, and from polluting metal alloy and electroplating facilities. Cadmium is present in vehicle tires and consequently in the particles resulting from tire wear. Cadmium is also emitted in tobacco smoke.

In the past, cadmium was used as a fungicide for golf courses and home lawns, but by 1997 all uses as pesticides were voluntarily cancelled.

Children are most likely to be exposed to cadmium through food and tobacco smoke. Younger individuals absorb and may even proportionally accumulate more cadmium than adults.

Health Effects

Immediate Health Effects

If SWALLOWED, cadmium is Very Highly Toxic

If ABSORBED THROUGH SKIN, cadmium is Not Available

If INHALED (SNIFFED OR BREATHED IN), cadmium is Very Highly Toxic

Longterm or Delayed Health Effects

Suspected Endocrine Disruptor = May interfere with, mimic or block hormones

Development Toxicant = Can interfere with normal development of a fetus or child

Reproductive Toxicant = Can harm reproductive system

Other

Inhaling high levels of cadmium (e.g., by industrial workers) can cause severe lung damage and irritation, with shortness of breath, chest pain, cough, and a buildup of fluid in the lungs. In severe cases, this may result in death or permanent lung damage and emphysema. Most cadmium levels found in the environment are not high enough to cause lung damage.

If ingested at high levels in foods or water, can cause stomach irritation, nausea, vomiting, salivation, cramps, diarrhea, convulsions, shock, kidney failure, and sometimes death. Short-term health effects include flu-like symptoms, such as chills, headache, aching and/or fever.

Repeated low-level exposures to cadmium can cause kidney damage, leading to stones and tubular-cell death in the kidneys; liver damage; and weakening of bones, causing bone and joint pain and osteoporosis. Long-term exposure can also cause anemia, loss of sense of smell, fatigue, and/or yellow staining of teeth. Cadmium appears to depress some immune functions, mainly by reducing resistance to bacteria and viruses.

Cadmium causes lung cancer and may also be linked to prostate, kidney and bladder cancers in humans.

Cadmium may affect the human endocrine (hormone) system. In test tube studies it behaves like the female sex hormone estrogen. One study found a link between elevated cadmium levels in blood and a decrease in sperm motility and an increase in abnormal sperm morphology and serum testosterone. It may possibly damage the testes (male reproductive glands) and affect the female reproductive cycle.

The offspring of test animals exposed to cadmium during pregnancy had decreased weight gain, effects on the skeleton, and deficits in behavior and learning ability. Cadmium causes brain damage to newborn animals, whereas adults are resistant to these effects. There may be a potential increase in risk of decreased birth weight or developmental problems for humans, but these effects have not been observed.

How Exposures Occur

Human Breast Milk

Cadmium levels in human milk can also be from 5 to 10% of the levels found in the mother's blood.

In Drinking Water

Children can ingest cadmium from drinking contaminated water. Cadmium may leach into groundwater from galvanized zinc pipes containing a cadmium impurity, cadmium in solder used on copper pipes, or from hazardous waste sites.

In Food

Children may be exposed to low levels of cadmium in foods. Shellfish (clams, oysters, mussels, lobster, crab, shrimp) and organ meats (liver or kidney) typically contain the highest cadmium levels. Sunflower seed kernels also can contain relatively high levels of cadmium. The largest contributors of cadmium in the diet, after shellfish, are green leafy vegetables, cereal grains, potatoes, and milk. The application of phosphate fertilizers and sewage sludge may increase cadmium levels in soil, which, in turn, elevates cadmium levels in food crops. Food is the principal means of exposure to cadmium for non-smokers.

Prenatal Exposure

Cadmium does not readily go from a pregnant woman's body into the developing child, but some can cross the placenta.

Rechargeable Batteries, Electronic Equipment, and Other Products

When rechargeable batteries, electronic equipment, or other products made with cadmium are discarded or burned rather than recycled, they can release cadmium into the environment.

Glazes for ceramics and glass, some fabric dyes used by home hobbyists, and some fertilizers, as well as fungicides purchased before 1997, may also contain cadmium.

Vinyl

Small children may be exposed to traces of cadmium if they chew vinyl toys, rain coats, umbrellas, clothing, backpacks, ponchos, school supplies, purses, and sports equipment. Traces of cadmium dust may form on the surface over time. Children might ingest small amounts if they chew these items or put their fingers in their mouths after touching cadmium-contaminated dust. Dermal exposure (through the skin) is not a problem, however.

In Polluted Air or Dust

Children can inhale cadmium when they are exposed to secondhand cigarette smoke. Most smokers have about twice as much cadmium in their bodies as do nonsmokers.

Children can breathe in low levels of cadmium from air in industrial areas near zinc, lead or copper smelters, fossil fuel-burning utility plants, and municipal waste incinerators.

Children may also breathe or ingest dust or soil particles contaminated with cadmium.

Significant Statistics

About 25,000 to 30,000 tons of cadmium are released to the environment each year, about half from the weathering of rocks into river water and then to the oceans. Forest fires and volcanoes also release some cadmium to the air. Release of

cadmium from human activities is estimated at from 4,000 to 13,000 tons per year, with major contributions from mining and from burning fossil fuels.

Public Health Statement for Cadmium, CAS# 1306-19-0. Agency for Toxic Substances and Disease Control, July 1999.<http://www.atsdr.cdc.gov/ToxProfiles/phs8808.html>

Between 1990 and 2000, cadmium production in the U.S. averaged approximately 1,440 metric tons per year. The U.S. was the third largest producer of cadmium in 2000, with about 10% of the world's production.

"Cadmium and Cadmium Compounds: Known to be a Human Carcinogen." *Tenth Report on Carcinogens*. U.S. Department of Health and Human Services, Public Health Service, National Toxicology Program, December 2002.<http://ehp.niehs.nih.gov/roc/tenth/profiles/s028cadm.pdf>

Food and cigarette smoke are the biggest sources of cadmium exposure for people in the general population. Smokers may receive twice the daily dose of cadmium as nonsmokers.

Public Health Statement for Cadmium, CAS# 1306-19-0. Agency for Toxic Substances and Disease Control, July 1999.<http://www.atsdr.cdc.gov/ToxProfiles/phs8808.html>

U.S. manufacturing plants released at least 12 million pounds of cadmium compounds into the environment in 1999, according to the U.S. Environmental Protection Agency's Toxic Release Inventory.

"Cadmium and Cadmium Compounds: Known to be a Human Carcinogen." *Tenth Report on Carcinogens*. U.S. Department of Health and Human Services, Public Health Service, National Toxicology Program, December 2002.<http://ehp.niehs.nih.gov/roc/tenth/profiles/s028cadm.pdf>

Solutions

How to detect cadmium

If you live near a source of cadmium pollution, you may want to also test your garden soil for cadmium before eating foods grown in it.

In Drinking Water: While cadmium is regulated under the Safe Drinking Water Act, if you live near a hazardous waste site, landfill, or metal smelter and draw your drinking water from a well, you may want to have your water tested for cadmium contamination. This law requires that community water systems monitor cadmium levels, and make public when levels exceed the set Maximum Contamination Level (MCL). The MCL for cadmium has also been set at 5 parts per billion.

Community water systems are required to produce annual consumer confidence reports and mail them to every water customer.

If your water source is a well, your water is not monitored for contaminants as is required for public water supplies by the Safe Drinking Water Act. Private testing of the water is necessary.

Even if your water comes from a community water system, contaminant levels can vary from house to house. You can have your water tested by sending samples to a certified laboratory.

You can search for water quality reports from your water provider, obtain information on well water testing and find a list of state-certified drinking water laboratories at the U.S. Environmental Protection Agency's Office of Water's website or call the EPA's Safe Drinking Water Hotline, 800-426-4791.

Most rechargeable batteries are nickel-cadmium, often abbreviated as Ni-Cad. Small children may mistake ni-cad batteries for toys and may accidentally swallow them. If the battery case is damaged, then some cadmium could escape and come in contact with the stomach or intestines. Keep Ni-Cad batteries out of the reach of small children, and teach your older children that the contents in Ni-Cad batteries can be harmful to their health if swallowed or burned.

Read labels on solders, glazes, dyes, fertilizers before purchase or use. Try to avoid those that list cadmium or a cadmium compound as an ingredient.

How to minimize exposure to cadmium

If you use products that may contain cadmium, make sure you are using them in a well-ventilated area and are instructed in the proper use of a respirator.

Keep all nickel-cadmium (Ni-Cad) rechargeable batteries out of reach of children. Recycle them when they've lost their final charge to keep them out of the waste stream. To find a recycling drop-off site, contact the Rechargeable Battery

Recycling Corporation, which has set up collection sites at numerous home stores across the country. See the RBRC website, or call 800-8-BATTERY, find your nearest dropoff site.

Reduce your children's exposure to secondhand cigarette smoke by making your home a smoke-free zone.

If tests on your well water supply have shown higher than permissible levels of cadmium, install a [water filtration system](#) to reduce cadmium in your drinking water. The following water filtration/treatment methods have been approved by EPA for removing cadmium: Coagulation/Filtration, Ion Exchange, Lime Softening, Reverse Osmosis.

Recycle old computers and electrical equipment whenever possible. See [What to do With Your Old Computer](#) for information.

Alternatives

Eating a nutritious diet that is high in zinc, iron and calcium, and has plenty of protein and other nutrients, and low in fat, will minimize your body's absorption of cadmium.

Natural fiber clothing and [wooden or cloth toys](#) do not contain cadmium stabilizers, as vinyl does.

For More information

Books, articles, factsheets and reports

Other government agencies

Agency of Toxic Substances and Disease Registry

Division of Toxicology
1600 Clifton Road E-29
Atlanta, GA 30333
800-447-1544

<http://www.atsdr.cdc.gov>

U.S. Environmental Protection Agency

Office of Ground Water and Drinking Water
Ariel Rios Building
1200 Pennsylvania Avenue, NW
Washington, DC 20460-0003
Safe Drinking Water Hotline:
800-426-4791

<http://www.epa.gov/safewater/>

U.S. Food and Drug Administration

Center for Food Safety and Applied Nutrition
5600 Fishers Lane
Rockville, MD 20857-0001
888-INFO-FDA (1-888-463-6332)

<http://www.cfsan.fda.gov>

Nonprofit organizations

Greenpeace USA

702 H Street NW
Washington, DC 20001
800-326-0959

<http://www.greenpeaceusa.org>

Silicon Valley Toxics Coalition

760 N. First Street
San Jose, CA 95112
408-287-6707

<http://www.svtc.org>

Inform, Inc.

120 Wall St.
New York, NY 10005
212-361-2400

<http://www.informinc.org>

Other websites

Environmental Defense Chemical Scorecard

<http://www.scorecard.org>

Pesticide Action Network Pesticide Database

<http://www.pesticideinfo.org>

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