

Sources of Exposure

Toxicokinetics and Normal Human Levels

Biomarkers/Environmental Levels

ToxGuide™

for

Zinc

Zn

CAS# 7440-66-6

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U.S. Department of Health and
Human Services
Public Health Service
Agency for Toxic Substances
and Disease Registry
www.atsdr.cdc.gov

Contact Information:
Division of Toxicology
and Environmental Medicine
Applied Toxicology Branch

1600 Clifton Road NE, F-62
Atlanta, GA 30333
1-800-CDC-INFO
1-800-232-4636

Zn



General Populations

- The general population may be exposed to zinc in ambient air, food, and water.
- Sources of exposure to zinc include ingestion of food, drinking water, polluted air, and tobacco products.
- Zinc is an essential element needed by the body in small amounts.

Occupational Populations

- Occupational exposure to zinc may occur by inhalation of aerosols, dusts, fumes, or mists containing zinc.
- Occupational exposure to zinc may occur at facilities involved in producing fabricated metal products.
- Exposure to zinc compounds can occur in workers involved in primary metal industries and in the production of stone, clay and glass products.

Toxicokinetics

- Zinc is absorbed through the lungs and skin; however, absorption efficiencies for these routes have not been quantified in humans or animals.
- Absorption of zinc through the gastrointestinal tract is homeostatically controlled; under normal conditions 20–30% is absorbed.
- Once absorbed, zinc is distributed throughout the body, with most (90%) found in muscle and bones.
- Zinc is not metabolized and absorbed zinc is eliminated via the feces and urine.

Normal Human Levels

- The levels of zinc in healthy adults are approximately 1 µg/mL in serum and 0.5 mg/g creatinine in urine.

Biomarkers

- Serum zinc level is the most useful biomarker of zinc exposure.
- High levels of zinc in feces or urine may be indicative of recent exposure.

Environmental Levels

Air

- Average concentration in ambient air in the U.S. is 0.02–0.16 µg/m³ for urban areas and 0.01–0.05 µg/m³ for rural areas.

Sediment and Soil

- Concentrations of zinc in soil samples from the contiguous U.S. range from <5 to 2,900 mg/kg with a mean of 60 mg/kg.

Water

- Zinc levels in surface water ranged from 0.002 to 1.2 mg/L
- Zinc levels in drinking water ranged from 0.003 to 2.0 mg/L.

Reference

Agency for Toxic Substances and Disease Registry (ATSDR). 2005. Toxicological Profile for Zinc. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Chemical and Physical Information

Routes of Exposure

Relevance to Public Health (Health Effects)

Zinc is a metal

- Zinc is a lustrous, blue-white metal.
- It occurs naturally in rocks.
- Because of its reactivity, zinc metal is not found as the free element in nature.
- Zinc metal is used as a protective coating of other metals, such as iron and steel.
- Zinc alloys are used for die casting and can be found in electrical components of household goods. Alloys containing zinc and copper are used to make U.S. penny coins.

- Inhalation (breathing) – Minor route of exposure for the general population. Predominant route of exposure for zinc workers.
- Oral (mouth) – The predominant route of exposure to zinc is via ingestion of food. The general population may also be exposed to zinc in drinking water.
- Dermal – Minor route of exposure to zinc.

Zinc in the Environment

- Zinc in the atmosphere is transported by dry and wet deposition.
- Adsorption of zinc onto suspended particles in water is one of primary removal mechanisms of zinc from the water column. A small portion of zinc in water will exist in the aqueous phase.
- Zinc is strongly adsorbed by soil.
- It is unlikely that zinc is significantly bioconcentrated.

Health effects are determined by the dose (how much), the duration (how long), and the route of exposure.

Minimal Risk Levels (MRLs)

Inhalation

- No inhalation MRLs were derived for zinc.

Oral

- No acute-duration oral MRL was derived for zinc (≤ 14 days).
- An MRL of 0.3 mg Zn/kg/day has been derived for intermediate-duration oral exposure (15–364 days).
- An MRL of 0.3 mg Zn/kg/day has been derived for chronic-duration oral exposure (≥ 1 year).

Health Effects

- Zinc is an essential nutrient for humans and animals that is necessary for the function of a large number of metalloenzymes.
- The effects of inhalation exposure to zinc and zinc compounds vary somewhat with the chemical form of the zinc compound, but the majority of the effects occur within the respiratory tract.
- Exposure to high oral doses can result in symptoms and signs of gastrointestinal irritation (abdominal cramps, vomiting, and diarrhea) in humans.
- Long-term oral exposure to zinc compounds can result in effects associated with early symptoms of copper deficiency, such as decreased number of erythrocytes and decreased hematocrit levels. The copper deficiency is due the interaction between zinc and copper resulting in a decrease in the absorption of copper from the diet.

Children's Health

- It is not known if children are more susceptible to zinc poisoning than adults.