

Sources of Exposure

Toxicokinetics and Normal Human Levels

Biomarkers/Environmental Levels

ToxGuide™ for Tungsten W

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U.S. Department of Health and
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Public Health Service
Agency for Toxic Substances
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General Populations

- The general population may be exposed to tungsten in ambient air and food.
- Tungsten carbide is the most frequently used tungsten compound. It is used in cutting tools, mining and drilling tools, forming and drawing dies, and several other wear-resistant applications.

Occupational Populations

- Occupational exposure to tungsten and its compounds occurs during the production of tungsten metal from the ore and preparation of tungsten carbide powders.
- Exposure to cemented tungsten carbide can occur during the manufacturing and grinding of cemented tungsten carbide hard metal parts.
- Workers can also be exposed to dusts and mists of tungsten and its compounds or cemented tungsten carbide during crushing, mixing, ball milling, loading and unloading, and grinding operations.

Toxicokinetics

- In dogs, about 60% of inhaled tungsten was retained in the lungs and 33% of that was absorbed through the lungs. The remaining tungsten was cleared to the gastrointestinal tract via the mucociliary escalator system.
- Approximately 55–92% of ingested tungsten is absorbed through the gastrointestinal tract, with humans being near the low end.
- Once absorbed, tungsten is distributed throughout the body with the highest concentrations initially in the bone and kidneys, with long term retention mainly in bone.
- Tungsten is not metabolized, and absorbed tungsten is eliminated mainly via the urine. Most absorbed tungsten is eliminated several days after exposure; however, tungsten stored in bone is slowly released and excreted.

Normal Human Levels

- Tungsten blood and urine levels of 1–6 µg/L and 0.085 µg/L, respectively, have been measured in the general population.

Biomarkers

- Blood and fecal tungsten levels are the most useful biomarkers of tungsten exposure. Urine and saliva may also be used to provide information on exposure.

Environmental Levels

Air

- Tungsten concentration in ambient air is generally <10 ng/m³.

Sediment and Soil

- Tungsten concentrations in soils and surface soils range from 0.5 to 83 mg/kg dry weight and from 0.68 to 2.7 mg/kg dry weight, respectively. Surface rock averages 1-1.3 mg/kg.

Water

- Tungsten is not required by EPA to be measured in surface water or groundwater, so information is limited. Levels ranging from <0.002-337 µg/L have been reported, with the lowest and highest in well water.

Reference

Agency for Toxic Substances and Disease Registry (ATSDR). 2005. Toxicological Profile for Tungsten. 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)

Tungsten is a metal

- Pure tungsten is a steel-gray to tin white metal.
- Tungsten is a naturally occurring compound found in some rocks and soil
- Tungsten metal typically does not occur as the free element in nature. There are more than 20 tungsten-bearing minerals.

- Inhalation (breathing) – A route of typically low exposure for the general population. Predominant route of exposure for tungsten and hard metal workers.
- Oral (mouth) – A route of typically low exposure to tungsten is via ingestion of food and water.
- Dermal – Minor route of exposure.

Tungsten in the Environment

- Atmospheric tungsten particulates will eventually settle to the earth's surface by dry deposition or may be removed by wet deposition.
- In water, tungsten will exist as insoluble solids that are expected to adsorb to suspended soil sediment in the water column.
- Under normal environmental conditions, tungsten is expected to have moderate to low mobility in soil.
- There is no information on the extent to which tungsten will bioaccumulate in the food chain.

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 tungsten.
- No oral MRLs were derived for tungsten.

Health Effects

- Pulmonary fibrosis, memory and sensory deficits, and increased mortality due to lung cancer have been attributed to occupational exposure to dusts generated in the hard metal industry. These health effects have been attributed to cobalt, not tungsten. Hard metal is an encapsulated mixture that is composed of tungsten or tungsten carbide and primarily a cobalt binder.

Children's Health

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