

Environmental Health Fact Sheet

Manganese

What is manganese?

- Manganese is a naturally occurring element found in many types of rocks.
- Manganese is an essential nutrient and small amounts are necessary for good health.

What are the uses of manganese?

- Manganese is used principally in steel production to improve hardness.
- Manganese occurs naturally in most foods and may be added to nutritional supplements.
- Manganese is used in a wide variety of products including fireworks, dry-cell batteries, fertilizers, paints, cosmetics, and as a medical imaging agent.
- Manganese has been added to gasoline to improve its octane rating.

Is manganese present in the environment?

- Manganese occurs naturally and is found in soils, sediments, water, and air.
- Manganese-containing dust can be released into the air when fossil fuels such as coal and oil are burned.
- Manganese can also become airborne during certain industrial manufacturing processes.
- In water most of the manganese tends to attach to particles in the water or settle into the sediment.
- Manganese does not breakdown in the environment.

How are people exposed to manganese?

- The primary way people are exposed to manganese is by eating foods rich in the substance or by using manganese-containing nutritional supplements.
- Exposure to manganese can occur when ground water containing it is used for drinking and food preparation.
- Workplace exposure to manganese in air can occur in occupations such as welding, mining, or working in a factory where steel is made.

- Swimming or bathing in water containing manganese may also result in the skin being exposed to manganese.
- Smoking cigarettes exposes the smoker and those nearby to manganese in the tobacco smoke.

How does manganese enter and leave the body?

- Manganese in food or water enters the body through the gut.
- Small amounts of manganese will enter the body through the lungs.
- Only very small amounts of manganese will enter the body through the skin.
- Manganese does not breakdown and most of it leaves the body in the feces within a few days.
- A limited amount of manganese is also able to cross the placenta during pregnancy, enabling it to reach the fetus.

How harmful is exposure to manganese?

- Exposure to large amounts of manganese can harm the nervous system. This may result in behavioral changes or cause slow and clumsy body movements.
- Breathing large amounts of manganese can result in lung irritation which may lead to a chemical pneumonia.
- Loss of sex drive and sperm damage has been observed following workplace exposures.
- Although manganese crosses the placenta, studies in humans have not found increases in birth defects or low birth weight babies.
- Manganese has been observed in animals to cause kidney inflammation and kidney stones.

Can exposure to manganese cause cancer?

- The U.S. Environmental Protection Agency (EPA) concluded that existing scientific information cannot determine whether or not excess manganese can cause cancer.

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

- There are tests that measure the amount of manganese in blood, urine, hair, or feces. Because manganese is normally present in the body, some is always found in these samples.
- Past exposure to manganese is difficult to detect since it is rapidly removed from the body.

- Magnetic resonance imaging, or MRI, can detect the presence of manganese in the brain. However, this type of test cannot determine if health effects have or will occur.
- Normal ranges of manganese are 4 – 15 micrograms per liter ($\mu\text{g/L}$) in blood, 1 – 8 $\mu\text{g/L}$ in urine, and 0.4 – 0.85 $\mu\text{g/L}$ in serum.

What is the treatment for manganese poisoning?

- Emergency medical care should be sought in cases of suspected manganese poisoning.
- Manganese poisoning is treated by removing the person from the source and then with supportive medical care in a hospital setting.
- No specific antidote exists for manganese poisoning.

Are there recommendations to protect public health?

- EPA – Exposure to manganese in drinking water at concentrations of 1 milligram per liter (mg/L) or 1000 parts per billion (ppb) for up to 10 days is not expected to cause any adverse effects in a child.
- EPA – Lifetime exposure to 0.3 mg/L (300 ppb) of manganese is not expected to cause any adverse effects.
- Food and Drug Administration (FDA) – Manganese in bottled water should not exceed 0.05 mg/L.
- Occupational Safety and Health Administration (OSHA) – Legal limit of 5 milligrams per cubic meter (mg/m^3) manganese in air averaged over an 8-hour work day.
- National Academies of Science, Institute of Medicine, Food and Nutrition Board – Dietary Reference Intakes (estimated average daily requirement) for manganese are 2 – 3 milligrams per day (mg/d) for ages 1- 8 and 6 – 11 mg/d for ages 9 and above.
- EPA – Secondary Maximum Contaminant Level for manganese in public water supplies is 50 ppb (0.05 mg/L). However, this is based on aesthetics (odor, taste, color, & clarity) and not health.

What can I do to prevent exposure to manganese?

- Identify and limit sources of harmful exposures.
- Wear appropriate protective gear when welding and limit or prevent exposure to welding fumes.
- While tap and bottled water generally contain safe levels of manganese, well water may sometimes be contaminated with sufficiently high levels of manganese to create a potential health hazard. If drinking water is obtained from a well, it may be wise

to have the water checked for manganese to ensure the level is below the current guideline established by the EPA.

- Cease smoking cigarettes and avoid exposure to tobacco smoke.

What should I do if I believe I am ill as a result of exposure to manganese?

- If you experience symptoms that you think may be related to manganese exposure, you should consult your physician.

Where can I get more information?

For more information, contact:

The Pennsylvania Department of Health, Division of Environmental Health Epidemiology, P.O. Box 90, Harrisburg, Pennsylvania, 17108. Telephone number: 717-787-1708 or visit the following websites:

The U.S. Department of Health and Human Services, Public Health Service, Agency for Toxic Substance and Disease Registry's Information Center. Telephone number: 800-232-4636.

References

- (1) U.S. Department of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry (ATSDR). 2000. Toxicological Profile for manganese.
- (2) Food and Nutrition Board, Institute of Medicine, National Academies; Dietary Reference Intakes (DRIs): Tolerable Upper Intake Levels, Elements searched 7/21/11 at http://fnic.nal.usda.gov/nal_display/index.php?info_center=4&tax_level=3&tax_subject=256&topic_id=1342&level3_id=5140.
- (3) U.S. Department of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry, Division of Toxicology and Environmental Medicine, ToxFAQs™; Manganese, September 2008.