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Spotlight Air Environmental
SAE Public Health Researcher

Notes on a Cancer-Causing Toxic Metal: Cadmium

Cadmium has no known nutritional value for humans, but it is one of the most toxic heavy metals in the environment. Like other toxic metals, cadmium is released into the environment from both natural sources and industrial activities. Cadmium exists in the earth's crust and gets released into the environment due to rock weathering and volcanic activities in oceans, seas and over land. Industrial activities—which are sources for the release of cadmium into aquatic and terrestrial environments--include, among others, mining and smelting of metals such as zinc, lead and copper; the burning of fossil fuels such as coal; the incineration of waste materials; and the production and recycling of nickel-cadmium batteries. The application of phosphate fertilizers and animal manure in the context of large-scale agriculture is another major contributor of cadmium pollution of soils.

Ingestion is a major pathway for the entry of cadmium into the human body. As cadmium accumulates in soils from the various sources, it is ready for uptake and accumulation in plants, which becomes foods for humans. Such staples including various kinds of vegetables, fruits, roots, nuts, and seeds. Similarly, cadmium gets into our body when we eat fish or shellfish. The same is true of consuming meats of internal organs such as kidney, liver, tongue, etc. Infants may ingest cadmium through breast feeding. Drinking water may carry cadmium due to leaching of soils or water pipes. Another major pathway for cadmium to get into the human body is inhalation of cigarette smoke or dust particles from the air as particulate matter.

When thinking about the toxicity of cadmium, it would be useful to keep in mind a couple of the metal's characteristics. First, cadmium can be very harmful even in trace levels. Second, cadmium lacks an effective excretion mechanism, which makes the process slow. Third, cadmium has a long half-life of 16 to 30 years. These characteristics interact to facilitate the toxin's accumulation in the human body to cause dysfunction in a number internal organs, including lung, kidney, heart, brain, and urinary organs. In addition, cadmium has the effect of undermining the strengths of the bones of the skeletal system. As a carcinogen, cadmium is potentially linked to cancers of several organs, including lung, kidney, prostate, bladder, pancreas, breast, and brain.

Sources
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2. Tchounwou, Paul B., et al, "Heavy Metals Toxicity and the Environment" (https://pmc.ncbi.nlm.nih.gov/articles/PMC4144270/pdf/nihms414261.pdf)
3. World Health Organization (WHO), "Chemical Fact-Sheets: Cadmium" (https://www.who.int/publications/m/item/chemical-fact-sheets--cadmium)