



# CADMIUM

**Cadmium is a naturally occurring element, a metal that is present at trace levels in the earth's crust, in water and in the air. In its pure form, it has a melting point of 321°C. It is used in a range of everyday objects, most notably in NiCd batteries. It is also found in yellow, red and orange pigments that are used to colour plastics, ceramics, glasses and enamels. It has excellent resistance to corrosion, and is often used in coatings for materials that will be exposed to alkaline or salt-water conditions.**

## Cadmium and health

Cadmium is not an essential element for animal or plant life and, like many other elements, at elevated levels it can be toxic to both humans and livestock. The effect of cadmium intake varies depending on whether the exposure is acute (short-term exposure to very high levels) or chronic (long-term exposure to lower levels).

Acute exposure to cadmium is extremely rare in today's world and is likely to occur only in industrial environments that involve the use of cadmium compounds. Inhalation of cadmium fumes severely damages the lungs. Eating or drinking very high levels of cadmium severely irritates the stomach, leading to vomiting and diarrhoea.

Chronic exposure to cadmium causes a build-up of cadmium in the kidneys, which can result in kidney disease. Other long-term effects include lung damage (from inhalation) and bone disease. There is a suggestion that cadmium may also be implicated in some cancers, but the link remains uncertain.

## Exposure to cadmium

In earlier times, the main concern regarding cadmium exposure was industrial settings. Prior to the establishment of modern standards for health and safety, cadmium

exposure was a risk for workers in the metals industry. Today, these risks are carefully controlled. Industrial emissions of cadmium to the environment have been decreasing steadily since the 1960s, with the result that levels of cadmium in air, water and food have also fallen during this time.

The natural occurrence of cadmium in the environment means that the general public is exposed to this element, but at far lower levels than would typically be found in industrial settings. Members of the general public are exposed to cadmium by both inhalation and ingestion.

## Ingestion of cadmium

For non-smokers, it is estimated that 95% of an individual's cadmium intake is by ingestion, as a component of the foods in a normal diet. It is important to note that the majority of cadmium ingested by humans is excreted, and it is estimated that only 5% of cadmium in the diet is actually absorbed into the body.



In addition, absorption of cadmium is affected by the nutritional status of the individual. If a person is deficient in iron, zinc or calcium, they have an increased propensity to absorb cadmium from their food. An iron-deficient person could eat exactly the same diet as a non-iron-deficient individual yet retain more cadmium. People with reduced iron stores have been shown to have increased uptake of dietary cadmium.

Cadmium occurs at very low levels in our food. Some foods are higher in cadmium than others. Plants tend to store cadmium in leafy parts, rather than roots or tubers. As a result, spinach (leaf) is naturally higher in cadmium than pumpkin (fruit). However, foods that are naturally high in cadmium do not necessarily result in higher levels being retained within the individual who eats them. For instance, sunflower seeds and oysters are both naturally high in cadmium, but people who eat large amounts of these do not show high levels of blood or urine cadmium. It is thought that foods high in cadmium are also enriched in substances that inhibit the uptake of this cadmium by the body.

The World Health Organisation has set a provisional tolerable monthly intake (PTMI) for cadmium of 25 µg/kg body weight, and the typical New Zealand diet has been shown to be well below this level (2009 New Zealand Total Diet Study).



### Inhalation of cadmium

For non-smokers, inhalation of cadmium is responsible for an estimated 5% of the total cadmium intake. Cadmium that is inhaled by non-smokers is found in the air we breathe; it enters the atmosphere naturally as a result of forest fires and volcanic eruptions. It is also added to the air through the combustion of fossil fuels.

For smokers, however, inhalation may account for 50% of cadmium intake. It has been estimated that a single cigarette contains 1-2 µg cadmium, and about 10% of this is retained by the body when that cigarette is smoked. The Centres for Disease Control has identified cigarette smoking as the most likely source for elevated cadmium levels in individuals.

Cadmium inhaled as a contaminant of dust particles, e.g. from soil or fertiliser dust, is unlikely to have much effect, as the size of the particles involved means that the dust would not enter the lungs or would be removed by the normal clearing mechanisms of the human body. In other words, they would be filtered out by nasal hairs, or deposited on the mucous

lining of the bronchial tubes, swept upwards to the throat and removed by coughing.

If mucous produced by the lungs is swallowed, then inhaled cadmium can be ingested. However, this is not likely to contribute significantly to cadmium intake. It has been estimated that a 70 kg person might ingest 100 mg of this type of dust per day. If we assume the worst-case scenario likely to occur in New Zealand agriculture (that 100% of the cadmium in the dust is absorbed by the body, and that the dust contains 30 ppm cadmium), then an individual would receive 3 µg cadmium, or 0.04 µg/kg body weight. This is well below the threshold set by the World Health Organisation (equivalent to 0.82 µg/kg body weight/day).



## REDUCING EXPOSURE TO CADMIUM

Measures to reduce exposure to cadmium vary depending on the precise circumstances of the individual involved. For the general public, exposure to cadmium can be reduced by not smoking, and by eating a balanced diet, i.e. one that is not dominated by a specific food item or group and that supplies adequate amounts of all the nutrients needed for human health.

Household products that contain cadmium should be both stored and disposed of safely. In particular, NiCd batteries should be kept out of the reach of young children and should be disposed of through an appropriate recycling depot. They should not be burned.

Workers in industries that involve cadmium should follow the health and safety guidelines of their company, and should avoid carrying cadmium-containing dust home on their clothing, skin, hair or tools.

### Testing for exposure to cadmium

Some medical laboratories can test for cadmium exposure. Blood tests can be used to show recent exposure to cadmium; urine tests can be used to show recent and earlier exposure to cadmium.

For more information on cadmium, see the website of the Centres for Disease Control, [www.cdc.gov](http://www.cdc.gov)