Ontario

Fact Sheet

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Ministry of the Environment programs and initiatives

Cobalt in the environment

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Cobalt is an element that occurs naturally in many different chemical forms throughout our environment. Small amounts of cobalt are essential for good health. It is a natural earth element and is present in trace amounts in soil, plants and in our diets. In pure form it is a steel-grey to black shiny hard metal. It also exists as Cobalt II and Cobalt III, which form a number of organic and inorganic salts.

Cobalt usually occurs in association with other metals such as copper, nickel, manganese and arsenic. Small amounts are found in most rocks, soil, surface and underground water, plants and animals.

Natural sources of cobalt in the environment are soil, dust, seawater, volcanic eruptions and forest fires. It is also released to the environment from burning coal and oil, from car, truck and airplane exhausts, and from industrial processes that use the metal or its compounds.

Cobalt and its salts are used in a variety of processes — to make superalloys which maintain their strength at high temperatures; as a paint drier; as a ground coat for porcelain enameling used on steel bathroom fixtures and large appliances; and as an ingredient of coloured pigments.

Some radioactive isotopes of cobalt, such as Cobalt 60, are used in treating patients in nuclear medicine and in research.

Natural cobalt can stay in the air for a few days, but it will stay for years in water and soil.

How much cobalt is there usually in our soil?

All soil contains some amount of cobalt. The average concentration of cobalt in soils throughout the world is 8 parts per million (ppm). In Ontario, background cobalt concentrations in old urban parkland can reach an upper limit of 17 ppm. Concentrations in rural parkland can reach 16 ppm. Cobalt concentrations in soils around Ontario mine sites have been reported as high as 6,450 ppm.

Toxic effects on plants are unlikely to occur below soil cobalt concentrations of 40 ppm. However, concentration in the soil is not the only factor determining toxicity. Plant species vary in their sensitivity to cobalt, and soil type and soil chemistry greatly influence cobalt toxicity. One of the most important soil properties is soil acidity. The more acidic the soil, the greater the potential for cobalt toxicity, at any concentration. Cobalt is rarely the contaminant of greatest concern at contaminated sites in Ontario, since it has relatively low toxicity. Soils with high cobalt concentrations usually also have high arsenic and, nickel concentrations and these elements are generally more toxic to plants and humans than cobalt.

Is cobalt harmful?

Cobalt is essential in trace amounts for human life. It is part of vitamin B-12, and plays a key role in the body's synthesis of this essential vitamin. Cobalt has also been used as a treatment for anemia, because it causes red blood cells to be produced.

The toxicity of cobalt is quite low compared to many other metals in soil.

Exposure to very high levels of cobalt can cause health effects. Effects on the lungs, including asthma, pneumonia, and wheezing, have been found in workers who breathed high levels of cobalt in the air.

In the 1960s, some breweries added cobalt to beer to stabilize the foam. Some people who drank large quantities of the beer experienced nausea, vomiting, and serious effects on the heart. However, effects on the heart have not been seen in people with anemia or pregnant women medically treated with cobalt. Animal studies have found problems with the development of the fetus in animals exposed to high concentrations of cobalt during pregnancy. However, cobalt is also essential for the growth and development of certain animals.

The International Agency for Research on Cancer has determined that cobalt is a possible carcinogen to humans. Studies in animals have shown that cobalt causes cancer when placed directly into the muscle or under the skin. Cobalt did not cause cancer in animals that were exposed to it in the air, in food, or in drinking water. Cobalt and cancer studies on people are inconclusive.

How does exposure to cobalt occur?

Everyone in the world is exposed to at low levels in air, water, and food. Estimates of exposure for cobalt suggest that typically more than 99 per cent is through the food we eat everyday. Exposure through drinking water, air and soil contact is considered very small.

Higher exposures can occur for workers who are exposed to cobalt in industries that process it or make products containing cobalt.

Can cobalt exposure occur through eating backyard vegetables?

It is unlikely that eating backyard vegetables will result in significant exposure to cobalt. In general, cobalt concentrations in vegetation rarely exceed 1 ppm, and high cobalt concentrations are almost never found in fruits or seeds. Even in areas of Ontario where cobalt concentrations in surface soil are very high, the amount of cobalt in local garden soils has been found to be just above background concentrations. This is because garden soils are often deeply cultivated, which mixes contaminated surface soil with often cleaner subsoil, and improved through the addition of clean soil, manure, compost, peat moss and other soil conditioners.

Sampling of garden vegetables in areas with soil cobalt concentrations of up to 28 ppm found the highest cobalt concentrations in plant tissue to be 11ppm in beet roots and 4 ppm in beet tops. These tissue concentrations are well below the concentrations of 25 - 100 ppm that are considered the threshold for toxicity in plants.

Who is at risk?

Elemental cobalt poses no recognized health hazard to people who are exposed to low levels in food or the environment. Exposures for children will tend to be higher than for adults because children have smaller body weights. No special age groups have been identified as being sensitive to the effects of cobalt and adverse effects have been seen only in adults.

What can you do to reduce exposure to cobalt in soil?

No special measures are needed to reduce exposure to environmental cobalt to people, but a person can take simple steps to reduce exposure, if they wish to. These steps apply to reducing exposures to any metal in soil in any location.

Where cobalt concentrations in soil are greater than 40 ppm, and cobalt toxicity to vegetation is suspected, cobalt uptake into plants can be reduced by liming the soil and by incorporating uncontaminated soil, peat moss, compost or manure into the soil.

Contaminated soil can also be removed, or exposure can be reduced by covering the soil with clean soil or sod. Soil can also be paved over or covered with paving stones or decking. Other things you can do:

1. Wash you hands and face and those of your children after working or playing outdoors and before eating.
2. Clean your home regularly using a damp mop or damp cloth. Vacuuming and sweeping can increase dust levels in the home. Use a phosphate cleaner at least once a week especially near window sills and doors. Use rugs, curtains and slipcovers that can be cleaned easily.
3. Have forced air ducts cleaned by professionals and replace furnace filters often.
4. Avoid bringing outdoor dirt inside by removing outdoor shoes.
5. Brush pets often as their fur collects dust. Pet should be brushed outside if possible
6. Keep children's toys and play areas clean; discourage mouthing activities such as eating dirt or sucking on dirty objects.
7. Before eating, thoroughly wash all vegetables thoroughly and peel skin from root crops.

How can you get more information?

Contact your local office of the Department of Public Health or your medical doctor if you are concerned about being exposed to cobalt or have questions about health effects.

If you have questions about possible cobalt contamination, contact your local office of the Ministry of the Environment for more information or call the Ministry's Public Information Centre at 1-800-565-4923.

Sources

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