Chromium

General Information

Key Points

- chromium occurs in two forms- a natural form as chromium (III) and a mainly synthetic form as chromium (VI)
- chromium (III) is found naturally in plants, animals and rocks
- chromium (VI) is mainly manufactured and is used in a variety of industrial processes
- breathing in chromium (III) can lead to swelling of the lungs and airways
- breathing in chromium (VI) can lead to cough, swelling of airways and chest pain
- repeated exposure can lead to inflammation of the lungs, kidney damage, and cancer of lung
- swallowing chromium can lead to abdominal pain, diarrhoea and heart failure, as well as damaging the gut, liver and kidneys and even death
- skin contact to chromium (VI) can cause dermatitis or skin ulcers if left untreated
- chromium (VI) may cause cancer
- chromium (VI) may be harmful to the reproductive system and to the unborn child
Public Health Questions

What is chromium?
Chromium is a metal that is widely distributed in the earth’s crust (soil and rocks), air and water. It mainly occurs in the environment in two forms trivalent chromium (chromium III) and hexavalent chromium (VI). Naturally occurring chromium exists mainly as chromium III. Chromium VI is rarely found in nature and is produced mainly from commercial and industrial processes. The different types of chromium exhibit different properties, which is important for assessing the risk of potential harm to human health. From here on, the use of the term chromium will refer to both forms unless stated.

Chromium (VI) compounds present the most significant effect on health.

What is chromium used for?
Chromium (VI) is used in the production and use of stainless steel and other chromium alloys, in pigments for paint and pottery, as catalysts in the chemical manufacturing industry, for the production of dyestuffs, in leather tanning agents, wood preservation and for electroplating/anodising.

Chromium (III) is used in a wide variety of industrial processes such as in the tanning of leather, in the manufacture of special alloys, plastics, ceramics and glass and as decorative plating for taps and door handles, as high temperature catalysts, and as dietary supplement and textile dyeing to fix dyes to fibres, especially in wool dyes.

How does chromium get into the environment?
Naturally occurring chromium exists predominantly as chromium III, occurring in rocks, soil, plants, animals, volcanic dust and gases and in coal and oil. It can also be released into the water through land erosion.

Chromium (III and VI) can also enter the air, soil and water from its use within industry through the combustion of fossil fuels and from domestic and industrial waste. It can also be released during the production of chromium VI compounds and metal treatment.

How might I be exposed to chromium?
Exposure to chromium may occur through contaminated air, food or water containing chromium. Exposure can occur through skin contact with certain consumer products such as chrome plated engine parts and a metal polish known as Green Rouge although these types of exposure are unlikely to cause health issues. Exposure to chromium may also occur by inhaling cigarette smoke.

Chromium (III) is an essential trace element, which is required by the body to help break down glucose and fat. Chromium is present in a variety of foodstuffs as well as available as a dietary supplement. Main sources of Chromium (III) in foodstuffs include bread and rolls,
milk and dairy products, and chocolate, although it is also present in meats, fruits and vegetables too.

Workers employed in industries that use or produce chromium-containing compounds, such as tanneries, manufacture or use of chromates and chrome pigments and metal industries may be exposed to higher levels of chromium than the general population. However, safe limits are enforced to protect the employees; such levels are below those that are thought to cause harmful effects.

If I am exposed to chromium how might it affect my health?

The presence of chromium (III and VI) in the environment does not always lead to exposure. In order for chromium (III and VI) to cause any adverse health effects, you must come into contact with it. You may be exposed by breathing, eating, or drinking the substance or by skin contact. Following exposure to any chemical, the adverse health effects you may encounter depend on several factors, including the amount to which you are exposed (dose), the way you are exposed, the duration of exposure, the form of the chemical and if you are exposed to any other chemicals.

Depending on the type of chromium (III or VI) compound, exposure may be harmful to health. Chromium (III) compounds are less harmful than chromium (VI) compounds.

Chromium (VI) trioxide, chromates and dichromates are highly toxic by all exposure routes. Breathing in chromium (VI) for a short period of time causes irritation of the airways, cough and chest pain. If swallowed, it can cause abdominal pain, diarrhoea and heart failure, as well as damaging the gut, liver and kidneys and even death. If skin is in contact with chromium (VI), dermatitis (a rash caused by the skin reacting to a substance it comes into contact with) or skin ulcers may develop if left untreated, and chromic acid can cause burns. Splashes into the eye may cause eye damage.

Repeat exposure can lead to ulcers in the nose or create holes in nasal septum. It can also cause inflammation of the lungs, kidney damage, and cancer of lung. Long term exposure to some inhaled chromium (VI) compounds may cause irritation of the airways, nose ulcers, damage to the gut, liver and kidneys affect the blood or cause lung cancer.

Short-term exposure to chromium (VI) compounds can cause allergic responses (e.g. asthma-like symptoms and allergic dermatitis) in sensitised individuals. Long-term exposure of the skin to chromium (VI) compounds can cause sores and ulcers, which may penetrate deep into the skin if left untreated.

Breathing in chromium (III) compounds for a long time causes swelling of the airways and lungs.
Can chromium cause cancer?
The International Agency for Research on Cancer (IARC) has classified Chromium (VI) as causing cancer in humans (group 1). Breathing air containing chromium (VI) compounds for long periods may cause lung cancer.

There is not sufficient evidence to suggest ingestion of chromium (VI) in food or water can cause cancer.

The IARC have classified chromium (III) compounds as not classifiable as to their ability to cause cancer due to inadequate evidence in humans, thus chromium (III) compounds are not considered to cause cancer in humans.

Does chromium affect pregnancy or the unborn child?
There is some limited evidence to suggest that chromium (VI) compounds e.g. potassium dichromate may be toxic to the reproductive system and the unborn child. Chromium (III) compounds are not considered to be harmful to the unborn child at levels not harmful to the mother.

How might chromium affect children?
Children exposed to chromium compounds would be expected to display similar effects to those seen in adults.

Are certain groups more vulnerable to the harmful effects of chromium?
People with breathing problems such as asthma may be more sensitive to the effects of chromium.

Individuals who are sensitised to chromium may develop an allergic response (e.g. allergic contact dermatitis) when they are exposed to chromium.

What should I do if I am exposed to chromium?
It is very unlikely that the general population will be exposed to a level of chromium high enough to cause adverse health effects. If you have any health concerns regarding exposure to chromium seek guidance from your GP or contact NHS 111.
Additional sources of information
UKTIS. Best Use of Medicines in Pregnancy (bumps) http://www.medicinesinpregnancy.org/

NHS Choices - Poisoning: http://www.nhs.uk/Conditions/Poisoning/Pages/Introduction.aspx

NHS Choices - Other vitamins and minerals: http://www.nhs.uk/Conditions/vitamins-minerals/Pages/Other-vitamins-minerals.aspx#chromium

This information contained in this document from the PHE Centre for Radiation, Chemical and Environmental Hazards is correct at the time of its publication.

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