Cobalt

Cobalt (chemical symbol Co) is a metal that may be stable (non radioactive, as found in nature), or unstable (radioactive, man-made). The most common radioactive isotope of cobalt is cobalt-60.

On this page:

The Basics

Who discovered cobalt and cobalt-60?
Where do cobalt and cobalt-60 come from?
What are the properties of cobalt-60?
What is cobalt-60 used for?

Exposure to Cobalt-60

How does cobalt-60 get into the environment?
How does cobalt-60 change in the environment?
How do people come in contact with cobalt-60?
How does cobalt-60 get into the body?
What does cobalt-60 do once it gets into the body?

Health Effects of Cobalt-60

How can cobalt-60 affect people's health?
Is there a medical test to determine exposure to cobalt-60?

Protecting People From Cobalt

How do I know if I'm near cobalt-60?
What can I do to protect myself and my family from cobalt-60?
What is EPA doing about cobalt-60?

The Basics

Who discovered cobalt and cobalt-60?

In 1735, a Swedish scientist, George Brandt, demonstrated that a blue color common in colored glass was caused by a new element, cobalt. Previously, people thought that bismuth, which occurs in nature with cobalt, was the cause. Radioactive cobalt-60 was discovered by

http://www.epa.gov/radiation/radionuclides/cobalt.html
Where do cobalt and cobalt-60 come from?

Non radioactive cobalt occurs naturally in various minerals, and has been used for thousands of years to impart blue color to ceramic and glass. The radionuclide, cobalt-60, is produced for commercial use in linear accelerators. It is also produced as a by-product of nuclear reactor operations, when structural materials, such as steel, are exposed to neutron radiation.

What are the properties of cobalt-60?

Cobalt (including cobalt-60) is a hard, brittle, gray metal with a bluish tint. It is solid under normal conditions and is generally similar to iron and nickel in its properties. In particular, cobalt, like iron, can be magnetized.

What is cobalt-60 used for?

Cobalt-60 is used in many common industrial applications, such as in leveling devices and thickness gauges, and in radiotherapy in hospitals. Large sources of cobalt-60 are increasingly used for sterilization of spices and certain foods. The powerful gamma rays kill bacteria and other pathogens, without damaging the product. After the radiation ceases, the product is not left radioactive. This process is sometimes called "cold pasteurization."

Cobalt-60 is also used for industrial radiography, a process similar to an x-ray, to detect structural flaws in metal parts. One of its uses is in a medical device for the precise treatment of otherwise inoperable deformities of blood vessels and brain tumors. Radionuclides, such as cobalt-60, that are used in industry or medical treatment are encased in shielded metal containers or housings, and are referred to as radiation 'sources.' The shielding keeps operators from being exposed to the strong radiation.

Exposure to Cobalt-60

How does cobalt-60 get into the environment?

Occasionally, medical or industrial radiation sources are lost or stolen. We call these "orphan sources." They pose a significant risk:

On a number of occasions, people have handled them, not knowing what they were, and have been exposed.

Sometimes sources find their way into municipal landfills, where it is illegal to dispose of them.

Because of their metallic housings, sources can get mixed in with scrap metal and pass undetected into scrap metal recycling facilities. If melted in a mill, they can contaminate the entire batch of metal and the larger facility, costing millions of dollars in lost productivity and cleanup costs. The scrap industry uses radiation
detectors to screen incoming material. However, sources that are under large loads may be undetected initially.

Cobalt-60 can also be released to the environment through leaks or spills at nuclear power plants, and in solid waste originating from nuclear power plants. Nuclear Regulatory Commission regulations allow small amounts of cobalt-60 to be released into the air, or poured down drains as part of a liquid.

How does cobalt-60 change in the environment?

Cobalt-60 undergoes radioactive decay with the emission of beta particles and strong gamma radiation. It ultimately decays to non radioactive nickel. The half-life of cobalt-60 is 5.27 years. This is short enough to make isolation a useful treatment strategy for contaminated areas. In some cases, simply waiting 10 to 20 years allows for sufficient decay to make the site acceptable for use again.

How do people come in contact with cobalt-60?

Most exposure to cobalt-60 takes place intentionally during medical tests and treatments. Such exposures are carefully controlled to avoid the adverse health impacts and to maximize the benefits of medical care. Accidental exposures may occur as the result of loss or improper disposal of medical and industrial radiation sources. Though relatively rare, exposure has also occurred by accidental mishandling of a source at a metal recycling facility or steel mill.

How does cobalt-60 get into the body?

People may ingest cobalt-60 with food and water that has been contaminated, or may inhale it in contaminated dust. The major concern posed by cobalt-60, however, is external exposure to its strong gamma rays. This may occur if you are exposed to an orphaned source, or if you come in contact with waste from a nuclear reactor (though this is very unlikely).

What does cobalt do once it gets into the body?

Once in the body, some cobalt-60 is quickly eliminated in the feces. The rest is absorbed into the blood and tissues, mainly the liver, kidney, and bones. Absorbed cobalt leaves the body slowly, mainly in the urine.

Health Effects of Cobalt-60

How can cobalt-60 affect people’s health?

All ionizing radiation, including that of cobalt-60, is known to cause cancer. Therefore, exposures to gamma radiation from cobalt-60 result in an increased risk of cancer.
Because it emits such strong gamma rays, external exposure to cobalt-60 is also considered a significant threat. The magnitude of the health risk depends on the quantity of cobalt-60 involved and on exposure conditions:

- length of exposure
- distance from the source (for external exposure)
- whether the cobalt-60 was ingested or inhaled.

**Is there a medical test to determine exposure to cobalt-60?**

Yes, there are several. However they are not routinely available in a doctor's office because they require special laboratory equipment.

Some tests can measure the amount of cobalt-60 in urine, even at very low levels. Scientists can estimate the amount in the body from the amount measured in the urine.

A technique called "whole-body counting" can detect gamma radiation emitted by cobalt-60 in the body. A variety of portable instruments can directly measure cobalt-60 on the skin or hair.

Other techniques include measuring the level of cobalt-60 in soft tissues (such as organs) and in blood, bones, milk, or feces.

**Protecting People from Cobalt-60**

**How do I know if I'm near cobalt-60?**

You need special equipment to detect the presence of any radionuclide.

**What can I do to protect myself and my family from cobalt-60?**

You are unlikely to encounter cobalt-60 unless you undergo certain medical treatments. Thorough discussions with your doctor about the amount of exposure and potential alternatives allow you to make informed decisions about the relative risks.

Although it is very unlikely, you may accidentally encounter a sealed radiation source containing cobalt-60 that has escaped proper control ("orphaned sources").

**What is EPA doing about cobalt-60?**

Cobalt-60 is regulated by both the EPA and the Nuclear Regulatory Commission. The Nuclear Regulatory Commission has jurisdiction over the licensing and use of cobalt-60 sources, and disposal of cobalt-60 sources.

EPA has several regulations that control cobalt-60 in the environment:

- standards for the maximum amount of cobalt-60 that nuclear facilities may release to the air.

maximum contaminant levels for cobalt-60 in drinking water
risk-based criteria for soil and groundwater at sites previously contaminated with
cobalt-60.