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# Radiation and health

The US Environmental Protection Agency has extensive information on radiation, the health effects of radiation and how to respond to radiological emergencies.

**Health Effects:** http://www.epa.gov/radiation/understand/health_effects.htm
**Cobalt:** http://www.epa.gov/radiation/radionuclides/cobalt.htm
**Caesium:** http://www.epa.gov/radiation/radionuclides/cesium.htm

## Summary:

## Health effects

As radioactive atoms decay, the energy they release in different forms of radiation can damage cells and cause cancers, genetic damage and non-genetic damage to the immune system, for example. Many radioactive substances are also heavy metals, which are commonly poisonous in the same way that other non-radioactive metals, such as lead, are toxic.

The magnitude of the health risk from radiation depends on exposure conditions and the type of radiation emitted. Exposure conditions include such factors as the size of the source, strength of the source, length of exposure, distance from the source, and whether there was shielding between you and the source, such as metal plating. If exposures are very high serious burns, and even death, can result. Most exposures to low level radiation could cause problems that would take many years to appear. Children are more susceptible to radiation effects than adults.

Different radionuclides affect the body in different ways depending on whether they emit alpha, beta or gamma radiation. For example, cobalt-60 produces strong gamma radiation that can easily penetrate the whole body from an outside source, while uranium's radiation, which is mainly alpha, cannot affect people in this way.Are there medical tests to determine exposure to radiation?

There are several tests to determine exposure to radiation, but they require special laboratory equipment and are expensive. Tests vary depending on what radioactive material the patient has been exposed to. Some tests can measure the amount of radionuclides in urine, or in fecal samples, even at very low levels and after some considerable time. A technique called 'whole-body counting' can detect gamma radiation emitted by some radionuclides in the body, but cannot detect all radiation. A variety of portable instruments can directly measure some radioactive particles that are still on the hair or skin. As uranium is known to cause kidney damage, special urine tests are often conducted to determine whether kidney damage has occurred.

## How do you treat people who have been exposed?

Treatment for people who have been exposed exists, but is difficult and expensive. In addition, it is often ineffective, especially if the patient does not receive qualified attention very soon after exposure. For further information see the EPA website.

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**Environmental persistence of radiation**

The environmental persistence of radiation varies. The half-life of caesium-137 is 30.17 years, meaning that half its radiation will be dissipated into the environment in that time. It is generally considered that it takes 10 half-lives before a substance is said not to be radioactive. Therefore, the control period for an area contaminated with caesium-137 would be about 300 years. Some radioactive material moves easily through the environment. For example, caesium-137 is soluble in water, which makes cleaning it up very difficult.

By contrast, the half-life of cobalt-60 is 5.27 years. This is short enough to make isolation a possible treatment strategy for contaminated areas. Simply waiting 50 years allows for sufficient decay to make a contaminated site acceptable for use again.

Uranium-238 has a half-life of 4.7 billion years.

**Yellowcake, Uranium, and Depleted Uranium**

1. To make fuel for nuclear reactors, rocks containing uranium are ground up, and chemically processed to produce a yellow powder with a much higher uranium content. This uranium oxide is called 'yellowcake' or 'natural uranium'.

2. There are normally three different forms of uranium in rocks: U-238, U-235 and U-234. Over 99% of uranium in rock is U-238, but U-235 is much more suitable for weapons or for use in fuel for nuclear reactors. So 'yellowcake' is further processed to produce 'enriched' uranium, in which the proportion of U-235 is much higher. Fuel for power station reactors is typically enriched to contain 2% or 3% of U-235, but for nuclear weapons, uranium has be enriched to about 90%, a large and complex industrial task.

3. The enrichment process also produces a by-product called 'depleted' uranium, where the U-235 content is much lower, and which is less radioactive.

The radiation that uranium produces does not penetrate human skin. However, it is a very toxic substance if it gets into the body through the lungs or ingestion. Once inside the stomach, much is excreted, but some will remain in the body for years, where its radioactive decay increases the risk of bone, blood and liver cancers. If inhaled, lung cancer risks are increased. Uranium in the body is also poisonous in similar ways to other non-radioactive heavy metals, and similarly increases the risk of kidney damage.