



# EPA Facts about Americium-241

## ***What is americium-241?***

Americium is a man-made radioactive metal. It is produced in nuclear reactors and during nuclear weapons tests when plutonium absorbs neutrons.

Americium occurs in several forms called isotopes. The most common isotope is americium-241.

## ***What are the uses of americium-241?***

Americium is commonly used in very small amounts in smoke detectors. It is blended with the element beryllium and is used as a neutron source to measure the quantity of water present in soil, as well as moisture and density for quality control in highway construction.

Americium is also used as a source of radiation in medical research and in medical diagnostic devices.

## ***How does americium-241 change in the environment?***

Americium-241 is introduced into the environment by the decay of plutonium that is a contaminant from nuclear weapons production and testing and potentially by certain types of nuclear reactors. Americium-241 is an unstable isotope. Therefore, as americium decays, it releases radiation and forms "daughter" elements. The first decay product of americium-241 is neptunium-237, which also decays and forms other daughter elements. The decay

process continues until the stable element bismuth is formed.

The radiation from the decay of americium-241 and its daughters is in the form of alpha particles, beta particles, and gamma rays. Alpha particles can travel only short distances and generally will not penetrate the outer layer of human skin. Gamma rays can penetrate the body. Beta particles are generally absorbed in the skin and do not pass through the entire body.

The time required for a radioactive substance to lose 50 percent of its radioactivity by decay is known as the half-life. The half-life of americium-241 is about 432 years.

## ***How are people exposed to americium-241?***

Most americium that has been released into the environment has come from atmospheric testing of nuclear weapons. Some americium has also been released through nuclear weapons production, but this amount is small compared with the amount released during atmospheric testing.

Nuclear weapon sites, certain types of nuclear reactors, and industries that manufacture smoke detectors are potential sources of exposure to americium-241. Potential pathways of exposure include ingestion, inhalation, and external exposure from gamma radiation.

### ***How does americium-241 get into the body?***

Americium can enter the body when it is inhaled or swallowed. When it is inhaled, the amount of americium that remains in the lungs depends on the size of the particle and the chemical form of the americium compound. Some americium compounds dissolve easily. These compounds are absorbed through the lungs and enter the blood stream. The forms that dissolve less easily are typically swallowed, where some may pass into the blood stream, and the remainder will pass through the feces. However, some undissolved material that stays in the body goes to the bones, where it can remain for decades.

### ***Is there a medical test to determine exposure to americium-241?***

Yes, tests are available that can reliably measure the amount of americium in a urine sample, even at very low levels. These measurements can be used to estimate the total amount of americium present in the body. There are also tests to measure americium in soft tissues (such as body organs), feces, bones, and breast milk. Whole body testing may also be used to measure americium in the body. These tests are not routinely available in a doctor's office because special laboratory equipment is required.

### ***How can americium-241 affect people's health?***

Americium poses a significant risk if enough is swallowed or inhaled because americium emits alpha particles. Once in the body, americium tends to concentrate primarily in the skeleton,

liver, and muscle. It generally stays in the body for decades and continues to expose the surrounding tissues to radiation. This exposure may eventually increase a person's chance of developing cancer, but these cancer effects may not become apparent for several years. Americium, however, also can pose a risk from direct external exposure through gamma ray emissions.

### ***What recommendations has the U.S. Environmental Protection Agency made to protect human health?***

Please note that the information in this section is limited to recommendations EPA has made to protect human health from exposure to americium-241. General recommendations EPA has made to protect human health at Superfund sites (the  $10^{-4}$  to  $10^{-6}$  cancer risk range), which cover all radionuclides including americium-241, are summarized in the fact sheet "Primer on Radionuclides Commonly Found at Superfund Sites."

EPA has established a Maximum Contaminant Level (MCL) of 15 picoCuries per liter (pCi/L) for total alpha particle activity, excluding radon and uranium, in drinking water. Americium-241 is covered under this MCL.

For more information about how EPA addresses americium-241 at Superfund sites *Contact Stuart Walker of EPA:*  
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*or visit EPA's Superfund Radiation Webpage:*  
*<http://www.epa.gov/superfund/resources/radiation/>*