



# EPA Facts about Strontium-90

## *What is strontium-90?*

Radioactive strontium-90 is produced when uranium and plutonium undergo fission. Fission is the process in which the nucleus of a radionuclide breaks into smaller parts. Large amounts of radioactive strontium-90 were produced during atmospheric nuclear weapons tests conducted in the 1950s and 1960s. As a result of atmospheric testing and radioactive fallout, this strontium was dispersed and deposited on the earth.

## *What are the uses of strontium-90?*

Strontium-90 is used in medical and agricultural studies. It is also used in thermoelectric devices that are built into small power supplies for use in remote locations, such as navigational beacons, remote weather stations, and space vehicles. Additionally, strontium-90 is used in electron tubes, radioluminescent markers, as a radiation source in industrial thickness gauges, and for treatment of eye diseases.

## *How does strontium-90 change in the environment?*

Strontium-90 is not a stable isotope. Strontium-90 decays to yttrium-90, which in turn decays to stable zirconium. The isotopes of strontium and yttrium emit beta particles as they decay. The release of radiation during this decay process causes concern about the safety of strontium and all other radioactive substances. Beta particles can pass through skin, but they cannot pass through the entire body.

The most common isotope of strontium is strontium-90.

The time required for a radioactive substance to lose 50 percent of its radioactivity by decay is known as the half-life. Strontium-90 has a half-life of 29 years and emits beta particles of relatively low energy as it decays. Yttrium-90, its decay product, has a shorter half-life (64 hours) than strontium-90, but it emits beta particles of higher energy.

## *How are people exposed to strontium-90?*

Although external exposure to strontium-90 from nuclear testing is of minor concern because environmental concentrations are low, strontium in the environment can become part of the food chain. This pathway of exposure became a concern in the 1950s with the advent of atmospheric testing of nuclear explosives. With the suspension of atmospheric testing of nuclear weapons, dietary intake has steadily fallen in the last 30 years. These concerns have shifted somewhat to exposure related to possible accidents at nuclear reactors or fuel reprocessing plants and exposure to high-level waste at weapons facilities. Strontium-90 is a component of contaminated soils at radioactively contaminated sites where nuclear fission has been used (such as research reactors and nuclear power plants).

Accidents involving nuclear reactors such as Chernobyl and Fukushima have released strontium into the atmosphere, which ultimately settles to the earth's surface as fallout.

Chernobyl contributed the largest worldwide amount of strontium-90 contamination, and a substantial portion of the strontium-90 released was deposited in the former Soviet Republics, with the rest being spread as fallout worldwide.

### ***How does strontium-90 get into the body?***

Ingestion, usually through swallowing food or water, is the primary health concern for entry of strontium into the human body. Small dust particles contaminated with strontium also may be inhaled, but this exposure pathway is of less concern than the ingestion pathway. After radioactive strontium is ingested, 20 to 30 percent of it is absorbed from the digestive tract, while the rest is excreted through feces. Of the portion absorbed, virtually all (99 percent) of the strontium is deposited in the bones or skeleton.

### ***Is there a medical test to determine exposure to strontium-90?***

Generally, levels of strontium in the body are measured by urinalysis. As with most cases of internal contamination, the sooner after an intake the measurement is made, the more accurate it is.

### ***How can strontium affect people's health?***

Strontium-90 behaves like calcium in the human body and tends to deposit in bone and blood-forming tissue (bone marrow). Thus, strontium-90 is referred to as a "bone seeker," and exposure will increase the risk for several diseases including bone cancer, cancer of the soft tissue near the bone, and leukemia. Risks

from exposure depend on the concentration of strontium-90 in air, water, and soil. At higher exposures, such as those associated with the Chernobyl accident, the cancer risks may be elevated. The magnitude of this health risk would depend on exposure conditions, such as the amount ingested.

### ***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 strontium-90. 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 strontium-90, are summarized in the fact sheet "Primer on Radionuclides Commonly Found at Superfund Sites."

EPA has established a Maximum Contaminant Level (MCL) of 4 millirems per year for beta particle and photon radioactivity from man-made radionuclides in drinking water. The average concentration of strontium-90 that is assumed to yield 4 millirems per year is 8 picoCuries per liter (pCi/L). If other radionuclides that emit beta particles and photon radioactivity are present in addition to strontium-90, the sum of the annual dose from all the radionuclides cannot exceed 4 millirems/year.

**For more information about how EPA addresses strontium-90 at Superfund sites**

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*or visit EPA's Superfund Radiation Webpage:*

*<http://www.epa.gov/superfund/resources/radiation/>*