

## External And Internal Irradiation Of The Body

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### Abstract

This paper demonstrates various precautions against external and internal irradiation, taken to combat the hazardous effects of radiation. It is established that when a radioactive substance enters the body, the energy level and type of radiation, the physical half-life, and the biological half-life of the radioactive isotope must be taken into account. The organ most susceptible to the radioactive substance is called the critical organ, and regulations determine the permissible concentration of each radioactive element.

**Keywords:** regulations, concentration, radioactive substances, atmospheric air, organism, irradiation, radiation, energy, protection

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The impact of radiation on humans can be achieved in two ways.

The first method is external irradiation – where radiation comes from a source located outside the body, which mainly depends on the radiation background of the area where the person lives or on other external factors.

The second option is internal irradiation, where irradiation is caused by the ingestion of a radioactive substance into the body, mainly through food.

Food and air, which may contain plutonium and americium isotopes, which have high alpha activity, pose a significant hazard. Alpha radiation has a high degree of ionization and, therefore, is highly damaging to biological tissue. The most dangerous carcinogen is plutonium, which fell out as a result of the Chernobyl accident. Alpha-active isotopes primarily result from nuclear weapons testing. However, analysis shows that the vast majority of alpha-active radionuclides from nuclear weapons testing have been released into the ground, without affecting humans.

External and internal exposure require different precautions to be taken against the dangerous effects of radiation.



External radiation is primarily caused by gamma-containing radionuclides and X-rays. Its damaging effect depends on:

- a) from radiation energy;
- b) from the duration of exposure to radiation;
- c) from the distance between the radiation source and the object;
- d) from the protective measures taken.

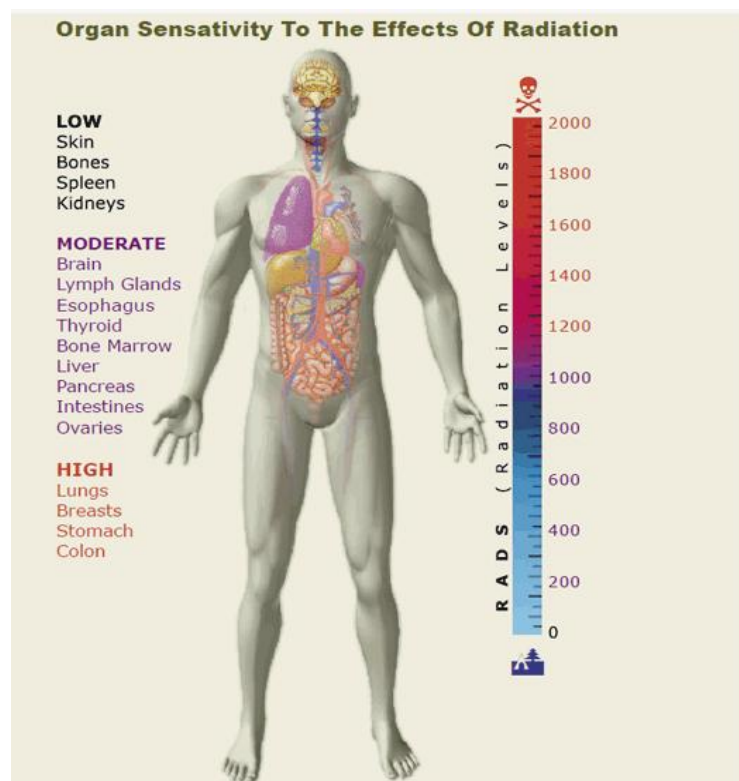
The absorbed dose depends linearly on the duration of irradiation, and the effect of distance on the result of radiation exposure has a quadratic dependence.

Lead and concrete shields are primarily used to protect against external radiation. The effectiveness of a material as a shield against X-ray or gamma ray penetration depends on the material's density and the concentration of electrons it contains.

While external radiation can be protected with special screens or other measures, protecting against internal radiation is much more difficult and, in many cases, impossible.

Radioactive isotopes can enter the body in three ways:

- a) with food;
- b) through the respiratory tract with air;
- c) through damage to the skin.



Human organs react to substances introduced into the body solely based on the chemical nature of the elements, regardless of whether they are radioactive or not. Chemical elements such as sodium and potassium are found in all cells of the body. Therefore, their radioactive form introduced into the body will also be distributed throughout the body. Other chemical elements tend to accumulate in specific organs (for example, radioactive iodine in the thyroid gland or calcium in bone tissue).

When a radioactive substance enters the body, it is necessary to consider the amount of energy and type of radiation, the physical half-life and the biological half-life of the radioactive isotope.

The biological half-life is the time required for half of a radioactive substance to be eliminated from the body. Some radionuclides are eliminated quickly and therefore do not have time to cause significant harm, while others persist in the body for a significant period. The combination of the physical half-life and the biological half-life is called the effective half-life. This characteristic is the most important in determining the total amount of radiation in the body.

The organ most susceptible to the effects of a radioactive substance is called a critical organ. Standards have been developed for various

critical organs, defining the permissible concentration of each radioactive element. Based on this data, documents have been created regulating permissible concentrations of radioactive substances in the atmosphere, drinking water, and food products.

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