What is the Current Dose Limits for Exposure to Licensed Sources of Radiation?

1. 100mSv over 5 years or 50mSv annually
2. 50mSv over 5 years or 10mSv annually
3. 500mSv over 5 years or 100mSv annually
4. 1000mSv over 5 years or 100mSv annually

ANSWER

1. 100mSv over 5 years or 50mSv annually

WHY IS IT RIGHT

All exposures to ionizing radiation carry a risk of biological damage, although this risk decreases as the exposure decreases. For example, the risk associated with natural background radiation is very small, although elevated levels of naturally occurring radon increase the risk of lung cancer. For workers in certain industries, such as miners and medical radiographers, the risk is slightly higher. Exposure levels as a result of a nuclear or radiological emergency can vary widely, depending on the nature of the incident, the type of radiation involved, and even weather patterns.

Dose assessment

There are a number of factors that must be taken into consideration in calculating the quantity, or dose, of radiation a person has received, including:

- the nature of the ionizing radiation,
- the strength of the source,
- the biological sensitivity of the area exposed, and
- exposure factors such as time, distance, and shielding from the source.
- This calculation is referred to as a dose assessment.

Radiation dose terminology

The terminology used for specifying radiation dose and its effects on the human body has been developed to account for all the factors that are important in determining its biological impact. The most frequently used dose measurements are absorbed dose, equivalent dose, effective dose, and collective dose, which are all briefly described below.

- **Absorbed dose:** As radiation passes through matter, some of its energy is left behind; that is, it is "absorbed" by the matter. This is referred to as the absorbed dose, and the measurement of this dose is given in grays (Gy).
- **Equivalent dose:** Different types of radiation have different effects on tissue. In order to account for these differences, the absorbed dose is multiplied by a radiation weighting factor. This factor is dependent upon the type and amount of radiation involved. The result is referred to as the equivalent dose, and it is expressed in sieverts (Sv).
- **Effective dose:** Different tissues and organs are affected differently by radiation. For example, lung tissue is more likely to be affected by radiation than is the skin. In order to account for the differing sensitivities, the equivalent dose is multiplied by a tissue weighting factor: the resulting unit is referred to as the effective dose. The effective dose is also given in sieverts.
- **Collective dose:** The collective dose refers to the amount of radiation received by a group of people. It is calculated by multiplying the average effective dose received by the number of persons exposed. The collective dose is expressed in person-sieverts (person-Sv).

WHY IS EVERYTHING ELSE WRONG

You are exposed to radiation on a daily basis, most of it in very small doses; however, if you are working in a job where exposure is a risk (dental office, x-ray clinic, airport, etc.) you should have a meter and be measuring you exposure over time. Radiation poisoning does not make you a superhero, it can lead to very serious effects like cancer, organ failure, or death.

Here is a list of some common everyday things that emit radiation.

1. **Hand-held lasers and laser pointers**
2. **Airport full-body scanners**
3. **Tanning beds and lamps**
4. **Smart meters**
5. **Power lines and electrical appliances**
6. **Wi-Fi**
7. **Compact fluorescent lamps**
8. **Wind turbines**
9. **Cell phones and cell phone towers**
10. **Personal stereo systems**
11. **Airplanes**
12. **Microwave ovens**

Acute Radiation Syndrome (ARS) (sometimes known as radiation toxicity or radiation sickness) is an acute illness caused by irradiation of the entire body (or most of the body) by a high dose of penetrating radiation in a very short period of time (usually a matter of minutes). The major cause of this syndrome is depletion of immature parenchymal stem cells in specific tissues. Examples of people who suffered from ARS are the survivors of the Hiroshima and Nagasaki atomic bombs, the firefighters that first responded after the Chernobyl Nuclear Power Plant event in 1986, and some unintentional exposures to sterilization irradiators.

The required conditions for Acute Radiation Syndrome (ARS) are:

- **The radiation dose must be large** (i.e., greater than 0.7 Gray (Gy)[1, 2] or 70 rads).
    - Mild symptoms may be observed with doses as low as 0.3 Gy or 30 rads.
- **The dose usually must be external** (i.e., the source of radiation is outside of the patient’s body).
    - Radioactive materials deposited inside the body have produced some ARS effects only in extremely rare cases.
- **The radiation must be penetrating** (i.e., able to reach the internal organs).

    - High energy X-rays, gamma rays, and neutrons are penetrating radiations.
- **The entire body** (or a significant portion of it) must have received the dose[3].
    - Most radiation injuries are local, frequently involving the hands, and these local injuries seldom cause classical signs of ARS.
- **The dose must have been delivered in a short time** (usually a matter of minutes).
    - Fractionated doses are often used in radiation therapy. These are large total doses delivered in small daily amounts over a period of time. Fractionated doses are less effective at inducing ARS than a single dose of the same magnitude.

The three classic ARS Syndromes are:

- **Bone marrow syndrome** (sometimes referred to as hematopoietic syndrome) the full syndrome will usually occur with a dose between 0.7 and 10 Gy (70 – 1000 rads) though mild symptoms may occur as low as 0.3 Gy or 30 rads[4].
    - The survival rate of patients with this syndrome decreases with increasing dose. The primary cause of death is the destruction of the bone marrow, resulting in infection and hemorrhage.
- **Gastrointestinal (GI) syndrome:** the full syndrome will usually occur with a dose greater than approximately 10 Gy (1000 rads) although some symptoms may occur as low as 6 Gy or 600 rads.
    - Survival is extremely unlikely with this syndrome. Destructive and irreparable changes in the GI tract and bone marrow usually cause infection, dehydration, and electrolyte imbalance. Death usually occurs within 2 weeks.
- **Cardiovascular (CV)/ Central Nervous System (CNS) syndrome:** the full syndrome will usually occur with a dose greater than approximately 50 Gy (5000 rads) although some symptoms may occur as low as 20 Gy or 2000 rads.

- Death occurs within 3 days. Death likely is due to collapse of the circulatory system as well as increased pressure in the confining cranial vault as the result of increased fluid content caused by edema, vasculitis, and meningitis.

The four stages of ARS are:

- **Prodromal stage (N-V-D stage):** The classic symptoms for this stage are nausea, vomiting, as well as anorexia and possibly diarrhea (depending on dose), which occur from minutes to days following exposure. The symptoms may last (episodically) for minutes up to several days.
- **Latent stage:** In this stage, the patient looks and feels generally healthy for a few hours or even up to a few weeks.
- **Manifest illness stage:** In this stage the symptoms depend on the specific syndrome (see Table 1) and last from hours up to several months.
- **Recovery or death:** Most patients who do not recover will die within several months of exposure. The recovery process lasts from several weeks up to two years.