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Radiation: Types, Natural sources, and Industrial Sources

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Abstract

The world is naturally radioactive and approximately 82% of human-absorbed radiation doses, which are out of control, arise from natural sources such as cosmic, terrestrial, and exposure from inhalation or intake radiation sources. In recent years, several international studies have been carried out, which have reported different values regarding the effect of background radiation on human health. Gamma radiation emitted from natural sources (background radiation) is largely due to primordial radionuclides, mainly 232Th and 238U series, and their decay products, as well as 40K, which exist at trace levels in the earth's crust. Their concentrations in soil, sands, and rocks depend on the local geology of each region in the world. Naturally occurring radioactive materials generally contain terrestrial-origin radionuclides, left over since the creation of the earth. In addition, the existence of some springs and quarries increases the dose rate of background radiation in some regions that are known as high level background radiation regions. The type of building materials used in houses can also affect the dose rate of background radiations. The present review article was carried out to consider all of the natural radiations, including cosmic, terrestrial, and food radiation.

Key words: Radiation: Types, Natural sources, and Industrial Sources

Supplementary information The online version of this article (https://doi.org/xx.xxx/xxx.xx) contains supplementary material,which is available to

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Introduction:

Some radioactive nuclides are detectable in soil. They belong to natural radionuclides such as the members of the uranium and thorium decay series. More specifically, natural environment radioactivity and the associated external exposure due to gamma radiation depend on the geological and geographical conditions and appear at different levels in the soils of each region in the world.[2,3] The specific levels of terrestrial radiation are related to the geological composition of each lithologically separated area and to the content of the rock from which the soils originated in each area in the radioactive elements of thorium (232Th), uranium (238U), and potassium (40K).

All building materials contain various amounts of radioactivity. For example, materials derived from rock and soil contains natural radionuclides of the uranium and thorium series and the radioactive isotope of potassium. Artificial

radionuclides can also be present, such as cesium (137Cs), resulting from the fallout from weapons testing and the Chernobyl accident. All these can be sources of both internal and external radiation exposures. Internal exposure occurs through the inhalation of radon gas, and external exposure occurs through the emission of penetrating gamma rays.[4]

Considering that about 50% of natural exposure of people is from radon gas, it is the leading cause of cancer patients suffering from respiratory and gastrointestinal system problems, and the highest percentage of radon that enters the human body is from drinking water and breathing. Once radon in water supplies reaches consumers, it may result in human exposure via inhalation and direct digestion. Radon in water transfers into the air during the rains, flushing toilets, washing dishes, and washing clothes. The aerosols tend to deposit in the lungs, where they release radiation that has been shown to increase the likelihood of lung cancer. Radon can also reach other body tissues through ingestion, resulting in radiation exposure to the internal organs. Ingestion of radon is believed to increase the risk of stomach cancer.[5,6] Besides the effect of soils in population exposure by using them as building material, they can affect the human body by taking the food containing radionuclide, which enters the food chain from deeper soil layers and also tainting the ground water [7].

Owing to the inevitable effects of radiations and health risk from these exposures, it is necessary to investigate all reported data in the last few years.

What is radiation?

Radiation is energy in motion transmitted through invisible waves or rays. Humansare exposed to radiation daily. In fact, radiation has always been part of everyday life on Earth.

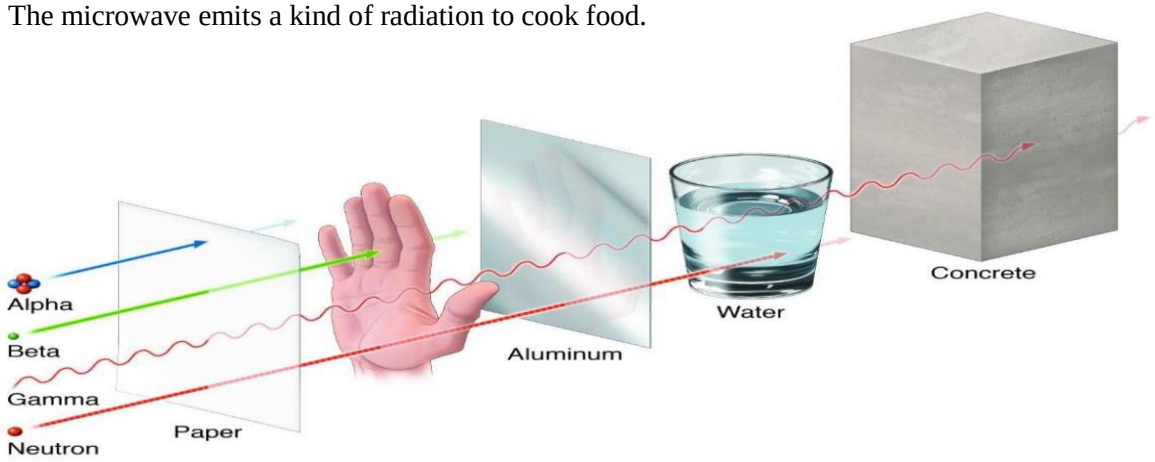
Radiation is emitted from natural and artificial sources.

Natural sources:

Sun: The sun emits ultraviolet rays that can cause skin burns

Industrial Sources:

1. Doctors use X-rays or MRI scans to see broken bones inside the human bodyand to diagnose other health problems.
2. The microwave emits a kind of radiation to cook food.



Types of radiation

There are two types of radiation: non-ionizing radiation (low frequency) and ionizing radiation (high frequency), both of which are harmful when exposed to them in large quantities. But scientists, nuclear engineers and doctors have been able to understand what radiation is, learn how to harness its benefits and protectus from its risks.

Non-ionizing radiation

emits enough energy to move atoms. For example, a microwave works with non- ionizing rays to cook food by oscillating water inside the food, producing heat thatcooks the food.

Ionizing radiation

emits enough energy to alter the structure of an atom that can destroy vital cells,and sunburn is an example.

Radiation protection

The nuclear energy industry follows the highest international standards and bestpractices to protect society, the environment and employees from radiation.

There are three simple ways to reduce radiation exposure:

- **Construction of barriers:** These barriers must be made of steel, concrete or water to protect against radiation. For this reason, the reactoris placed inside a building whose walls contain several thick layers madeof steel and concrete. It is also for this reason that spent nuclear fuel is stored in aquariums lined with steel and concrete.
- **Reduce** time: The less time a person spends near the radiation source, theless radiation injury they experience.
- **Increased distance**: The farther a person is from the source generatingradiation, the less they are exposed to. Therefore, there are prohibited places inside the station.

What are the benefits of radiation? Here are some examples:Health:

Radiation can be used in medical procedures, in many cancer treatments anddiagnostic imaging methods.

Energy:

Radiation allows us to produce electricity by solar and nuclear energy.

Environment and climate change:

Radiation can be used to treat wastewater or to breed new varieties of plants thatare resistant to climate change.

Industry and science:

Using radiation-based nuclear techniques, scientists can examine old parts or produce materials with distinctive

properties such as in the automotive industry.

Non-ionizing radiation

What is non-ionizing radiation? Non-ionizing radiation is defined as a group of electromagnetic radiation that cannot ionize atoms or molecules because they do not have enough energy, they are unable to remove electrons but are able to makethem vibrate in place, raising body temperature.

Non-ionizing radiation is defined as low-energy, frequency, and high-wavelength wavelengths, and non-ionizing radiation is usually preferred in various applications because of its inability to change and interact with atoms and molecules, and its inability to cause genetic mutations.

But these radiations are able to raise the temperature of tissues, causing damage, and they interact with electronic devices implanted inside the body, such as pacemakers.

Some Types of non-ionizing radiation

Non-ionizing radiation travels at a speed equivalent to the speed of light, and exposure to this radiation can cause significant health risks for people who are exposed to it, especially within work environments where non-ionizing radiation isfrequent, and the following are the types of non-ionizing radiation:

Ultra-low frequency radiation

Radio frequency and microwave radiationInfrared radiation

Visible light radiation

Laser

Ultraviolet radiation

Non-ionizing radiation sources

Non-ionizing radiation is produced from a range of natural and industrial sources,the most prominent of which are the following:

Natural resources

Natural sources of non-ionizing radiation include: The phenomenon of lightning.

Light and heat from the sun.

The natural electric and magnetic fields of the Earth.

Industrial Sourcing

Industrial sources producing non-ionizing radiation include:Tanning or tanning beds.
Microwave ovens.

Cell phones. Mobile phone towers.Wi-Fi equipment.

Radio and television broadcasting antennas.LED lamps.

Incandescent bulbs. Compact fluorescent lamps.

Power lines and household wiring. Handheld lasers and laser pointers.

Ionizing radiation

Ionizing radiation is defined as a form of energy that is produced due to the removal of electrons from atoms and molecules of substances that include air, water and living tissues, and ionizing radiation can travel through materials invisibly, and a familiar example of ionizing radiation is X-rays, which penetrateour bodies to reveal the presence of bone fractures.[1]

Types of ionizing radiation Types of ionizing radiation include: X-ray

Types of ionizing radiation include:

Gamma rays Alpha particlesBeta particles

Sources of ionizing radiation

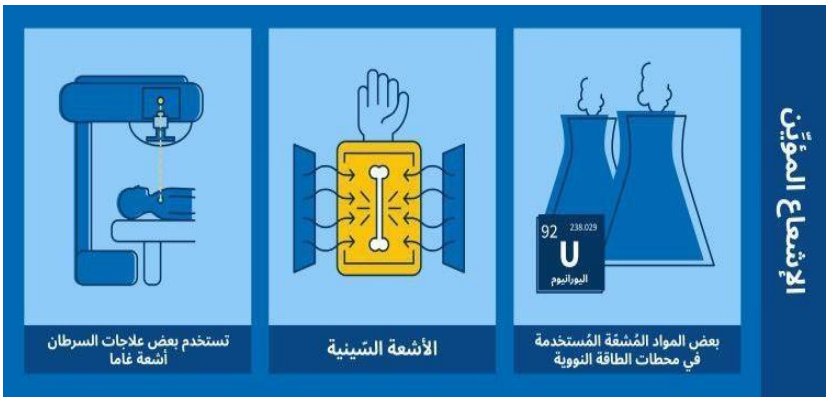
Radiation sources vary to natural and man-made sources, and radiation levels vary according to their source as follows:

Natural sources

There are 60 radioactive materials in nature found in various elements of soil, water and air, and radiation is also emitted from radon and natural gas, so that rocks and soil are the main source of natural radiation, and cosmic rays are another source of radiation, especially for individuals who reside at high altitudes, and it must be noted that ionizing radiation levels vary according to geographical locationdue to the geological differences of the earth.

Industrial Resources

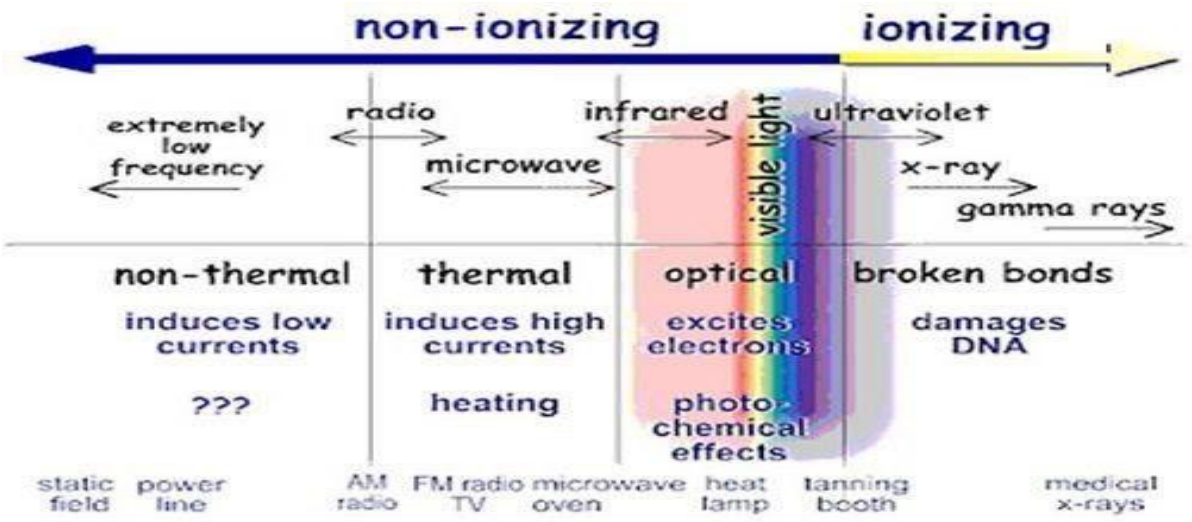
Industrial sources of ionizing radiation come from nuclear power generators and radiation emitted from medical uses, whether for the diagnosis of injuries such as X-rays or radiology used in the treatment of diseases and nuclear medicine, in addition to mentioning research laboratories, such as universities, colleges and scientific institutions that use ionized radioactive materials, and air and space travel and transport operations that occur at high altitudes.



The difference between ionizing radiation and non-ionizingradiation

"Non-ionizing radiation" is radiation that carries enough energy to move or causeatoms in a molecule to vibrate, but not enough to remove electrons. Examples of this type of radiation are visible light and small electromagnetic waves.

Ionizing radiation is radiation that carries enough energy to remove tightly attachedelectrons from atoms, forming ions. Examples of ionizing radiation include X-rays and gamma rays. The following figure shows the types of ionizing and non- ionizing radiation in the electromagnetic spectrum.



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