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IMPACT OF RADIATION ON HUMAN

Dr. Inder Singh Meena

Assistant Professor

Dept. Of Zoology

Govt. College Tonk, Rajasthan

Dr. Narender Kumar Chandel

Assistant Professor

Dept. Of Geography

Govt. College Tonk, Rajasthan

ABSTRACT

The effects of radiation were not realized until it was used in medical diagnosis. The haste to exploit the therapeutic advantages revealed the dangers and damage. Radiation exposure originally produced burns, therefore attempts to safeguard practitioners rather than patients concentrated on preventing them. Though restricted, the subject matter helped create radiation protection as a separate field of research. Later, it became clear that radiation may have other adverse effects, such as radiation-induced cancer, which may be fatal at low doses. This danger can only be lessened so much; it cannot be eliminated. Due to this, one of the most essential parts of radiation protection is comparing the advantages of nuclear and radiation activities to the dangers of radiation and reducing the remaining risks. This study will focus on ionizing radiation safety measures.

Keywords: radiation, environment, health care

INTRODUCTION

Each and every one of us is exposed to radiation and radioactive substances. There are two primary sources of radiation in the environment: cosmic rays that originate from space and radioactive materials that may be found in both nature and in people. The term "background radiation" pertains to all of these different types of radiation. All people are exposed to background radiation on a continuous basis throughout their daily lives. Radiation and radioactive elements are produced as a consequence of excessive human activity, which also leads in the generation of radiation. It is common knowledge that x-ray machines used in the medical and scientific fields, as well as particle accelerators, send out radiation. Both nuclear reactors and particle accelerators are capable of producing radioactive gases and materials.

Ionizing radiation, which is characterized by its high intensity, has the potential to adversely affect DNA by disrupting the atomic structure of living cells. The good news is that the cells in our bodies are experts at repairing damage themselves. However, if the damage is not repaired in the appropriate manner, the cell may die or develop cancer. Details in Spanish that are pertinent to the topic. One would have skin burns and acute radiation syndrome, sometimes referred to as "radiation sickness," if they were in close proximity to an atomic bomb, for instance. This is because of the very high levels of radiation that they would be exposed to because of the explosion. It is possible that, in the long term, it will make your health worse in ways such as cancer and heart difficulties. Even if it does not immediately have any obvious effects, being exposed to modest amounts of radiation in the environment does raise our chance of developing cancer to a certain extent.

Radiation

Radiation is the term used to describe the movement of energy through matter or space at very high rates. The release of energy from radioactive materials may take the form of particles such as alpha and beta particles, or waves such as light, heat, radio waves, microwaves, x-rays, and gamma rays. Radioactive substances, also known as radionuclides or radioisotopes, are constructed from stable atoms, which are the fundamental building blocks of these substances. When they are found in nature, atoms that are unstable have a tendency to become stable. When they go through the process of transformation, radiation is emitted. There is a kind of radiation known as ionizing radiation that, when it comes into contact with certain substances, has the potential to produce ions. The removal of electrons from their positions inside an atom results in the formation of charged particles known as ions. These particles, along with x-rays and gamma rays, are all forms of ionizing radiation. Alpha and beta particles are other examples. Nonionizing radiation, on the other hand, is described as radiation that is incapable of ionizing materials.

Radiation Dose Measured

When radiation travels through different materials, it loses some of the kinetic energy that it possesses. Within the context of radiation treatment, the term "absorbed dose" refers to the quantity of energy that a substance takes in in relation to its mass. The radiation dose that has been absorbed is measured using the rad, which is the standard unit of measurement. The possible amount of damage may be predicted by taking into account both the dose of radiation and the kind of radiation that is absorbed by living tissue. In comparison to beta and gamma waves, alpha radiation is more hazardous due to the fact that it has both mass and an electric charge. The dose equivalent is a measure that takes into account this variance and offers a standardized method for evaluating the dosage of radiation in all of its forms. The dosage equivalent may be calculated by multiplying the absorbed dosage, which is measured in rads, by a "quality factor" that is specific to the kind of radiation. When it comes to measuring this length, the rem is the conventional unit of measurement. In many cases, the corresponding levels of radiation exposure are far less than one rem. Since one millirem is equivalent to one thousand, the millirem is the more compact unit of measurement.

OBJECTIVE

1. Research on the Relationship Between Radiation and Cancer Risk
2. Research on electromagnetic radiation's effects on human health

Fra Effects of Radiation on Humans

The results of a battery of tests that Francine had undergone confirmed that she had a thyroid tumor in addition to a neck injury that had resulted in two shattered vertebrae. Because Francine was concerned about whether or not the tumor had grown as a result of the damage she sustained to her neck, she questioned her physician. According to the advice of the physician, it was not the case. The MRI was the only one that was able to detect an item that had been present before to the damage. Francine would still be in a much more precarious situation than she was before the MRI was performed if the tumor hadn't been discovered in time to prevent it from spreading to other regions of the body, something that would have been known as metastasis. After the end of the treatment, Francine was told by the physician that she would be required to have routine ultrasounds of the thyroid (Figure 3-1) in order to monitor the condition. Before Francine asked any questions about the different treatment choices or the technologies that are used for periodic checkups, she wanted to learn more about the long-term consequences that the CT and x-ray scans may have. The magnetic resonance imaging (MRI) technology did not include the use of radiation, in contrast to the other two diagnostic methods. Her first thought was, "What on earth was the point of this ionizing radiation?" Following that, she proceeded with her work.

Non-Ionizing Radiation

A kind of radiation known as non-ionizing radiation is a type of radio wave that does not possess the energy necessary to ionize an atom. In order for an atom to become ionized, it must first undergo the process of electron loss or gain. Ionizing radiation is more dangerous than non-ionizing radiation because it causes irreversible changes in the chemical composition of the body. This means that it is still feasible to track the effects of radiation that does not ionize. Radiation that does not ionize includes radio waves, microwaves, infrared light, and visible light. All of these types of radiation are radio waves. The sun's rays that reach the surface of the Earth are not able to ionize the majority of the time; nevertheless, there are instances in which a little quantity of ultraviolet light is able to do so. There is a possibility that the intensity levels of infrared or laser light might cause skin burns as well as damage to the eyes. Furthermore, the strength of the laser beam may be regulated in order to safeguard the eyes and skin from exposure to harmful radiation. For the purpose of preventing skin irritation, the typical laser pointers that are offered in shops have been designed precisely. Microwaves are used in microwave ovens due to the fact that they contain adequate energy to efficiently heat surfaces. According to the findings of several studies, nerve and muscle responses may become unexpected when they are subjected to the high levels of energy that are present in the region around the low-frequency electrical fields that are produced by power lines.

Ionizing Radiation

There is a possibility that atomic nuclei may experience disintegration or transition, which will lead to the emission of particles or waves as ways of generating energy. "Alpha decay" refers to the process by which the nucleus of a radioactive material, such as uranium, releases an alpha particle into the atmosphere. It is possible for alpha particles to participate in nuclear processes because they are naturally occurring and contain adequate energy. The nuclei of alpha particles are composed of two protons and two neutrons, much as the nuclei of helium. When the nucleus of an unstable atom undergoes spontaneous decay or change, a neutrino and a beta particle are released into the environment. In the same way that an electron may have a negative charge, a beta particle can also have a positive charge, much like a positron in electrons. There is no such thing as a charged neutrino that is emitted. Beta decay is a process that occurs in atoms when their nuclei have an excessive number of protons or neutrons. The weak nuclear force is responsible for the conversion of neutrons into protons or protons into neutrons in order to establish stability. When it comes to ionizing radiation, beta particles are the most fundamental kind. However, there are certain beta particles that do not ionize, and these particles have relatively low energies.

Due to the fact that it is ionizing, gamma radiation has the ability to change the chemical makeup of everything that it passes through. Because of their high density, lead and other elements with a high atomic number have the potential to absorb gamma rays and prevent them from propagating through the material. However, the attenuation coefficient could shift depending on the atomic number of the subatomic particle. When determining whether or not an element can function as a shield against gamma rays, scientists need to take into consideration more than simply the element's atomic number. There is a possibility that any kind of ionizing radiation might cause DNA in cells to become damaged or destroyed. There is a possibility that exposure to high amounts of ionizing radiation might result in mutations in the progeny of radiation accident victims. Small doses of ionizing radiation, as suggested by Dr. David Boreham of McMaster University, have the potential to protect cells from further DNA damage and lessen the probability of developing some kind of cancer. His disputed beliefs are based on research that was carried out on mice in an environment that was under certain conditions. The bulk of the case studies that radiation researchers do are comprised of cancer cases that were caused by the atomic bombs of Hiroshima and Nagasaki, the accident that occurred at Three Mile Island, and the nuclear power plant that was located in Chernobyl.

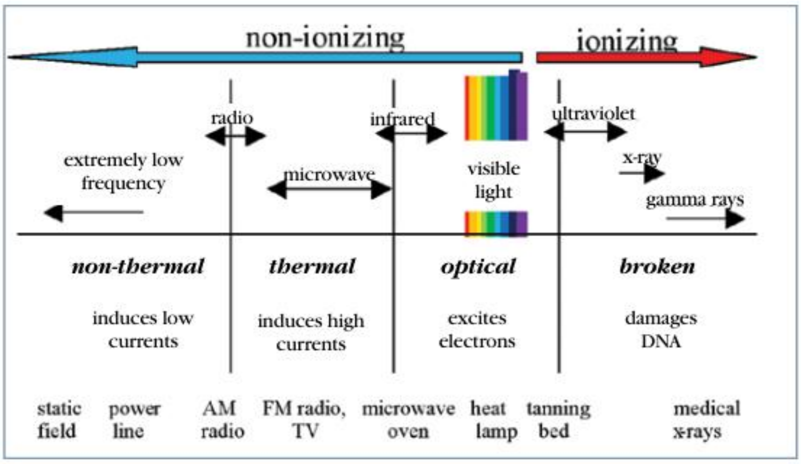

Figure -1 Observed in the above figure is the correlation between various radiation types and the electromagnetic spectrum.

catastrophe. Boreham is interested in disproving the notion that broad generalizations may be taken from statistics on radiation exposure on a large scale. He wants to do this from a scientific standpoint.

By noticing that the possibility of absorption is directly connected to the thickness of the material, one may mathematically determine how much gamma radiation a material will absorb. This can be done by drawing a correlation between the two. It is feasible to formulate a formula that expresses this link.

Gamma Radiation Absorption equation: $I(d) = I_0 e^{-\mu d}$

I0 represents the initial number of gamma rays, also known as the incoming intensity. I(d) represent the number of gamma rays that are able to permeate a material with a thickness of d, measured in centimeters. The mathematical constant 2.71828183 is denoted by the symbol e, while the coefficient of linear absorption is denoted by the symbol μ. The linear absorption coefficient of a material is what determines how easily gamma radiation may pass through that material. This value, in turn, is dependent on the kind of material that is used to block gamma rays. One of the most significant aspects to consider is the substance's density. Lead is a great protective layer for the body because it acts as a barrier against the penetration and transmission of ionizing radiation. Additionally, the value of lead is much higher than that of aluminum.

Substance		Substance	
Carbon	0.0244	Cadmium	0.035
Aluminium	0.0264	Uranium	0.0459
Water	0.0284	14..ad	0.436
Sodium Iodide	0.0350		

Just now, a worker has been subjected to gamma radiation. Hazardous materials teams are available to determine whether or not the radiation levels were high enough to cause damage that would continue for an extended period of time. Their calculations are based on the assumption that the gamma rays have an energy level of one hundred kilobits per second. Given this quantity of energy, the value of μ is equal to 0.1692. The quantity of gamma radiation that has the potential to enter a worker's arm muscle, which measures 4 centimeters in thickness, is equivalent to the amount of radiation that would be communicated if the worker were exposed to x-rays with an energy level of 30 keV, resulting in a μ value of 0.3651.

Somatic Effects

The two primary forms of radiation damage that may be caused to living organisms are somatic radiation damage and genetic radiation damage. Radiation may cause somatic harm, which applies to any part of the body other than the reproductive organs. Radiation can also cause damage to the reproductive organs. When it comes to somatic injury, the only person who is affected is the current sufferer, and any possible consequences for following generations are disregarded. Chronic radiation exposure may cause damage to the skin, which in turn raises the chance of developing cancer. The condition known as anaemia, which is brought on by a low red blood cell count and may be brought on by irradiated bone marrow, may be accompanied with feelings of fatigue and weakness in the muscles. There is a possibility that irradiation of the gastrointestinal tract may result in decreased digestion and the accumulation of nutrients. In addition to dryness of the skin and hair loss, large radiation doses may also cause hair loss. Long-term exposure to high amounts of radiation may be the cause of cancer as well as cataracts, which are a group of cataracts that grow on the lenses of the eye. Beyond a certain threshold, the chance of experiencing certain types of somatic damage tends to grow in tandem with the level of radiation exposure that has been increased.

Genetic Effects

Given that the reproductive organs are especially susceptible to the effects that radiation has on DNA, it follows that any children who are born to a mother who has been injured would also be impacted by the radiation. There is a possibility that the damage that radiation causes to chromosomes and genes will be passed on to following generations. Among survivors of the Chernobyl accident in Ukraine, as well as among survivors of the atomic bombs dropped on Hiroshima and Nagasaki, there has been an increase in the number of stillbirths, miscarriages, and infant deaths. This is also the case among survivors of the nuclear bomb of Nagasaki. In the event that the children are able to survive their first few years of life, there is a greater likelihood that they will be diagnosed with mental disorders, leukemia, microcephaly (slowed cranial development), or birth anomalies (missing limbs, large growths).

In the event that radiation exposure was not abrupt, the genetic repercussions may be less severe or perhaps nonexistent. Because even minute doses of radiation from procedures such as x-rays or CT scans may have an effect on the growing baby, it is imperative that pregnant women refrain from receiving any medical treatments that include the use of ionizing radiation if they are pregnant. This guideline originates from Health Canada, which acknowledges the possible dangers that radiation exposure may provide to the unborn child.

The life and career of a radiation physicist from Manitoba, Louis Slotin, and his story

An historical publication of the Canadian Nuclear Society has a biography of Dr. Louis Slotin, a physicist who was born and raised in Winnipeg. The biography is both easy to understand and full of useful information. The criticality incident that resulted in Slotin's death has been the subject of countless misconceptions, but fortunately, one of the reviewers here has gone to considerable pains to clarify several of these beliefs.

EXTENSION: Units of Measurement - A Historical Approach

Methods for measuring radiation levels have been created by scientists due to the fact that ionizing radiation may cause damage not only to the one who is exposed to it but also to their descendants. In order to determine the dose, the three basic methods that are used are the biologically comparable dosage, exposure, and absorbed dose procedures.

The number of ions that are released into the air as a consequence of x-ray or gamma radiation is often referred to as exposure. In addition to being the first radiation method to be established, the unit of measurement was given its name in honor of one of the researchers who investigated the effects of radiation. The exposure unit that was created by the System International (SI) is coulombs per kilogram (C/kg), despite the fact that the roentgen (R) is still being used. In order to ascertain the origin of this unit, a beam of x-rays or gamma rays is sent through a certain mass (kg) of dry air while maintaining a consistent temperature and operating pressure. This beam is responsible for the generation of a total charge (C) of positively charged ions that may be seen. Regarding the conversion from roentgens to coulombs per kilogram:

$$\text{Exposure (in roentgens)} = 2.58\times10^{-4}\text{m}$$

$$\text{In other words, } 1\text{ R} = 2.58\times10^{-4}\text{ C/kg}$$

The exposure units, on the other hand, do not make any connection between the effects of radiation and biological tissue. The quantity of radiation energy that is taken in by a tissue is referred to as its absorbed dose, and it is calculated as a function of the tissue's mass. In this situation.

$$\text{Absorbed dose} = \frac{\text{Energy absorbed}}{\text{Mass of absorbing material}}$$

According to the International System of Units (SI), the dose that is absorbed is measured in gray units (Gy), which are equivalent to joules per kilogram (J/kg). Among the units that are not a part of the Systeme Internationale is the rad (rd), which stands for radio frequency. What is meant by the acronym "rad" is the dose of radiation that is absorbed by the body. In general, one rad is equivalent to 0.01 grayscale units. This is a rule of thumb.

The absorbed dose unit was an improvement over prior exposure units, but researchers rapidly realized that various forms of ionizing radiation produced varied degrees of damage to living tissue. However, the absorbed dose unit did the most damage. On the other hand, the absorbed dose units did not take into account these variances. Utilizing the quality factor (QF) or the relative biological effectiveness (RBE) is one method that may be used to measure and evaluate the impacts of different radiations.

Comparing the dose of the radiation in issue with the dosage of the radiation that is necessary to inflict the same level of damage—in this example, 200 keV x-rays—is one method that may be used to ascertain the relative biological effectiveness of a particular radiation.

$$\text{Relative biological effectiveness (RBE)} = \frac{\text{The dose of 200 keV x-rays that produces a certain biological effect}}{\text{The dose of radiation that produces the same iological effect}}$$

In order to estimate the RBE, the kind of ionizing radiation and the intensity of that radiation are taken into consideration when irradiating a particular sort of tissue. An RBE of one is assigned to a gamma ray or a negative beta particle (referred to as an electron), while the RBE of a proton is ten. Protons, on account of their higher RBE value, are responsible for a greater amount of tissue damage compared to beta particles and gamma rays. The RBE values of beta particles and gamma rays are much lower when compared to those of alpha particles, neutrons, and protons. The physiologically equivalent dose is formed by combining the absorbed dosage in rads with the red blood cell equivalent (RBE):

$$\text{Biologically equivalent dose} = \begin{matrix}\text{Absorbed dose}\\ \text{(in rads)}\end{matrix} \quad \text{x} \quad \text{RBE}$$

The rem, which is an abbreviation that stands for "short for roentgen equivalent, man," is the unit of measurement that is used to determine the dose that is physiologically equal. The units of rems are used in the process of evaluating the presence of occupational radiation. The majority of persons do not experience any discernible biological effects when exposed to radiation up to 25 rems. It should be brought to your attention that the government has established limitation thresholds for radiation exposure in the workplace; the maximum amount that is permitted is five rem. For your convenience, the following table provides statistical information on the rem and the millirem, which is equal to one thousandth of a rem: It is possible that your total radiation exposure will increase by one millirem if you watch the typical amount of television all during the course of a year. That is the same amount of radiation that you would be exposed to if you flew from coast to coast.

CONCLUSIONS

The degree to which electromagnetic fields represent a harm to human health is still up for debate, despite the fact that electronic devices are used by a large number of people. At this time, there is no evidence to suggest that the use of low-frequency radiofrequency waves is related with any adverse consequences on human health. On the other hand, research at the cellular level is making progress, with a particular focus on high frequency. In a great number of studies, the impacts of electromagnetic fields (EMFs) on cellular levels, such as DNA, RNA, proteins, hormones, intracellular free radicals, and particles, have been investigated. Numerous people are becoming more concerned about the possible risks that radio frequency poses to human health as a result of the exponential development of mobile phone usage. There is continuous research being conducted in both in vitro and in vivo settings to investigate the molecular pathways. For the reason that there are billions of people who use mobile phones in close proximity to brain tissue, researchers have shown that electromagnetic fields may be responsible for the development of brain tumors. Researchers from the field of genotoxicity are now carrying out investigations on human health; however, the results of these studies have not yet been published.

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