Innovative: International Multi-disciplinary Journal of Applied Technology
(ISSN 2995-486X) VOLUME 02 ISSUE 06, 2024

"Protection of Nuclear Radiation"

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Abstract:

Radioactive materials or radioactive elements have been present in nature since the beginning of creation. They are present in our bodies, our food, the water we drink, and the air we breathe. Our bones contain radioactive polonium and radium, and our muscles contain radioactive carbon and potassium, and there are noble gases and hydrogen tertiary (tritium), which are all radioactive and present in the lungs of any of us. We also recognize cosmic rays and inhale radioactive radon gas permanently. Also, many of us live from Lishua in An atmosphere full of radioactive materials if he works in oil or phosphate extraction areas or goes to relax in mineral baths, and if he is a fan of traveling by plane, this doubles the amount of radiation to which he is exposed. All the radioactive materials mentioned above are natural radioactive materials that have existed since the beginning of creation. However, devices have been manufactured that emit radiation, such as those used in medical and industrial radiography, and many radioactive materials have been manufactured [2] by converting stable materials into materials with unstable nuclei, through nuclear reactions, to produce a radioactive material that can be used for various purposes. The aim of studying and preventing nuclear radiation: Radiation protection is the science of protecting humans from the effects of ionizing rays, whether they are elementary particles such as protons and neutrons or high-energy electromagnetic rays such as X-rays and results of this science, which combines physics and medicine, have been included gamma rays. The in globally agreed upon instructions and commandments, and each country places them within its laws for the purpose of radiation protection. It is imperative for workers in scientific and industrial journals, as well as doctors who specialize in dealing with materials and devices that emit ionizing radiation, to follow these commandments and laws, in order to preserve their health and safety, as well as the safety of the patients who are being treate, By radiation and radioactive isotopes. This also applies to radiographers. This study also aims to clarify the benefits and harms of nuclear radiation and protect humans and all living organisms from radiation damage and benefit from its benefits.

Introduction -:

Nuclear radiation: It is energy or particles that are liberated from the nucleus of an atom as a result of a state of instability in which the nucleus is located. A substance whose atomic nuclei are unstable is called a radioactive substance. The released energy, or what is called gamma rays, is one of the forms of electromagnetic radiation that includes, in addition to radar and radio waves, infrared rays (heat), visible light (red, orange, yellow, green, blue, and violet), ultraviolet rays, and x-rays. All of these types of rays surround us. It submerges us, clings to us, and penetrates us through glass or sieves, so that it does not care about our, and back and forth, as if we werperessigennscein our bodies and they are not affected by us, and if we are affected by them and need them urgently, who among us can imagine life without light or warmth? As for the particles that emanate from the unstable nucleus, they are alpha, beta, and neutron particles, and they have high energy, although their energies differ and their abilities to penetrate materials vary [1]. Radioactive materials or radioactive elements have been present in nature since the beginning of creation. They are present in our bodies, our food, the water we drink, and the air we breathe. Our bones contain radioactive polonium and radium, and our muscles contain radioactive carbon and potassium, and there are noble gases and hydrogen tertiary (tritium), which are all radioactive and present in the lungs of any of us. We also recognize cosmic rays and inhale radioactive radon gas permanently. Also, many of us live from Lishua in An atmosphere full of radioactive materials if he works in oil or phosphate extraction areas or goes to relax in mineral baths, and if he is a fan of traveling by plane, this doubles the amount of radiation to which he is exposed. All the radioactive materials mentioned above are natural radioactive materials that have existed since the beginning of creation. However, devices have been manufactured that emit radiation, such as those used in medical and industrial radiography, and many radioactive materials have been manufactured [2] by converting stable materials into materials with unstable nuclei, through nuclear reactions, to produce a radioactive material that can be used for various purposes. Specific, such as radioactive cobalt used in cancer radiotherapy units, which is produced by bombarding non-radioactive nickel with neutrons, producing radioactive cobalt, radioactive iodine, which is used in diagnosing and treating thyroid diseases, and many other substances that are used in diagnosing and treating many diseases. Nuclear reactors that are used to produce energy or for the purposes of scientific research are considered one of the largest sources of radioactive material production ever, as the fission of the nuclei of the uranium atoms of these materials located in the heart of the reactor leads to the production of more than two huAnnd dred radioactive materials, the period of which their radiation effectiveness varies greatly. However, most of them quickly turn into non-radioactive materials through the process of radiolysis, and they mostly remain inside fuel tankers until they are treated in appropriate locations, and only a small amount of them are allowed to exit into the environment. The discovery and use of ionizing radiation has led to great benefits in medicine, industry, agriculture, and education. However, many people are still terrified and frightened when they hear the word radiation due to their lack of knowledge on this subject, which leads to a false assessment of the benefits and risks of radiation [3]. The explosion of the fourth unit of the Chernobyl reactor in 1986 had a negative psychological and social impact. The global contribution to exaggerating the accident and what was expected of it at the time of its occurrence, but the health and environmental risks were very low. The fears of some may be justified, but as a result of the low knowledge of many or the presence of insufficient knowledge to answer all questions related to radiation, even among many specialists, this leads to incorrect fears [4]. With Especially, Previous studies -: In 2013, the World Health Organization issued a report on the damage caused by the Japanese Fukushima accident Which occurred in 2011, as a result of a catastrophic potential increase in some types of cancer, such as breast cancer, solid types of cancer, and thyroid cancer in females who were exposed to radiation as infants, while it predicted an increase in the incidence of leukemia in males who were exposed to the damage it catuoseras.diation while they were infants. Nuclear radiation constitutes a serious danger that affects the environment, water, air, plants, animals, and

humans[4] for long-term periods, as it pollutes the environment and leads to the killing of animals, plants, and humans, or changes in their nucleic acids, in addition to the many diseases that it may cause. [5] It was noted until 1896 that external exposure to X-rays may cause a number of diseases, such as erythema (or edema) . In 1897, a researcher counted 69 cases of burns caused by X-rays. In 1911, 94 cases were discovered in a cancerous tumor caused by I believe that some compounds of radium and thorium have therapeutic value and can be used in some aspects of medical treatment. Accordingly, many people were injected with this deadly substance, and for the period from 1928 until 1945, a large number of people who were injected with thorium dioxide died. It is then used to concentrate materials for the purposes of medical diagnosis. It was also noted that a large number of these people were afflicted with liver cancer[4].

Research objectives-:

The aim of studying and preventing nuclear radiation: Radiation protection is the science of protecting humans from the effects of ionizing rays, whether they are elementary particles such as protons and neutrons or high-energy electromagnetic rays such as X-rays and results of this science, which combines physics and medicine, have been included gamma rays. The in globally agreed upon instructions and commandments, and each country places them within its laws for the purpose of radiation protection. It is imperative for workers in scientific and industrial journals, as well as doctors who specialize in dealing with materials and devices that emit ionizing radiation, to follow these commandments and laws, in order to preserve their health and safety, as well as the safety of the patients who are being treate, By radiation and radioactive isotopes. This also applies to radiographers. This study also aims to clarify the benefits and harms of nuclear radiation and protect humans and all living organisms from radiation damage and benefit from its benefits. Knowing the types of nuclear rays and their biological effects on living organisms. Types of nuclear rays, There are two basic types of radiation: 1- Ionizing Radiation: It is called this because this type of radiation has the ability to ionize the atoms through which it passes, such as electromagnetic radiation (X-rays, gamma rays, and rays), beta and alpha cosmic radiation, particle rays such as (particles and protons) [3] and neutrons. Non-Ionizing Radiation, That is, it does not have the ability to ionize the atoms it passes through, such as radio waves, television waves, radar waves, thermal waves with short wavelengths (microwaves), infrared waves, ultraviolet rays, ordinary light, and laser rays.[3], Nuclear radiation: During the many years of the discovery of radioactivity, it was found that radioactive nuclei naturally emit one or more of three types of radiation (alpha particles, beta particles, and gamma rays), which could be distinguished among themselves as follows: 1 - Power Its penetration into the medium through which it passes. 2- Its ability to ionize the atoms and molecules of the materials through which it passes. 3- Its behavior in the electric and magnetic fields [5], Types of ionizing radiation , Alpha particles (particles): Alpha particles are characterized by the . following: - 1 - They are the nuclei of helium atoms, meaning they are positively charged - 2 - The speed of alpha particles depends on the type of radioactive source. -3 The range of alpha particles in the air is equivalent to a few centimeters and can be stopped with a piece of paper thick.[5], 4- Ionization occurs in the gas through which it passes. 5- It is affected by the magnetic field, as it deviates towards the negative direction and is relatively heavy It carries a positive charge. 6- The penetrating power of alpha particles is very weak, as they lose their energy as soon as they leave the radioactive element. The reason for the limited ability of alpha particles to penetrate materials is due to their high charge, which causes high ionization of the material that passes through . During it, it loses its energy quickly, which makes its range short, and it is possible to cause harm and health damage to tissue through the simple path. This ray is absorbed by the outer part of the human skin. Therefore, alpha particles are not considered harmful outside the body, but they can cause great harm if they are inhaled or Swallowed or entered into the body as a result of a wound, it is very harmful. When alpha particles pass through matter, they cause ionization [6] of their atoms due to their high charge. The ionization is not uniform along its path, but rather reaches a maximum near the end of its range, and the property of its ability to

cause ionization is used in the detection process. -7 When emitted from the nucleus of a radioactive element, the mass number of the radioactive element decreases by fo, Its atomic number decreases by two. The equation below shows the decomposition or disintegration of alpha.[3]… .....(1) = ÿ+ ÿ, Where: X represents the chemical symbol for the element, A: Mass number Z: atomic or proton number N: neutron number

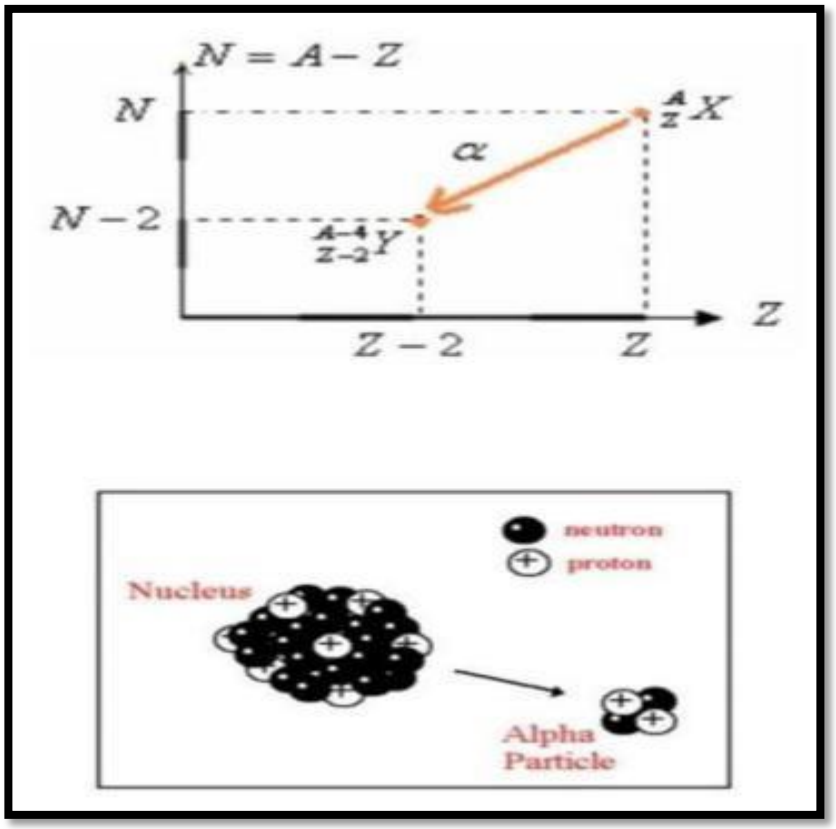
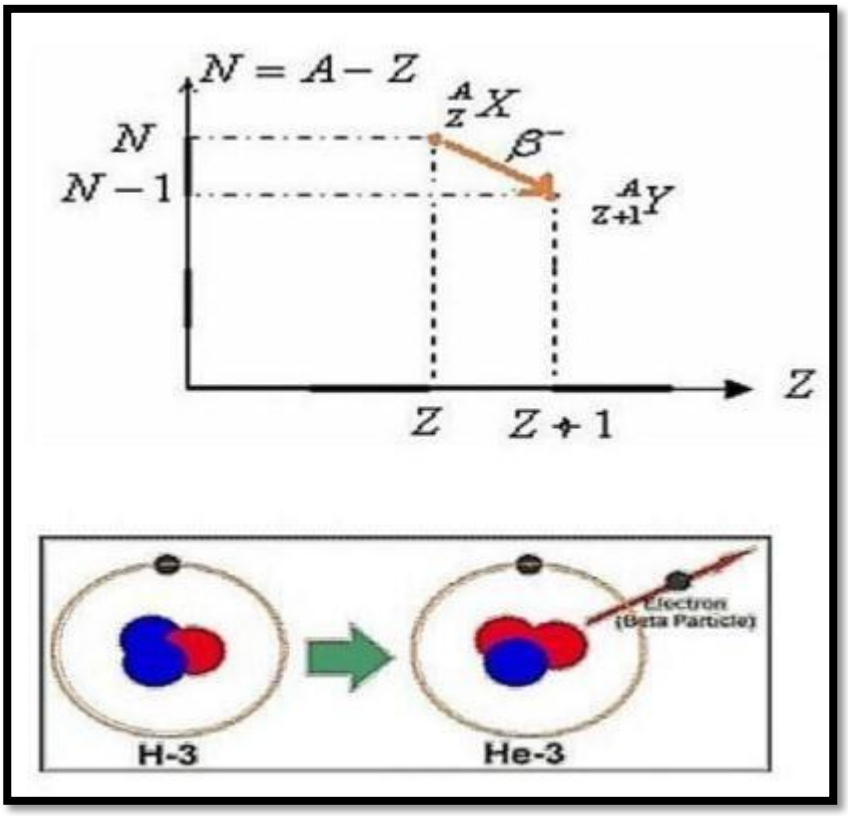


Figure (1): Radionuclide decay radioactive

Beta particles (particles): Beta particles are characterized by: 1- These particles have a greater penetrability than alpha particles, about 100 times. 2- They can travel several centimeters in the air before being absorbed and a few millimeters into a substance. Aluminum. 3- It ionizes the medium through which it passes to a lesser degree than that caused by alpha particles. 4- The deflection of beta particles in the presence of a magnetic field is greater than the deflection of alpha particles and in the direction that indicates that they carry a negative charge (they are electrons), and since beta particles are charged, they interact with the medium. Atomic particles pass through it and cause ionization of its atoms. For this reason, their range in the air is about 280 times greater than the range of alpha particles under standard conditions. -5 The range of beta particles depends on their speed, which may sometimes reach close to the speed of light, It is emitted from most natural and industrial sources [3]. 6- Beta particles cannot be stopped with a piece of paper, and the flow of these rays cannot be stopped with a piece of wood, and they may cause harm if they penetrate the bofadtheyr. 7- When beta particles emerge from the nucleus of a radioactive element, the mass number does not change, but its atomic number increases by one with the emission of an electron (beta particle), as in the equation below [4]. (2) (ÿ) = ÿ ÿ+ÿ +

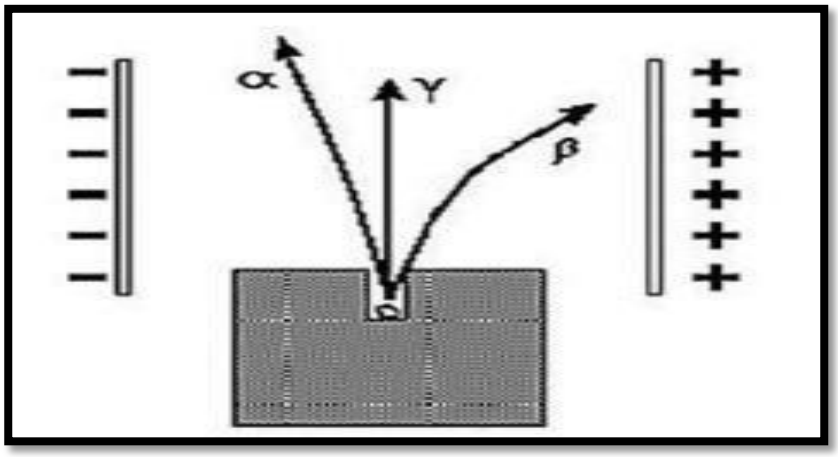


Gamma rays are characterized by the following: - 1. The energy of gamma rays is high, and therefore their ability to penetrate the material is large, exceeding several centimeters for lead [3]. 2 - Gamma rays weakly ionize the gas through which they pass. 3- They are not affected by the presence of a magnetic field, and this indicates that they are electromagnetic waves. 4- The emission of gamma rays is not accompanied by a change in the mass number or atomic number, and therefore the element does not change. Rather, it is produced when the nucleus is in an excited state, meaning it has more energy than its natural limit, and since there is a tendency for any particle to be at the lowest level of energy. The excited nucleus gives off excess energy in the form of electromagnetic waves . called gamma rays 5- Gamma rays are considered one of the most dangerous types of radiation and have a very high penetrating power, much greater than alpha and beta particles. Their flow can be stopped by a concrete barrier (reinforced concrete). X-rays fall within the divisions of gamma rays, but they are less able to penetrate than gamma rays. .[2]. The following equation explains the decay of gamma rays.

ÿ +ÿ.....3

Table No. (1): Shows the relative ionization strength and relative transmittance strength of nuclear radiation

الإشعاعات النووية	قوة التأين النسبية	قوة النفاذية النسبية
جسيمات ألفا	10000	1
جسيمات بيتا	100	100
أشعة الفا	1	10000



The relationship of nuclear rays with the magnetic field is illustrFaitgeudrein(3):

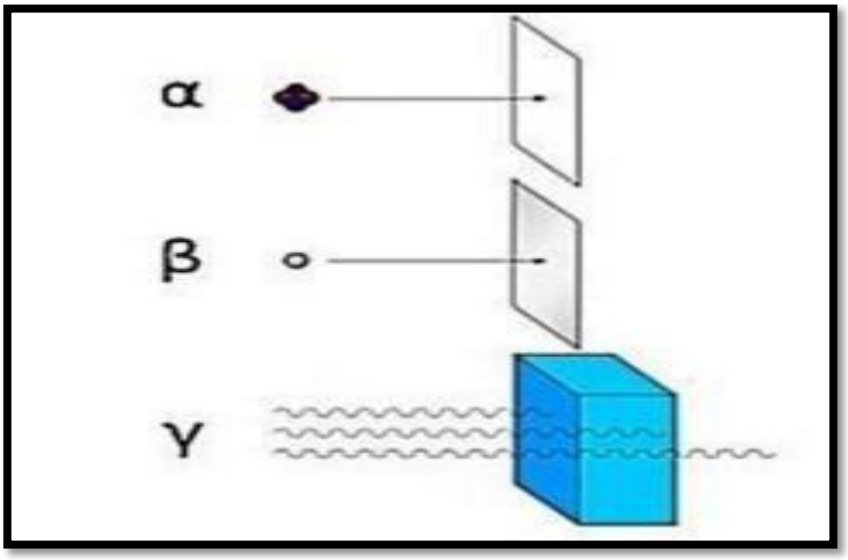


Figure (4) (susceptibility to lead barrier) Alpha,

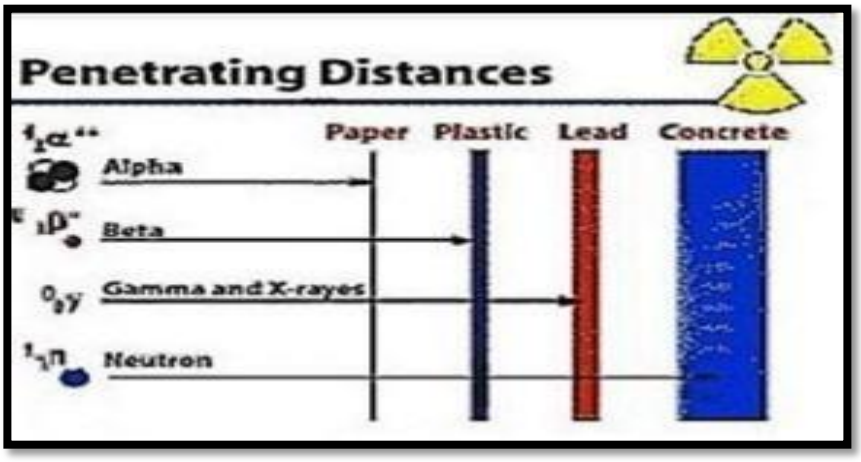


Figure (5): The ability to penetrate nuclear radiation

Biological effects of nuclear radiation, When any living organism is exposed to nuclear radiation, ionization of the atoms that make up the molecules of the human body occurs [6], which leads to the destruction of these tissues, threatening human life. The degree of danger resulting from these radiations depends on several factors, including their type, the amount of energy produced from them, and the time of exposure. These rays have two types of biological effects [7], which are: -3.1.1 Physical effect: It often appears in humans, where they become afflicted with some serious diseases such as skin and blood cancer, cataracts in the eyes, decreased ability to fertilize, and so on. Genetic impact: Its effects appear on successive generations, as this is clearly evident even now in the Japanese after the dropping of the nuclear bombs on Hiroshima and Nagasaki in September 1945. Which led to the death of tens of thousands of people [7] , causing them to suffer burns and deformities, and infecting their grandchildren with serious, fatal diseases. Also, the pregnant woman's blood should be taken to What a person exceeds is 5 rem per day, and the rem is the unit of measurement of absorbed radiation [2], which is equivalent to one Roentgen of X-rays. Man Equivalent Roentgen. A person is exposed to many sources of radiation in daily life, and this affects many parts of the human body. For example, radiation affects the circulatory system through its effect on blood lymphocytes and causing chromosomal abnormalities in them, which are of the dicentric type, thus causing cancer. These chromosomal abnormalities are considered the first step in cancer. [8]. When radioactive materials are swallowed, they pass with food through the digestive system. If these materials are of the type that dissolve by various enzymes, they are absorbed with the food and reach the blood, which in turn distributes them to all parts of the body, and they may also be concentrated in certain organs of the body. As for insoluble substances, they pass through the entire digestive system and irradiate this system as they pass through it, especially the intestines. As the doses increase, their effect becomes clear on the central nervous system, as the survival time gradually decreases. In general, there is not sufficient data on humans regarding the central nervous system, but experiments on animals have proven the appearance of symptoms indicating some damage to the central nervous system. There is another effect that appears once exposed, This effect is known as erythema, which is a redness of the skin, as the skin is more exposed to radiation than any other tissue in the body, especially to From low-energy Agriculture, as well as the exposure of workers in nuclear reactors and workers in the mines from which radioactive elements are extracted to [7] radiation from radioactive materials such as radium, uranium, and others [9]. One of the main factors causing nuclear pollution is what happens in the Nuclear Club countries in terms of conducting experiments, especially after the war The Second World, War aims to develop atomic weapons to increase their destructive power. The experiments led to the spread of large quantities of radioactive atomic dust in the areas where the experiments were conducted, as the winds carry this radioactive dust to the upper layers of the atmosphere, knowing that this dust contains some radioactive isotopes such as cesium-137. Strontium-90, carbon-14, iodine-131, and other isotopes whose radioactive activity continues for a long period of time, falling over many areas far from the experimental site, polluting the air, water, and food. Most radioactive isotopes continue their radioactivity for a long period of time, which doubles the damage of pollution to all elements of the environment. The spread of nuclear plants has led to the emergence of problems with a harmful impact on all elements of the environment as a result of nuclear waste [9]. The radioactivity of these wastes is measured by what is known as the curie, which is The radioactivity that results from one gram 3of the element radium 226 (the is 10 x 3.7 decay/second). Among the waste produced by power generation plants are beta and gamma radiation, and these rumors do not have a great danger due to their small relative size, and other strong radiation includes many isotopes. Radioactive particles, such as neptunium and plutonium, radiate. These isotopes are highly radioactive and have an extremely long half-life, as their radioactive activity continues for a very long period of time. Nuclear waste is disposed of in several ways that, Due to the strength of the rumors emanating from it, vary according to...For example, the weak and medium ones are placed after cooling in the ground [3], where they are surrounded by a layer of cement or rocks, and sometimes some countries throw them into the waters of the seas and oceans. Waste with strong

radiation is placed in water to cool it and then enters great depths underground and in places far from urban areas. There is another type of pollution caused by nuclear plants, which is thermal pollution, which results from the use of ocean, sea, or day water in large quantities to cool the reactor, which is then thrown into the source and its temperature rises, causing [7] a defect in the ecosystem, as well as harm to all aquatic life that lives in the water. By reducing the percentage of dissolved oxygen in the water, which is necessary for the life of marine organisms, and to overcome this problem, some countries have put in place special laws requiring these stations to cool hot water before throwing it into the seas or lakes. Some stations have also created artificial lakes that they use for cooling purposes. [2] With a permanent successor from radiation, it is not a new thing. Life on Earth has evolved. It was invented by human intelligence. Radiation has been around since the Earth existed, and one of the most debatable matters is the question of whether life has evolved despite the inherent harmful effects of radiation. Or perhaps the radiation may have contributed to this development based on the principle of the winner in the ongoing battle. Thus, the effect of the radiation on living organisms, according to some theories, is considered a vital factor in the continuous advancement of life types, and there is no one at the present time who can prevail over both opinions with some certainty. Indeed, it is It is possible that the answer will never be known with any certainty, at least not at the present time [7]. The radiation was not as harmful as is currently known because it has always been present. What we are doing these days is adding additional doses of radiation to the naturally occurring amount. Made by man. This is the basic difference between radiation and other forms of pollution that can turn, in the final analysis, into something deadly [2]. Cytogenetic effects of radiation: - The bodies of living organisms consist of small units called cells [9]. The cell, in turn, is composed of a central nucleus surrounded by a fluid known as cytoplasm, which is surrounded by an envelope called the cell wall. Cytoplasm can be considered as the cell factory that digests food, converting it into energy and complex molecules used for processes. Repairing what is given in the cell or dividing it. As for the nucleus, it can be considered as the organizing mind or controlling the course of operations in the cell. The nucleus also contains 46 chromosomes, which are a threadlike structure consisting of hereditary genes, and hereditary genes are made up of DNA and protein molecules, which carry... These genes are the information that determines the characteristics of the newborn cells, and the cells have the ability to reproduce to compensate for the third cells. Humans are exposed to different types of radiation, such as light. And heat, but his exposure to nuclear radiation results in serious effects on his health [7]. The only difference between nuclear radiation and the known radiation such as light and heat lies in that if the energy of the element is high, it is sufficient for the particles of matter. In the case of ionization of water, from which most of the cell is composed [9], molecular changes result and are formed. New chemical substances may lead to the destruction of the genetic material, and this may lead to a change in the structure and function of the cell. When a substance is exposed to radiation, the radiation loses part of its energy, which is absorbed by the materials exposed to it, which may lead to ionization of the substance. We must differentiate between the radiation dose, which is the amount The total energy absorbed and the rate of absorption of this energy. As a result of the exposure of the human body to the radiation, a different set of direct and indirect effects occur. These effects do not depend only on the atomic structure of the substance that absorbs the radiation, but also on its molecular structure, its crystalline composition, and the nature of the material surrounding it. [7] The effects are produced. Genetic radiation causes damage to reproductive cells, and this damage leads to a group known as mutation genetic _(changes in the genetic material).

Conclusion

There is another type of pollution caused by nuclear plants, which is thermal pollution, which results from the use of ocean, sea, or day water in large quantities to cool the reactor, which is then thrown into the source and its temperature rises, causing a defect in the ecosystem, as well as harm to all aquatic life that lives in the water. By reducing the percentage of dissolved oxygen in the water, which

is necessary for the life of marine organisms, and to overcome this problem, some countries have put in place special laws requiring these stations to cool hot water before throwing it into the seas or lakes. Some stations have also created artificial lakes that they use for cooling purposes.

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