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Review Article about Radioactive Contamination

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Abstract: Radioactive pollution is the increase in natural radiation levels due to human activities. Human activities that can release radiation include activities involving radioactive materials such as mining, handling and processing of radioactive materials, handling and storage of radioactive waste, as well as the use of radioactive reactions to generate energy (nuclear power plants),

Radioactive pollution occurs when radioactive elements are present in the atmosphere or environment, especially when their presence is unexpected and creates an environmental threat due to radioactive decay.

In addition to the use of radiation in medicine (such as X-rays) and research. Radiation is basically of two types: 1. Non-ionizing radiation: These are electromagnetic waves with a wavelength longer than near-ultraviolet to radio waves. These do not contain enough energy to ionize them. 2. Ionizing radiation: These are electromagnetic radiations with high energy, such as short-wavelength ultraviolet, X-rays, and gamma rays. Energetic radiation produced by radioactive decay can cause the atoms and molecules of the medium through which they pass to ionize and convert them into charged ions. The radiations are (γ) gamma, (β) beta, (α) alpha

produced by a process called radioactive decay. They can also affect other non-radioactive atoms to become radioactive and emit radioactive radiation. Sources of radiation contamination Nuclear power plants. Mining for nuclear fuel, nuclear waste, nuclear power plant accidents, nuclear testing, diagnostics, biological research and nuclear weapons are all potential sources of radioactive contamination. On average, 82% of this radiation comes from natural sources and 18% from anthropogenic sources (i.e. those associated with human activities). The main natural source of radiation is radon gas, which accounts for about 55% of the total radiation dose. The main anthropogenic sources of radiation are medical X-rays and nuclear medicine.

Introduction: -

Radiation is a natural phenomenon that surrounds humans everywhere in their daily lives. Human activity has led to an increase in its concentrations in some locations or due to accidental accidents, certain industrial problems, or mismanagement, which leads to serious cases of pollution. Radiation during accidents that occur in nuclear reactors or due to nuclear experiments or radioactive waste that leaks from vehicles and satellites or due to dangerous waste resulting from factories that use radioactively treated chemicals, as these radiations are returned to the earth, polluting the air, water, soil, and food, which leads to fatal and deadly risks to humans and other living organisms or causing deformities or imbalances in vital systems according to the level and type of radiation doses.

Radioactive pollution is defined as the emission of dangerous radiation as a result of accidents that occur in nuclear reactors or from radioactive waste or any source used in radiation in harmful doses that work to destroy the cells of the living organism directly when exposed to radiation directly or indirectly through its concentration in the air, water, soil, or food.

Radioactive Pollution: -

Humans have always been exposed to radiation since ancient times through cosmic radiation coming from space, such as sunlight emitted from rocks, volcanoes and water. All types of radiation, in their natural form, do not negatively affect environmental elements or living organisms. Also, all types of natural radiation do not result in radioactive pollution.

Radiation is defined as the ability of some elements to emit particles, particles or other physical media. The use of radiation began since the German scientist "Roentgen" discovered X-rays (X-rays) in 1895 AD in order to diagnose pathological conditions and bone fractures in humans.

Radioactive pollution, the deposition or presence of radioactive materials on surfaces or inside solids, liquids or gases (including the human body), where their presence is unintended or unwanted. Ionizing radiation (i.e. alpha, beta and gamma rays) and free neutrons. The degree of danger is determined by the concentration of pollutants, the energy of the emitted radiation, the type of radiation, and the proximity of the pollution to the body's organs. It is important to be clear that contamination creates a radiation hazard, and that the terms radiation and contamination are not interchangeable.

Sources of radioactive contamination can be classified into two groups: natural and man-made. After a nuclear containment is discharged into the atmosphere or a nuclear reactor containment is breached, the air, soil, people, plants, and animals in the immediate area will be contaminated with nuclear fuel and fission products. A spilled vial of radioactive material, such as uranyl nitrate, contaminates the ground and any equipment used to clean up the spill. Widespread cases of radioactive contamination include the Bikini Atoll, the Rocky Flats plant in Colorado, the Fukushima Daiichi nuclear disaster, the Chernobyl disaster, and the area around the Mayak facility in Russia.

Radiation measurement units

1. Rad (RAD (: It is the oldest unit of measurement for the amount of absorbed radiation energy (absorption dose) of radiation
2. Roentgen (ROENTGEN (: A unit of measurement for emitted radiation and is mainly used X-rays and can be defined as the amount of X-rays or gamma rays that lead to the generation of an electric charge of (10×2.58) coulombs/kg of air under standard conditions And is symbolized by the symbol R.
3. Curie (: It is a measure of emitted radiation and represents the energy of a joule of a kilogram of matter and one curie is 10×3.7 decays per second and is symbolized by ci and every 1 curie = 100 rads.
4. Rem (REM (: It is the old unit used to measure the dose equivalent and is known as The unit of measurement of the biological effect of absorbed radiation.
5. Sievert (SIEVERT (It is one of the most recent Units of measurement of the signal resulting from the absorption of radiation and is known as the dose distributed according to the possibility of causing damage caused by radiation and is equivalent to 1 joule per kilogram and the sievert = 100 rem and is symbolized by the symbol SV

In 1896 AD, when the French scientist "Henri Lecourelle", a natural scientist, was conducting an experiment on a number of phosphorous materials, he discovered by chance that when the phosphorous uranium salt, which contains the element uranium, glowed, it did not only emit light, but also a type of energy called radiation. After that, the scientist "Marie Curie" discovered other elements that had the radioactive property of uranium, as she discovered that the element thorium, like uranium, emits radiation without requiring exposure to sunlight or any other source.

Since the beginning of the forties of the last century, countries began conducting a number of experiments using radiation in the manufacture of military weapons. The first country to begin conducting experiments and manufacturing radioactive weapons was the United States of America in the world.

Over time, the arms race that the world is witnessing, and the effects of weapons on living and non-living organisms, a type of environmental pollution has emerged, which is radioactive pollution, which is defined as pollution resulting from the scattering of nuclear and atomic waste from the reactor or as a result of nuclear experiments and the use of nuclear weapons in wars. Or as a result of burying nuclear waste on land and sea in an incorrect manner, which results in serious environmental effects. The Iraqi environment is currently witnessing radioactive pollution as a result of the wars it has fought and the types and quantities of weapons it has been exposed to. The United States of America played a major role in exacerbating the problem of radioactive pollution from internationally prohibited weapons during the Gulf War in 1991 and 2003.

The amount of radiation released on Iraq in 2003 was estimated to be equivalent to 250,000 nuclear bombs the size of Nagasaki and Hiroshima. As a result of the severe pollution in the country, several international studies have been conducted, confirmed by United Nations experts, that the Iraqi environment is currently one of the most contaminated environments in the world due to the

dangerous radioactive pollution it faces, which threatens all aspects of life in it, as radioactive pollution is spreading in vast areas of Iraqi territory, ranging from hundreds to thousands of times the permissible limit. This pollution will not only have effects on the current generation of Iraqis, but also on future generations.

Sources of radioactive pollution: There are many sources of radioactive pollution, the most prominent of which are:

Natural sources: There are many natural sources of radioactive pollution

1. Cosmic radiation, as outer space, including its galaxies, releases a group of rays, some of which penetrate the Earth's atmosphere and interact with its components. Cosmic radiation also includes solar rays, some of which may cause clear changes on the Earth's surface.
2. Radioactive gases, as these gases are found near the Earth's surface, and may be formed as a result of the decomposition of some radioactive terrestrial elements, such as thoron resulting from the decomposition of the element thorium in the Earth
3. Radioactive materials in water, as the concentration of radioactive materials in water varies based on the source of the water. For example, when groundwater passes through rocks rich in uranium, it is affected by it and becomes polluted at very high rates.
4. The terrestrial environment, as some radioactive elements such as uranium and thorium are found in the Earth's crust.

Industrial sources: There are many sources of radioactive pollution found by humans for various purposes, including the following

1. Nuclear explosions The environmental medium chosen to cause nuclear explosions is a determining factor in the severity and intensity of the explosion. Airborne explosions are more harmful than underwater explosions or explosions near the Earth's surface, due to their ability to spread their contaminated atomic waste to all elements of the vital environment.
2. Nuclear reactors The impact of radioactive pollution resulting from nuclear reactors can be reduced by taking into account the selection of places as far away as possible from population centers, and the food and water sources that depend on them

Medical sources may use some types of radiation for medical purposes, such as X-rays used in treatment and diagnosis. These rays cause the formation of radioactive pollution

Types of radioactive contamination: -

Radioactive contamination is divided into three categories in terms of its occurrence:

1. Continuous radioactive contamination This type of contamination occurs continuously and permanently in places where radioactive materials are present, such as uranium mines, nuclear reactors, and experimental laboratories.
2. Accidental radioactive contamination This type of contamination occurs when experiments on hazardous materials fail, or when control of the materials used in the experiment is lost.
3. Instantaneous radioactive contamination occurs at a specific time or circumstance, for example when conducting nuclear experiments and experimental experiments on radioactive materials.

Ways of exposure to radioactive contamination: -

Exposure to radioactive contamination occurs in two ways, which are

1. Internal contamination occurs when radioactive materials enter the body through swallowing or breathing radioactive materials, or by entering through an open wound, or being absorbed through the skin, and some of these materials can settle in various organs of the body permanently, or they can be disposed of through blood, sweat, urine, and feces.

2. External contamination, which occurs when radioactive materials in the form of dust, powder, or liquid settle on the outer surface of the skin, hair, or clothing, and external contamination can become internal if radioactive materials enter their bodies.

The harmful effects of radiation pollution depend on several factors: -

1. The amount of radiation (dose)
2. The speed of receiving the radiation dose
3. The area of the body exposed to radiation
4. The sensitivity of the tissue exposed to radiation
5. The presence of genetic abnormalities that hinder the natural repair processes of DNA
6. The person's age at the time of exposure to radiation
7. The person's general health condition before exposure to radiation

Biological effects of radioactive contamination

When radioactive materials enter the body by any means, they are absorbed and enter into the basic biochemical processes and these radioactive materials reach the blood circulation and body fluid and are distributed to all tissues of the body, their chemical properties and characteristics of the elements and compounds that make up these radioactive materials. The effects resulting from internal radiation exposure are controlled by many factors, the most important of which are the slow development and appearance of the effect, and the lack of homogeneity of absorption of the radiation dose in the tissues, in addition to the time period required for the radioactive analysis of the radioactive material, which gives an accumulated dose over time, as well as the degree of chemical scatter of the radioactive material itself. The harmful effects of radiation in the human body are represented by:

a) Somatic effects (radiation of effects): These are the risks or effects that affect all types of body cells. That is, its symptoms or effects appear in the living organism itself that was exposed to radiation.

b) Genetic effects: These are the effects whose symptoms appear in the offspring of the living organism that was exposed to radiation as a result of damage to its reproductive organs.

Factors that control the effects of radiation exposure

A. The physical properties of the radioactive material, including the half-life, type and energy of the emitted rays, linear transfer of energy, and absorbed energy From the tissue containing the source to the tissue receiving the rays.

B. Biological factors of the radioactive material and the transfer of the material inside the body from one organ to another, in addition to the retention of the radioactive material in a specific tissue, and the period of time for the presence of the radioactive material inside the body, then the ways of exiting the radioactive material from the body, as well as the biological half-life, in addition to other factors such as age sex and various diseases.

The transfer of the radioactive material depends on the blood circulation and body fluids as well as the respiratory system and the digestive system, which determine the mechanical mechanisms for the transfer of the radioactive material from one tissue to another.

- One of the health effects of radiation exposure is the cancerous transformation of some tissues in which radioactive materials are present for relatively long periods, and the radioactive effect goes through two basic stages, which are Physicochemical stage:

This stage shows the appearance of the radiation injury related to the absorption of energy

Radioactive within the bonds of chemical molecules in the cells, which results in the occurrence of tension or ionization of these physicochemical bonds, which are the molecules present in the biological space that was exposed and in which energy absorption processes occurred.

This results in the occurrence of changes in the performance of the function of the chemical molecules that prepare for the occurrence of tension and ionization of their bonds, and they are called changes in the molecules.

This stage is considered the basis on which the development, appearance, and type of injury resulting from radiation exposure will result. This stage is important in terms of what concerns the occurrence of repair processes in the chemical molecules that were affected by radiation exposure, the absorption of radiation energy, as well as the development of radiation injury and its origin, which determines the amount and size of the remaining effect after the repair that takes place in the molecules.

The stage of biological impact on cells and tissues:

The chemical changes that occur to the molecules form the basis of the radiation that follows it.

The development and appearance of radiation effects in cells and tissues, the most important of which is the transformation of molecules.

The production of free radicals, which is characterized by great chemical activity, which affects the structure of cells and thus their functions. The size, type and intensity of these effects depend on many factors related to the biological system exposed to radiation and

Also related to the physical system of the incident rays in all its aspects.

All stages of the development of the injury are linked to many chemical, physiological, functional, and immune factors associated with the total systems controlling all biological systems in the body. At the top of the factors controlling the development of the radiation injury and its appearance is the amount of radiation dose that the body is exposed to and the size of the exposed space in the body. Some scientists have recently reached a chemical composition for a drug called an anti-radiation drug. One of its most important properties is strengthening the immune system of the body affected by radiation.

Health risks caused by radioactive contamination:-

The following are the most prominent health risks caused by radioactive contamination:

1. Acute radiation syndrome:- Acute radiation syndrome or radiation sickness or radiation poisoning (in English: Acute Radiation Syndrome) or abbreviated (ARS), is a serious disease that affects people when exposed to a high level of radiation within a short period of time, and occurs only when: Exposure to a high dose of radiation. In the event that radiation penetrates the body and reaches the internal organs. Exposure of the entire body or most of it to radiation. Exposure to radiation within a short period of time, i.e. several minutes. A person with acute radiation syndrome shows a set of symptoms, which are:

1. Nausea.
2. Vomiting.
3. Headache.
4. Diarrhea.

The time it takes for the body to show symptoms varies, as they may start within minutes of exposure to radiation or after days, and may also last for a few minutes or several days, and may appear and disappear quickly, and if these symptoms appear, you should go to a radiation emergency center to obtain the necessary medical assistance after officials decide that it is safe to undergo treatment. The person usually feels stable for a period of time after the initial symptoms

appear, but the symptoms will return in a different form and with different severity depending on the dose of radiation received, as they may show the same previous symptoms, in addition to fatigue, fever, loss of appetite, and in some cases they are exposed to seizures and coma, and this disease lasts for a period ranging from a few hours to several months. People who have been exposed to large doses of radiation may suffer from skin problems similar to the symptoms of a bad sunburn, which may lead to damage. These problems begin to appear several hours after exposure to radiation, or may appear after several days, including: swelling, itching, and redness of the skin, and in some severe cases, ulcers and blisters appear on the skin. The damage and recovery time for the skin vary depending on the dose of radiation that the person received. The skin may begin to heal after a short period, then return to a state of swelling, itching, and redness after several days or weeks. The process of the skin recovering completely may take a period ranging from several weeks to a few years. People who were exposed to high doses of radiation may suffer from temporary hair loss, and the hair returns to grow after approximately several weeks.

How can radiation contamination be treated? It is done through the following: -

1. Treating serious and life-threatening injuries first
2. Cleaning wounds, skin and hair from the effects of contamination
3. Treating internal radiation contamination
4. Sometimes specific procedures for radionuclides
5. Treating a weak immune system
6. Supportive care

Serious physical injuries are treated before starting treatment for radiation injury, because they are more life-threatening. There are no emergency treatments for radiation injuries, but the doctor may decide to monitor the person and investigate the appearance of various symptoms on him, and treat them if they appear.

How can a person deal with radioactive contamination? It can be dealt with by: -

1. Exit the accident area to protect oneself from radiation and head to the nearest safe building according to the instructions of officials and medical personnel.
2. Get rid of outer clothing, as this procedure will reduce the possibility of any external or internal contamination in the event of radioactive materials on the clothes, and will also reduce the time of exposure to radiation.
3. Put the clothes in a plastic bag and keep it in a place away from people; so that they are not exposed to radiation, as it can be placed in the corner of the room, and wounds must be covered before touching contaminated items to prevent radioactive materials from entering them.
4. Wash exposed parts of the body with plenty of lukewarm water and soap to get rid of contamination, while avoiding touching uncontaminated areas that were covered with clothes to prevent the spread of contamination in them. If the authorities responsible for the accident determine the possibility of people in the place being exposed to internal contamination, people can take medication to try to reduce the presence of radioactive materials inside the body.

How radioactive contamination spreads:

People who are externally contaminated with radioactive material can contaminate other people or surfaces they touch. For example, people who have radioactive dust on their clothes may spread radioactive dust when they sit in chairs or hug others.

People who are internally contaminated can expose people nearby to radiation from radioactive

material inside their bodies. The body fluids (blood, sweat, urine) of an internally contaminated person can contain radioactive material. Access to these body fluids can cause contamination.

Possibility of combating radioactive pollution Radioactive pollution is combated by the following:

1. Placing warnings in places where radiation is present.
2. Monitoring radioactive pollution by taking preventive and security measures.
3. Covering the floors of buildings with a layer of a material resistant to chemical reactions and heat and sticking it well to ensure that radioactive materials do not leak underneath.
4. Necessary ventilation in workplaces with radiation and radioactive materials.
5. Following and applying the required specifications for surfaces and walls.
6. Detecting radioactive pollution using dedicated devices.
7. Storing radioactive materials in safe places such as the ground floor of the building, with the warehouse being equipped with radioactive pollution detection devices at its drains, with the necessity of placing radioactive materials in the warehouse inside appropriate containers and shields.
8. Treating radioactive waste using silicon titanium and oxygen components that extract radioactive cesium from them.

Conclusion:

Radioactive elements affect the environment and can pose a risk to human health if inhaled, injected or exposed. Human tissues absorb radiation through contaminated water and food, which can cause serious health hazards. High exposure to radiation can lead to acute radiation syndrome or radiation skin damage. Exposure to radiation causes various disorders in human body functions, including cancer, leukemia, genetic mutations, bone necrosis, cataracts and chromosomal abnormalities. Safe water supply now requires proper analysis and monitoring of radioactive contaminants. Human causes of radioactive contamination of water resources can be reduced through prevention and precautionary measures.

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