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Radiation Pollution: Source and Impacts

S. Malathi

Brackishwater Research Farm Facility, Institute of Fisheries Postgraduate Studies, OMR Campus, Tamil Nadu Dr. J. Jayalalithaa Fisheries University, Vaniyanchavadi, Chennai, Tamil Nadu (603 103), India

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Corresponding Author
S. Malathi
e-mail: malathi@tnfu.ac.in

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Abstract

Radioactive pollution is referred to release the radiation to environment by the human activities. Radiation is the emission of rays (Electromagnetic radiations) or particles (Corpuscular radiation). Natural sources of radiations include cosmic rays, environment and living organisms. Radionuclides of radium, thorium, uranium, C^{14} and K^{40} are commonly found in soil, rocks and air. Manmade resources of radiation include X-ray machines, radioactive fall outs nuclear reactor waste uses of radioactive materials in testing nuclear weapons research and treatment *etc*., biological effects of radiation or of short and long range and on somatic and genetic cells. Its most hazards type of pollution having its effects transmitted from generation to generation these may cause mutations, chromosomal abreactions, cancer *etc*., protective measures or only methods to control nuclear pollution of which risk free disposal is most effective.

Introduction

Radiation is the emission of rays and particles from a sources and the source of ionizing radiations is the group of radioactive elements. The radiations are of two types:

i) Corpuscular radiations (Particulate in nature, *e.g.*, α and β radiations).

ii) Electromagnetic radiations (waves of shorter wavelength, *e.g.*, X rays, UV rays, infra red rays *etc*.).

High energy radiations which have ionizing property are emitted by radioactive elements and are called ionizing radiations.

Source of Radiation

The sources of radiation by two ways: (i) Natural, and (ii) Man-made sources.

Natural sources include: i) Cosmic rays, (ii) Environmental, (iii) Living organisms. Radionuclides of radium, Thorium, Uranium and isotope of potassium (K^{40}) and carbon (C^{14}) are very common in soil, rock, air and water. Uranium and thorium ores found in kerala (Gautam and Aithekar, 2019). Man is also exposed to internal radiation due to presence of small amounts of uranium, thorium and isotope of K, C and strontium in the body. Internal radiation values vary from 25 to 75 Yr^{-1}.

Manmade sources include: (i) X rays machine, (ii) Radioactive fallouts (nuclear tests), (iii) Nuclear waste, (iv) Industrial and medical radioactive material, (v) Miscellaneous *etc*.The important radionuclides and their target tissues of human body as listed below in Table 1.

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E-mail: *bioticapublications@gmail.com*

Table 1: Some important nuclides and their half lives

Radionuclide	Half-life	Target tissue
Calcium-45	165 days	Bones
Carbon-14	5760 years	Whole body
Caesium-137	27 years	Soft tissue, genital organs
Iodine-129	17 Million years	thyroid
Iodine-131	8 days	Thyroid, spleen, lymph
Plutonium-239	24,400 years	Bones, liver, spleen
Radium-226	1620 years	Bones
Strontium-90	28 years	bones
Tritium (3H)	12.3 years	Whole body

Source of Radioactive Pollution

Three main source of radioactive pollution are as follows:

i) Radioactive fallout from atomic weapon testing.

ii) Radioactive fallout from small weapons used for peaceful purpose.

iii) Atomic waste material.

Biological Effects of Radiation

The effect of radioactive pollutions depends upon:

i) Half life time,

ii) Energy releasing capacity,

iii) Rate of diffusion, and

iv) Rate of deposition of contaminants.

Biological effects of ionizing radiation may be:

(i) Shorts range effects,

(ii) Long range effects.

The short range effects are acute and expressed within few days or weeks after the exposure to radiation .The effects may be:

(a) Physical crippling,

(b) Immediate death.

The long range of effects takes longer time to express. Such delayed effects of radiations are now center of world interest. These include:

i) Genetic changes.

ii) Point mutations and chromosal aberrations.

iii) Increased incidence of tumours and cancers.

iv) Shortening of life span.

v) Loss of vitality.

vi) Anemia.

vii) Haemorrhages *etc*.

The most sensitive tissues for acute doses of radiation are intestine, spleen, lymph, nodes and bones marrow. Thyroid glands of children are badly damaged due to such exposures. Two main radioactive elements in the nuclear fall out are Iodine-131 and Strontium-90 (I-131 and Sr-90).

I-131 easily enters the food chain at any level and gets concentrated in the terminal component through the process of biological amplification Unfortunately man is most often the last link of many food chains. Once I-131 becomes accumulated in the humen body it can damage:

i) White blood cells,

ii) Bone marrow,

iii) Spleen,

iv) Lymph nodes *etc*. and can cause,

v) Lung tumours,

vi) Skin cancer,

vii) Sterility,

viii) Defective eye sight *etc*.

Strontium can replace calcium in plant and animals and Sr-90 is a bone seeker. It causes-

• Bone cancer,

• Tissue degeneration.

• Sr-90 reaches dairy products through the vegetation and use of it by cattle and then to man by consumption of contaminated food, meat, milk and dairy products.

• The elimination rate of strontium-90 is strongly affected by age and sex, due to differences in bone metabolism (Shagina *et al.*, 2006).

Health Impacts

• Every antenna on cell phone tower radiates electromagnetic radiation (power).

• One cell phone tower is being used by a number of operators, more the number of antennas more is the power intensity in the nearby area.

• The power level near towers is higher and reduces as we move away.

• EMR may cause cellular and psychological changes in human beings due to thermal effects that are generated due to the absorption of microwave radiation.

• The exposure can lead to genetic defects, effects on reproduction and development, Central Nervous System behaviour *etc*.

• EMR can also cause non-thermal effects which are caused by radio frequency fields at levels too low to produce significant heating and are due to movement of calcium and other ions across cell membranes.

• Such exposure is known to be responsible for fatigue, nausea, irritability, headaches, loss of appetite and other psychological disorders.

• The current exposure safety standards are purely based on the thermal effects considering few pieces of evidence from exposure to non-thermal effects.

Protective Measures

Following are a few important measures to protect from damage done by radioactive substances:

• While handling UV lamps, Dark glass spectacles or goggle must be worn. Ultra violet rays cannot penetrate dark glasses.

• Visible light neutralizes UV damage considerably. Thus, exposure to sunlight to any individual exposed to UV could be a good remedial measure to treat the exposed individual.

• Nuclear fall out hazards must be minimized by adopting certain precautions.

High level wastes are long lived and have high radioacitivity per unit volume. These must be contained somewhere as follows:

• In underground tanks without treatments.

• Liquids should be converted into inert solids like ceramics and then buried in deep underground.

• Stored in deep salt mines.

• These should be used in minimum and subjected to natural disintegration.

Low level waste which has a very low radioactivity must be dispersed into the environment in such a way that these can not enter the food chain. The high level components of these wastes should be separated and disposed like level waste (Michalik *et al.,* 2013).

The radioactive waste should be stored in places where these gradually decay to their final stable products.

Conclusion and Recommendations

The current regulatory framework for the control of medical uses of byproduct materials and a uniform national approach to the regulation of ionizing radiation in all medical applications. The health effects associated with low level radiation are acute childhood leukemia, leukemia, brain and spinal tumors, terminal and non terminal cancer, chromosome damage, low birth weights, still birth and morel. The idea of a safe level of low level radiation is in my opinion is a myth. Though used medically limits are set on the amount of x-rays and the length of radiation treatment one may receive. The body to a small extent can repair some damage caused by radiation in short frequencies but only the repair the damage cause for so long.

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