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Radiation Protection among Radiation Workers in Teaching Hospital.

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ABSTRACT
Radiation protection entails the harmful effect of ionizing radiation, the interaction of any amount of ionizing radiation of any type, such as X-rays, gamma rays, electrons, protons, neutrons, alpha particles and beta particles with a biological system results in the absorption of the energy of the radiation by the system. This in turn may result in effects that become manifest in the exposed individuals (somatic effects) or appear in the descendant of exposed individuals (Genetic or Hereditary effects). The physics of the absorption process is over in 10^{-16} seconds, the chemistry takes longer, since the life time of the free radical is about 10^{-6} seconds, the biology takes days to months for cell killing, years for carcinogenesis, and generations for heredity damage. Available information on human susceptibility to effects of ionizing radiations has it that the lethal dose for 50% of the exposed population to die within thirty days of exposure is about three gray, for whole body exposure. Some organs and tissues are more sensitive to radiation and some are less. More sensitive tissues are blood forming organs, reproductive organs are those that constitute the nervous system. Death of a person may result from the overall exposure of the body for the destruction of vital organs. Acute exposure and chronic exposure at equal total doses may or may not produce the same effects.

GLOSSARY

Absorbed dose: A measure of energy deposition in any medium by all types of radiation.
Acute exposure: A large dose received over few hours or less
Chronic Exposure: A low dose received over a long time.
Dose Equivalent: Quantity obtained which absorbed dose is multiplied by quality factor, the unit of which was originally the rem.
Dose equivalent = absorbed dose x Q, where Q = quality factor (a factor that reflects the ability of a particular type of radiation to cause damage.
Genes: Carriers of information which determine the characteristics of daughter cells.
Gray: A unit of absorbed dose of ionizing radiation. The dose is 1 gray when the density of the total energy absorbed in any medium from any type of ionizing radiation is 1 joule/Kg.
Fallout: Is the residual radioactive material propelled into the upper atmosphere following a nuclear blast, so called because it “talks out” of the sky after the explosion and shock wave have passed.
Lettal dose: The absorbed dose that result in the death of the absorbing medium within a specific period of time.
Linear energy Transfer (LET): Total energy deposited per unit of length (Kev/mm).
RAD: An acronym for radiation absorbed dose 100 rads is equal to 1 gray (Gy).
Radiographer: Is a radiologic technologist, also known as medical radiation technologist.
Radiology: Is a medical specialty that employs the used of imaging to both diagnose and treat disease visualized within the human body.
Radiation protection: Sometimes known as radiological protection, is the protection of people and the environment from the harmful effect of ionizing radiation.
REM: An acronym for roentgen equivalent man. This is also a unit of absorbed dose that indicate the relative degree of biological damage caused by a particular exposure to ionizing radiation.
Sievert (SV): SI unit of dose equivalent
Threshold dose: That particular dose below which the risk of the effects of an ionizing radiation will not occur.

INTRODUCTION

Radiation is all around us, it is naturally present in our environment and has been since the birth of this planet. Radiation is a process in which energetic particles or energetic waves travel through a medium or space. There two classes of radiation, ionizing and non ionizing radiation.

Ionizing Radiation: Is defined as a radiation having sufficient energy to ionize an atom in the medium through which it passes. As a matter of convention, ionizing radiation is classified as photons(X rays and gamma rays) or particles (electrons, protons, neutrons, alpha particles and beta particles). When ionizing radiation passes through matter, it may interact with whole atom electrons, nuclei or nucleons.

This interaction process in general is often described as collision. In this case of practical interest, the interaction results in the full transfer of energy of the incident radiation to electrons or nuclei of the constituent atoms or to charged particle products of nuclear reactions.

The major sources of ionizing radiation that were available until 1930s were naturally occurring radioactive substance and low energy X-ray. But today, ionizing radiation can be produced from particle accelerations (Shalak and Chien, 1986) and is present in the environment, it is invisible and not directly detectable by human senses, so instrument such as Geiger counters are usually required to detect its presence.

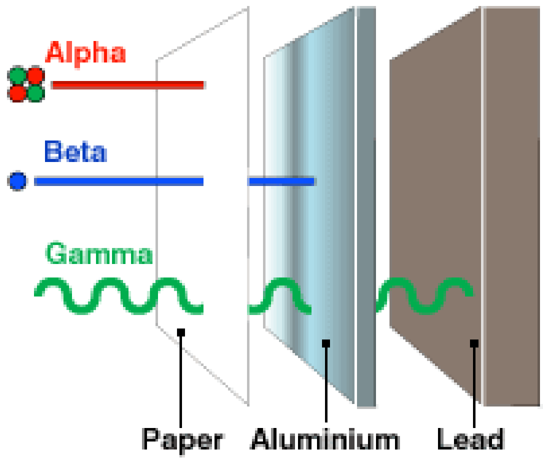


Illustration of the relative abilities of three different types of ionizing radiation to penetrate solid matter. Alpha particle (α) are stopped by a sheet of paper. Beta particles (β) are stopped by aluminium plate. Gamma radiation (γ) is dampened when it penetrates matter.

The Electromagnetic Spectrum

According to the international commission on Non-ionizing radiation, protection electromagnetic radiations from ultraviolet to infra red to radio frequency (including microwave) radiation, static and time varying electric and magnetic fields, and ultrasound belong to non-ionizing radiations.

Non ionizing radiation: Are radiations which are not energetic enough to detach electrons from atoms or molecules, ionizing them. Radiation is classified into two, namely natural radiation and Artificial radiation (human-made radiation).

Natural Radiation: the three major sources of naturally occurring radiation are:

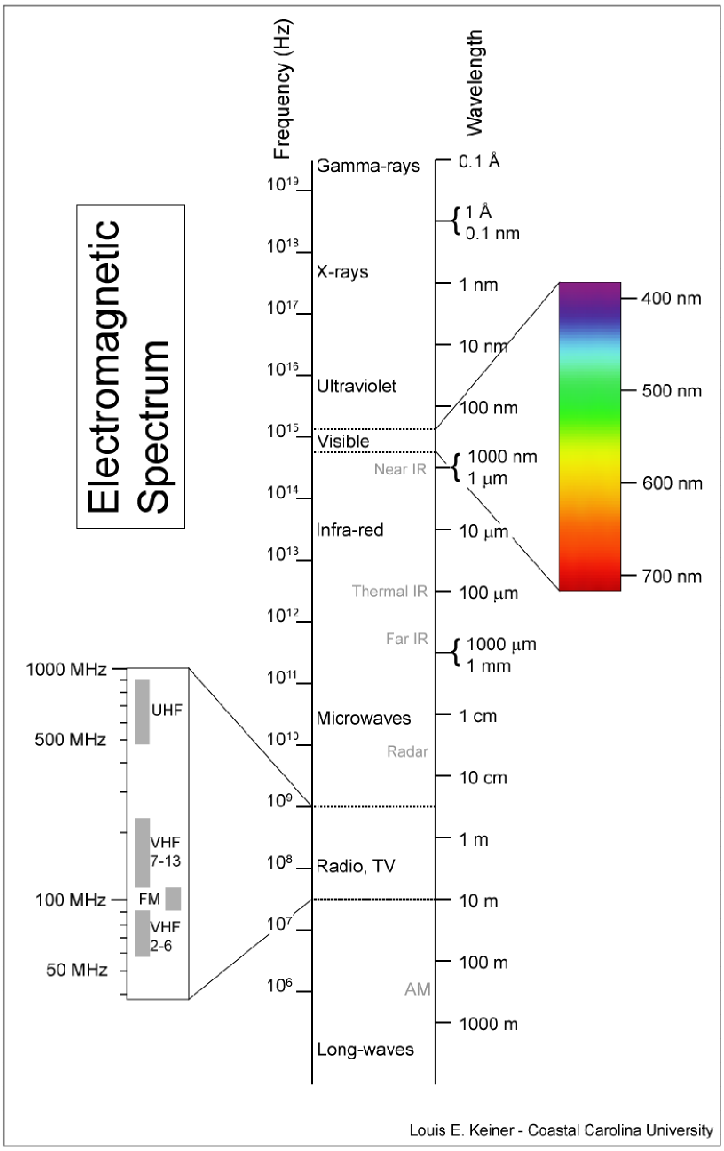
Cosmic radiation: Cosmic radiation reaches the earth from interstellar space and from the sun. It is composed of a very wide range of penetrating radiations, which undergo many types of reactions with the elements they encounter in the atmosphere. The atmosphere acts as a shield and reduces very considerably the amount of cosmic radiation reaching the earth's surface. The filtering action means that the rate at sea level is less than at high altitudes.

Sources in the earth's crust, also referred to as terrestrial (ground).

Radiation: the rock and soils of the earth's strata contain small quantities of the radioactive elements uranium and thorium with their daughter products. The concentration of these elements varies considerably depending on the type of rock formation. For example, in sandstone and limestone regions the concentration is much lower than in granite. Thus, the dose rate from this source depends on the geographical location.

Sources in the human body, also referred to as internal sources. Isotopes Carbon -14 (^{14}C) and Potassium -40 (^{40}K). The ^{14}C originates in the atmosphere and results in a dose of ten millisievent per year in the soft tissue. Potassium – 40 is naturally – occurring (half-life is 1.27 x 10^9 yrs) and contributes about 0.2 millisievert per year to the gonads(Mettler and Moseley, 1985). A significant contribution to the radioactivity in the body comes from the gaseous decay products of the uranium and thorium series, namely radon and thorium. These gases diffuse from the rocks and soil and are present in easily measurable concentrations in the atmosphere. They are breathed by man along with their decay products and are also taken up by plants and animals with the result that most foodstuffs contain measurable amounts of natural radioactivity, of ordinary foods, cereals have high radioactive contents while milk produce, fruit and vegetables have a low content.

NON –IONIZING RADIATION



Artificial radiation (Man-made): Although all living things are exposed to natural background radiation, exposure to man-made radiation sources differs for the following groups.

- Members of the public
- Occupationally exposed individuals (workers)
- Members of the public: In general, the following man made sources expose the public to radiation (the significant radioactive isotopes are indicated in parenthesis).

Medical sources (by far, the most significant man-made source).
Diagnostic X-rays
Nuclear medicine procedures (iodine -131, Cesium -137 and others).
Consumer products
Building and road construction materials
Combustible fuels, including gas and coal
X-ray security systems
Televisions
Fluorescent lamp starters
Smoke detectors (Americium)
Luminous watches (tritium)
Lantern mantles (thorium)
Tobacco (polonium – 210)
Ophthalmic glass used in eye glasses.

Some ceramics

To a lesser degree, the public is also exposed to radiation from the nuclear fuel cycles, from uranium mining and milling to disposal of used (spent) fuel. In addition, the public receives some minimal exposure from the transportation of radioactive materials and fall out from nuclear weapons testing and reactor accidents (such as Chernobyl).

Occupationally Exposed Individuals: In general, occupationally exposed individuals work in the following areas:

- Fuels cycle facilities
- Industrial radiography
- Radiology departments (medical)
- Nuclear medicine departments
- Radiation oncology department
- Nuclear power plants
- Government and University research laboratories

Such individuals are exposed to varying amounts of radiation, depending on their specific jobs and the sources with which they work (including cobalt -60, cesium -137, Americium -241 and other isotopes).

Radiation Protection: Sometimes known as Radiological protection is the protection of people and the environment from the harmful effect of ionizing radiation.

Classification of Radiation Protection: This can be divided into three categories:

i). Occupational Radiation Protection: This is the protection of workers

ii). Medical Radiation Protection: This is the protection of patients and the radiographer.

iii). Public Radiation Protection: This is the protection of individual members of the public, and the population as a whole.

The type of exposure, as well as government regulations and legal exposure limits are different for each of these groups.

BASIC PRINCIPLE OF RADIATION PROTECTION:

There are three factors that control the amount, or dose of radiation exposure. Radiation exposure can be managed by a combination of these factors.

i) **Time:** Reducing the time of an exposure reduces the effective dose proportionally. An example of reducing radiation doses by reducing the time of exposures might be improving operator training to reduce the time they take to handle a source.

ii) **distance:** increasing distance reduces does due to the inverse square law. Distance can be as simple as handing a source with forceps rather than fingers.

iii). **Shielding:** The term “biological shield” refers to a mass of absorbing material placed around a reactor, or other radioactive source, to reduce the radiation to a level safe for humans. The effectiveness of a material as a biological shield is related to its cross-section for scattering and absorption, and to a first approximation is proportional to the total mass of material per unit area interposed along the line of sight between the radiation source and the region to be protected. Hence, shielding strength or “thickness” is conventionally measured in units of g/cm^3. The radiation that manages to get through falls exponentially with the thickness of the shield. In X-ray facilities, the plastic on the rooms with the X-ray generator contains barium sulfate and the operators stay behind a leaded glass screw and wear lead aprons.

OBJECTIVE OF THE STUDY

i). To find out how much, the radiation workers (personnel) knew about radiation hazard.

ii). To know if they actually practice radiation protection.

iii). To check if the measures taken in UMTH is the same with the Radiation Safety standard as recommended by international Commission on Radiological protection (ICEP).

SIGNFICANCE

This study will help to create awareness about Radiation protection to general public.

ii). Also help to prompt the personnel about the effects of ionizing radiation.

Also help reinforce existing knowledge to the radiation workers.

REVIEW OF RELATED LITERATURE

2.1 Discovery of ionizing radiation and its effect, Henry Becquerel discovered radioactivity in 1896 from the naturally occurring phosphorescent potassium uranyl sulphate. Similarly, radium (present as chloride) discovered from the uranium ore, pitchblende by pierre and marie curie in 1898 has also been a radioactive and feeble self-luminescent material (BEIR Report, 1990).Then came the artificially produced radioisotopes discovered on alpha irradiation by Irene curie and Fredrick joliot in 1993,followed by Neutron irradiation and cyclotron produced radioisotopes.

Radioisotopes and x-ray sources are example of an immensely important family of ionizing radiation sources. But there is a big distinction between them. However light emission has also distinction from x=ray sources, say long with copper (cu),Rubidium silver, Barium x-rays from copper (metal), rubidium sulphate, silver (metal), barium oxide or terbium peroxide respectively on gamma excitation from Americium 241 (^{241}AM). Earlier to this, no literature was available on light emission either from an x-ray tube or characteristic source ever since the discovery of X-rays (bremsstrahlung) from Crook's tube by W.C. Roentgen in 1895 and characteristic X-ray of elements by Charles Glover Barkla (Rao, 1998).

Following the rapid implementation of X-ray for diagnostic purposes at the beginning of the twentieth century, the dangers of exposure to the radiologist to these rays did not immediately become apparent. However, after only a few years, especially in cases where the radiologist had frequently kept his hands in the radiation beams for some time, it become evident that these rays could have a devastating effect. These early radiologists suffered from skin erythema sometimes leading to ulceration as well as radiation –induced cancer. The ironic fact is that the very effect is used to cure cancer, if the radiation is given in a controlled manner. This was the first evidence to man of the damaging effects of ionizing radiations (Aird, 1975).

In November, 1895 Wihelm Roentgen discovered X-rays. Roentgen was diligent in his investigation of the behavior of these new –found rays and he established their physical characteristics almost fully within a short period. It was, however, the tragedy of the radiation pioneers that drew attention to the fact that these X-rays were not only wonderful and useful in medicine, but harmful too. However, it took some 30 years before radiation protection measures and the concept of a limit to the exposure dose for radiation workers was established.

According to Bushong the radiation effects to the patient were considered only much later. It was not until the 1950s that scientific reports appeared that implicated the low levels of radiation exposure used in diagnostic radiology in the late radiation responses in patients. This lead to the radiation –protection regulations of today that are based on the concern for late effects of radiation to patient and radiation workers.

Stages of ionizing radiation action in a Biological medium

The damage done to a cell as a result of interaction of ionizing radiation with it, taxes the forms of changes in the construction and the function of the cell. The processes leading to this damage are complex and are often considered in four stags discussed as follows (Alan and Samuel, 1979).

First State (Initial Physical Stage)

When ionizing radiation transfers energy to a biological medium, this energy is usually absorbed by the water constituent of the cell resulting in excitation and ionization events that consume twenty percent and eighty percent of the total energy respectively. This stage only lasts a minute fraction of a second (approx. 10^{-16} second). In water the process may be written as;

$H_2O \rightarrow H_20^+ + e^-$

Where H_20^+ is positive ion and e^- the negative ion.

Second Stage (Physiochemical Stage)

In this stage the ions that are produced interacts with other water molecules resulting in a number of new products. For example the positive ions dissociates.

$H_20^+ \rightarrow H^+ + OH$

The negative ion (electron), attaches to the neutral water molecule, which they dissociates:

$H_20 + e^- \rightarrow H_20^-$

$H_20 \rightarrow H + OH^-$

Thus the products of the reactions are H^+, OH^-, H and OH. Two of those new products, H^+ and OH^- are present to quite a large extent in ordinary water and take no part in subsequent reactions. The other two products, H and OH are electrically neutral but poses an unpaid electron, which make them free, they are called radicals and are chemically highly reactive. Another reaction product is hydrogen peroxide (H_2O)), which is a strong oxidizing agent.

$OH + OH \rightarrow H_2O_2$

This stage usually lasts about 10^{-6} seconds.

Third Stage (Chemical Stage).

This stage involves the interaction of the reaction products with the important organic molecules of the cell. The free radicals oxidizing agents may attack the complex molecules, which form chromosomes. They may for example, attach themselves to a molecule or cause links in long chain molecules to be broken.

Fourth Stage (Biological Stage)

Here the chemical changes show up as effects in the individual cells in a number of ways. These effects on the biological system depend on the linear energy Transfer (LET) of the incident radiation and on the nature of the biological system that is involved.

Because the DNA is broken, a sudden change in the nucleotide sequence of the DNA may occur, this results in genetic code that as a consequence may cause the cells and all cells derived from it differ in appearance or behaviours. This is referred to as a change in phenotype. The possible alterations due to the broken DNA are:

i). **Point mutation:** Replacement of one nucleotide by another (DNA degeneracy) that is chances of repair is very high.

ii). Clastogenic mutation: this includes insertion or deletion which is the addition or removal of any piece of DNA from one base pair to quite extensive part.

Generally, the chemical changes may show up in the following ways;

a). The early death of the cell

b). The prevention or decay of cell division

c). A permanent modification, which is passed on to daughter cell.

The time scale for this stage varies from tens of minutes to tens of year depending on the particular symptoms.

EFFECTS OF RADIATION

These effects can follow low dose exposure and the latent period, often several years of even decades. The somatic late effects of concern are leukemia, and other malignancies. These can also be damage to genetic material and the effect than only becomes evident in a future generation, it is difficult to pin-point the origin of these health effects as they will usually not be distinguishable from similar effects arising from other causes. However, there is adequate evidence that the harmful effects of low dose radiation are a reality.

There is no absolute evidence of a threshold below which no damage occurs. Even the lowest does may cause damage to cells, which might later lead to malignancy, or hereditary effects if the cells irradiated are the germ cells in the gonads. Therefore, we have to assume the probability of radiation induced cancer or serious hereditary defects are proportional to the radiation dose right down to the lowest levels and this linear dose – response relationship suggests that no radiation dose, however low radiation dose can be considered absolutely safe. Although, this may be an overestimation of the true radiation effects, at low-dose levels, it is preferably to hold to the model and it is the basis for the radiation. Protection standards of today.

cells are damaged, repair the damage and operate normally.

Some ionizing event produce substances not normally found in the cell. These can lead to a break down of the cell structure and its components. Cells can repair the damage if it is limited. Even damage to the chromosomes is usually repaired. Many thousands of chromosome aberration (changes) occurs constantly in our bodies. These are effective mechanisms to repair these changes (UNSCEAR Report, 1994).

Cells are damaged, repair the damage and operate abnormally.

If a damaged cell needs to perform a function before it has had time to repair itself, it will either be unable to perform the repair function or perform the function incorrectly or incompletely. The result may be cells that cannot perform their normal functions or that are damaging to other cells. These altered cells may be unable to reproduce themselves or may reproduce at an uncontrolled rate. Such cells can be the underlying causes of cancers (Aird, 1975).

Cells die as a result of the damage

If a cell is extensively damaged by radiation or damage in such a way that reproduction is affected, the cell may die. Radiation damage to cells may depend on how sensitive the cells are to radiation.

We should note that not all cells are equally sensitive to radiation damage. In general, cells which divide rapidly and/or are relatively non-specialized, tent to show effects at lower doses of radiation than those, which are less rapidly dividing and more specialized. Examples of the more sensitive cells are those, which produce blood. This system (called the hemopoietic system) is the most sensitive biological indicator of radiation (Brenner, 1972).

- Acute and Chronic Radiation Dose

Potential biological effects depend on how much and how fast a radiation dose can be grouped into two categories, acute dose and chronic dose.

a). Acute dose

An acute radiation dose is defined as a large dose (ten rad or greater, to the whole body), delivered during a short period of time (on the order of a few days at the most). If large enough, it may result in effects, which are observable within a period of hours to weeks. Acute doses can cause a pattern of clearly identifiable symptoms (syndromes). These conditions are referred to in general as Acute Radiation syndromes. Radiation sickness symptoms are apparent following acute doses greater or equal to hundred rad. Acute whole body doses of greater or equal to four hundred rad, may result in a statistical expectation that fifty percent of the population exposed will die within sixty days without medical attention (Metter and Moseley, 1988).

Blood –forming organ(bone marrow) syndrome (greater than hundred rad) can cause damage to cells that divide at most rapid pace (such as bone marrow, the spleen and the lymphatic tissue). Symptoms include internal bleeding, fatigue, bacterial infection and fever. Gastrointestinal tract syndrome greater than one thousand rad is characterized by damage to cells that divide less rapidly (such as linings of the stomach and intestines). Symptoms include nausea, vomiting, diarrhea, dehydration, electrolytic imbalance, loss of digestion ability, bleeding ulcers and the symptoms of blood –forming organ syndrome (Aird, 1975) control nervous system syndrome greater than five thousand rad is characterized by damage to cells. Symptoms include loss of coordination, confusion, come, convulsion, shock and the symptoms of the blood-forming organ and gastrointestinal tract syndromes. Other effects from an acute dose include:

i). Two hundred to three hundred rad to the skin can result in the reddening of the skin (erythema), similar to a mild sun burn and may result in hair loss due to damage to hair follicles.

ii). One hundred and twenty –five to two hundred rad to the ovaries can result in prolonged or permanent suppression of menstruation in about fifty percent of women.

iii). Six hundred rad to the ovaries or testicles can result in permanent sterilization.

iv). Fifty rad to the hydroid gland can result in benign (non concerous) tumours.

The effects caused by acute doses are called deterministic. This is because the severity of the effect is determined by the amount of dose received. Deterministic effects have some threshold level –below which the effect will probably not occur, but above which the effect is expected. When the dose is above the threshold, the severity of the effect increases as the dose increases.

b). Chronic dose:

A chronic dose is a relatively small amount of radiation received over a long period of time. The body is better equipped to tolerate a chronic dose than an acute dose. The body has time to repair damage because a smaller percentage of the cells need repair at any given time. The body also has time to replace dead or non-functioning cells with new healthy cells. This is the type of dose received as occupational exposure.

The biological effects of high level of radiation exposure are well known but the effects of low levels of radiation are more difficult to determine because the deterministic effects described above do not occur at these levels.

At lower levels of radiation dose, there may be little or no immediate effect. The effects of a few rads may not be seen for tens years or even the next generation, or not at all. It is these long term effects that have determined the permissible levels of exposure to personnel and to the population in general (Aird, 1975).

TISSUE SENSITIVITY

In general, the radiation sensitivity of a tissue is proportional to the rate of proliferation of its cells and also inversely proportional to the degree of cell differentiation. For example, the following tissues and organs are listed from the most radiosensitive to least radiosensitive.

Most sensitive Blood – forming organ
Reproductive organ
Skin
Bone and teeth
Muscle
Least sensitive Nervous system:

This also means that a developing embryo is most sensitive to radiation during the early stages of differentiation, and an embryo/fetus is more sensitive to radiation exposure in the first trimester than in later trimesters (Brenner, 172).

Since an embryo/fetus is especially sensitive to radiation (embryo/fetus cells are rapidly dividing), special consideration is given to pregnant workers. Protection of the embryo/fetus is important because the embryo/fetus is considered to be at the most radiosensitive stage of human development, particularly in the twenty weeks of pregnancy.

Limits are established to protect the embryo/fetus from any potential effects, which may occur from a significant amount of radiation. This radiation exposure may be the result of external sources of internal sources of radioactive material. Potential effects associated with prenatal doses are:

Growth retardation
Small head/brain size
Metal retardation
Childhood cancer

At present occupation dose limits, the actual probability of any of these effects occurring in the embryo/fetus from occupation exposure is small (Mettler and Moseley, 1985).

Research methodology and result

Resign design: Cross sectional design was adopted for the study

source of data: primary source of data was used

Sample size: The sample size consists of all the radiation workers in radiology department.

Sampling technique: convenient sampling technique was used for the study

Instrument of data collection: data were collected using a self completion questionnaire are distributed to all radiology staff in the university of Maiduguri teaching hospital. The questionnaire consists of 15 item scale questions divided into two sections, section A consists of the demographic data of the respondents, while section B consists of knowledge and practice of radiation protection.

Data analysis: data were analyzed using SPSS version 16.0
Results: a total number of 60 questionnaires were distributed to radiological workers in radiology department of university of Maiduguri teaching hospital. The response rate over the period of four weeks was 100% (N=60)

Table 1: Sex

	Frequency	Percent	Valued percent	Cumulative percent
Valid male	50	83.3	89.3	89.3
Female	6	10.0	10.7	100.0
No response	4	6.7	100.0	
Total	60	100.0		

From table 1 above, it shows that the demographic data of the respondents. It shows that about 83.3% ,9N=50) of our respondents were male while 10% (N=6) were female with 6.7% (N=4) did not respond.

Table 2: Age

	Frequency	Percent	Valued percent	Cumulative percent
Valid 21-25	12	20.0	20.7	10.7
26-35	34	56.7	58.6	92.9
35 – 45	10	16.7	17.2	100.0
46 – 55	2	3.3	3.4	
No response	2	3.3	3.4	
Total	60	100.0	100.0	

Table 2 shows the age distribution of the respondents, it shows that most respondents fall within the age group of 26-35 years, 56.7%, (N=34) while those within the age group of 46-55 years where the least with 3.3%,(N=2) and of the participants did not respond.

Table 3: Qualification

	Frequency	Percent	Valued percent	Cumulative percent
Valid SSCE	6	10.00	10.7	10.7
B. RAD	46	76.7	82.1	10.7
M. Sc.	4	6.7	7.1	92.9
No response	4	6.7	100.0	100.0
Total	60	100.0		

Table 3 shows the qualification of the respondents, it shows that 10.0%(N=6) of the respondents were with SSCE, 76.7%, (N=46) and B. RAD 6.7% (N=4) had M.Sc., 6.7% (N=4) did not respond.

Table 4

Question	Frequency	Percent	Valued percent	Cumulative percent
1. Do you know or have an idea on what radiation is all about	30	100.0	100.0	100.0
2. Radiation protection is concerned with the protection of patient only	30			
Total	60	100.0	100.00	100.00

Table 4, shows that all respondents have the idea on what radiation is all about, knowing that it is not concerned with protection of patient only.

Table 5; Radiation protection is concerned with the protection of personnel alone (staff).

	Frequency	Percent	Valued percent	Cumulative percent
Valid Yes	2	3.3	3.3	3.3
No	58	96.7	96.7	100.0
Total	60	100.0	100.0	

Table 5 shows that radiation protection is not concerned with the protection of personnel, 96.7%, (N=58) confirm that, while only 3.3%(N=2) did not confirm.

Table 6: Radiation is concerned with the protection of the general public only

	Frequency	Percent	Valued percent	Cumulative percent
Valid Yes	10	16.7	16.7	16.7
No	50	83.3	83.3	100.00
Total	60	100.0	100.0	

Table 6 shows that 83.3%(N=50) of our respondents replied that radiation protection is not concerned with the general public alone, while 16.7% (N=10) replied that it is concerned with the general public only.

Table 7: Which of the following is not a radiation monitoring device

Frequency	Film	Badge	TLD (Thermoluminiscece dosimeter)
Valid Yes No	4 56	8 52	
Total	60	60	

Table 7 shows that 93.3% (N=56) of the respondents know that (TLD) is a radiation monitoring device while 6.7% (N=4) did not. Also 86.6% (N=52) know that film badge is a radiation monitoring device while 13.3% (N=8) did not.

Table 8: Do you use lead aprons or lead glass shields to protect your co-workers and patient from radiation.

	Frequency	Percent	Valued percent	Cumulative percent
Valid Yes No	58 2	96.7 3.3	100.0	100.0
Total	60	100.0		

Table 8 shows that 96.7%, (N=58) of the respondent used lead aprons or lead glass shields to protect co-workers and patient, while 3.3% (N=2) Don't used.

Table 9: Do you do proper collimating of your radiation beam to the area of interest when carrying out investigation.

	Frequency	Percent	Valued percent	Cumulative percent
Valid Yes No	52 8	86.7 13.3	86.7 13.3	86.7 100.00
Total	60	100.0	100.0	

Table 9 shows that 86.7% (N=52) of the respondents do proper collimating of the radiation beam to the area of interest when carrying out investing, while 13.3% (N=8) do not.

Table 10: Do you close the doors of your investigating rooms when exposing ionizing radiation.

	Frequency	Percent	Valued percent	Cumulative percent
Valid Yes	60	100.0	100.0	100.0
Total	60	100.0	100.0	

Table 10 shows that 100% (N=60) of our respondent do close the doors before exposing ionizing radiation.

Table 11: What type of building materials is used in the construction of your department.

	Frequency	Percent	Valued percent	Cumulative percent
Valid concrete blocks and Barium Plaster	60	100.00	100.00	100.00
Total	60	100.0	100.0	

100%(N=60) of our respondents, respondent that concrete blocks and Barium plaster is used in the construction of the department.

Table 12: How are the neighbouring department protected from radiation.

	Frequency	Percent	Valued percent	Cumulative percent
Valid had shielded walls No Response	58 2	96.7 3.3	96.7 3.3	100.00
Total	60	100.0	100.0	

Table 12 shows that 96.7% (N=58) responded that the neighbouring department is protected from radiation by the shielded walls, while 3.3% (N=2) did not respond.

Table 13: What is the average number of patient you attend to per day

	Frequency	Percent	Valued percent	Cumulative percent
Valid 12	2	3.3	3.7	3.7
15	24	40.0	44.4	48.1
16	2	3.3	3.7	51.9
18	2	3.3	3.7	55.6
20	6	10.0	11.1	66.7
30	10	16.7	18.5	85.2
40	4	6.7	7.4	92.6
60	4	6.7	7.4	100.0
No Response	6	10.0	100.0	
Total	60	100.0	100.0	

Table 13 shows that the maximum number of patient that the respondents can attain to per day is 40.0%, (N=24) while the minimum number is 3.3%(N=2) and 10.0% (N=6) did not respond.

Table 14: What is the average number of patient you attend to per week

	Frequency	Percent	Valued percent	Cumulative percent
Valid 1	2	3.3	4.3	4.3
25	2	3.3	4.3	8.7
70	2	3.3	4.3	13.0
80	4	6.7	8.7	21.7
85	2	3.3	4.3	26.7
100	2	3.3	4.3	26.1
120	2	3.3	4.3	30.4
125	2	3.3	4.3	34.8
126	2	3.3	4.3	39.1
150	20	33.3	43.5	43.5
160	2	3.3	4.3	87.0
175	2	3.3	4.3	91.3
200	2	3.3	4.3	95.7
No response	14	23.3	100.0	100.0
Total	60	100.0	100.0	

Table 14 shows that the average number of patient responses per week as 76.7% 9N=46) as maximum and a minimum of 3.3% (N=2) and 23.3%(N=14) no respond.

Table 15: How often do you carry out quality assurance test

	Frequency	Percent	Valued percent	Cumulative percent
Annually	8	13.3	13.3	10.0
Quarterly	6	10.0	10.0	13.3
Monthly	20	33.3	33.3	16.7
Weekly	8	13.3	13.3	33.3
Daily	10	16.7	16.7	66.7
Currently	4	6.7	6.7	70.0
No Response	4	6.7	6.7	100.0
Total	60	100.0	100.0	

Table 15 shows that quality assurance test is mostly done 33.3%, (N=20) according to our respondents and it is least done currently that is 6.7%, (N=4), 6.7%, (N=4) did not respond.

Table 16: What is the time range that it takes to exposed a patient.

	Frequency	Percent	Valued percent	Cumulative percent
Valid 2.5h	2	3.3	3.3	3.3
0.02-0.5s	2	3.3	3.3	6.7
0.15	2	3.3	3.3	10.0
0.2-0.4s	6	10.0	10.0	20.0
0.2s	2	3.3	3.3	23.3
0.3s	6	10.0	10.0	23.3
0.5m	2	3.3	3.3	33.3
0.5m	2	3.3	3.3	36.7
10m	8	13.3	13.3	40.0
1 Micro sec	2	3.3	3.3	53.3
2.5s	6	10.0	10.0	56.7
2m	2	3.3	3.3	66.7
2s	6	10.0	10.0	70.0
3m	2	3.3	3.3	80.0
5m	2	10.0	10.0	83.3
5mn and above	2	3.3	3.3	86.7
0.5m	2	3.3	3.3	90.0
0.5s	2	3.3	3.3	96.7
Total	60	100.0	100.0	

Table 16, the time range that it takes to expose a patient according to our respondent, the minimum time is 0.1 secs and maximum is 2-5hrs and it depends on the exposed body part.

Sex Qualification Cross Tabulation

	QUALIFICATIONS				
	SSCE	**B.RAD**	**M.Sc.**	**NO RESPONSE**	**TOTAL**
Sex Male Count	3	19	1	2	25
Expected Count	2.5	19.2	1.7	1.7	25.0
% within Sex	12.0%	76.0%	4.0%	8.0%	100.0%
% of total	10.0%	63.3%	3.3%	6.7%	83.3%
Female Count	0	3	0	0	3
Expected Count	3	2.3	2	.2	3.0
% within Sex	.0%	100.0%	.0%	.0%	100.0%
% Of total	.0%	10.0%	.0%	.0%	10.0%
No Response Count	0	1	1	0	2
Expected Count	.2	1.5	.1	.1	2.0
% within Sex	0%	50.0%	50.0%	.0%	100.0%
% of total	.0%	3.3	3.3%	.0%	6.7%
Total Count	3	23	2	2	30
Expected Count	3.0	23.0	2.0	2.0	30.0
% within Sex	10.0%	76.7%	6.7%	6.7%	100.0%
% of total	10.0%	76.7%	6.7%	6.7%	100.0%

Chi – Square Tests

	Value	dF	Asymp.Sig. (2 sided)
Pearson chi-square likelihood Ratio linear by linear Association	7.500a 5.239 .329 60	2 2 1	.277 .514 .566

a). 11 cells (91.7%) have expected count less than 5. The minimum expected count is 13.

From the table above, when pearson chi-square value is greater than > 0.05, it means that sex has no relationship with qualification.

AGE QUALIFICATION CROSS TABULATION

	QUALIFICATIONS				
	SSCE	**B.RAD**	**M.Sc.**	**NO RESPONSE**	**TOTAL**
Age 26-35 % with Age % of total	5.9% 3.3%	88.2% 50.0%	.0% .0%	-59% 3.3%	100.0% 56.7%
35-45 Count Expected Count % within Age % Of total	0 .1 .0% .0%	0 .8 .0% .0%	0 .1 .0% .0%	1 .1 100.0% 3.3%	1 1.0 100.0% 3.3%
No Response Count Expected Count % within Age % of total	1 .1 100.0% 3.3%	0 .8 .0% 0%	0 .1 .0% .0%	0 .1 .0% .0%	1 1.0 100.0% 3.3%
Total Count Expected Count % within Age % of total	6 6.0 10.0% 10.0%	46 46.0 76.7% 76.7%	4 4.0 6.7% 6.7%	4 4.0 6.7% 6.7%	60 60.0 100.0% 100.0%

Chi Square Tests

	Value	Df	Asymp.Sig. (2 sided)
Pearson chi-square likelihood Ratio linear by linear Association	36.604a 22.065 .956	24 14 1	.000 .037 .328
N0. Of Valid Cases	60		

a). 19 cells (95.0%) have expected count less than 5. The minimum expected count is .07.

From the table above, it shows that pearson chi-square is < 0.05 which means that there is a relationship between age and Qualification.

From the result of the study, it was found that 83.3% of our respondents were male while 10.0% were female and 6.7% did not respond. This could be due to the perceived notion of the hazards.

In table 5, 96.7% of the respondent of the respondent has a clear knowledge that radiation protection is not only concerned with personnel alone, while 3.3% did not, this shows that most of our respondent had good knowledge of what radiation protection is.

In table 15, quality Assurance test is the systematic activities undertaken by the medical physicist to ensure a consistent high quality diagnostic yield as reported, 16.6% did not respond due to lack of quality Assurance facilities.

In Table 16, 0.1secs is the minimum time of exposure, owing to that fact that the longer the time of exposure the higher the risk of ionizing radiation and the maximum to be 2-5 hrs which is usually practiced in the radiotherapy where time is used to bombard a tumor cells.

DISCUSSION

From the result of the study, it was found that 83.3% of our respondents were male while 10.0% were females and 6.7% did not respond. This could be due to the perceived notion of the hazards.

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In table 16, 0.1secs is the minimum time of exposure, owing to the fact that the longer the time of exposure, the higher the risk of ionizing radiation and the minimum to be 2-5hrs which is usually practiced only in radiotherapy where time is used to bombard a tumor cell with ionizing radiation.

SUMMARY, CONCLUSION AND RECOMMENDATIONS

Radiation Protection: Sometimes known as radiological protection, is the protection of people and the environment from the harmful effect of ionizing radiation.

An ionizing radiation is a radiation of sufficiently high energy to cause ionization in the medium through which it passes. The principle factors that determined the radiation protection among Radiation workers are radiation dose, type of radiation, type and volume of biological cell exposed. The possibility of injury from ionizing radiation increases with increasing exposure. Increasing the volume of tissue exposed increases the severity of radiation injury.

The main categories of biological effects of ionizing radiations genetic effects, genetic effects apply to future generations. Background radiation account for one percent to three percent of the spontaneous incidence of cancer. The unborn and newborn are particularly sensitive to radiation exposure.

CONCLUSION

Knowledge about the radiation is of fundamental importance in medicine I have been able to present effects of these radiations and also to ascertain the damages they can cause with respect to dose received. Radiation is known to increase the incidence of cancer in nigh dose. At low does much controversy surrounds the premise that radiation increase the rate of cancer. The controversy that population is much greater than any contribution from horsing radiation for example. In a population of one million people about 2000 people will die of cancer. If that population were exposed to one rem of horsing radiation about four (4) to eight (8) additional cancer deaths would be calculated from high dose projection. The variation is so large that any effect from radiation would not be distinguishable from natural incidence. Also, when ionizing radiation interacts with cells, the chromosome are considered the most critical part since they contain the genetic information and instruction required for the cell to perform its function. This interaction may damage the cells. Though the cells have the mechanism to repair it if the radiation is limited. Now the Radiation workers must protect themselves from Hazard, must accept their responsibility for the appropriate and beneficial applications of their work and ignore the hazard.

RECOMMENDATION

Since radiation is all around us and it is naturally presents in our environment. I recommend that more research should be carried out on the low level of radiation to say with certainty if the effect is only at chronic exposure.

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