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Paper Radiation Protection
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Ans 1 Effect of Radiation Exposure

★ Stochastic Effects

* Stochastic effect Severity independent of dose recived.
* Stochastic effect is a latent period is seen between the time of exposure and the events to manifest.
* Stochastic effect are occurs at level of cells.
* They has no threshold levels of radiation dose.
* They are also seen when the cells are modified rather than killed.
* The probability of effects is proportional to dose
* Also the malignancies, mutations

teratogentic effects.

* Deterministic Effects

* The Deterministic effect are Severity may be proportional to the dose received.
* Deterministic effect Acute radiation Syntromes.
* Also Sterility, Cataract.
* They has no threshold levels of radiation dose.
* They also seen when the cells are killed or loose capability to divide.
* A latent period is seen between the time of exposure and the events to manifest.
* Also occurs at level of tissues.
* The probability of effects is proportional to dose.

Ans 2 **Radioactivity** :- Some atoms exist in an abnormally excited state characterized by an unstable nucleus. To reach stability, the nucleus spontaneously emits particles and energy and transforms itself into another atom. This process is called radioactive disintegration or radioactive decay.

Radioactivity is the spontaneous emission of particles and energy in order to become stable.

★ **Radiation:**

Energy that emitted from a source is referred as Radiation. Radiation is energy that travels through spaces. It can be defined as energy released

in form of particles. It is in the form of waves or moving subatomic particles and rays. we can differentiate Radiation in two types.

* Ionizing Radiation
* Non-Ionizing Radiation.

★ Ionizing Radiation:-

The radiation which has very high energy is called Ionizing Radiation.

★ Non-Ionizing Radiation:-

The type of radiation which has low energy Radiation no ion charge are presence in this Radiation.

★ Harmfull Effects

1 Somatic effect:- Damage to all parts of the body except the reproductive organs.

Symptoms Include:

Fatigue, vomiting, Hair loss, Severe Skin

Brain.

* Genetic Effect :-

Damage to reproductive cells, Genetic defect can be passed down the next generation. Down Syndrome, Klinefelter Syndrome, Turner Syndrome.

Ans (3) (a) Basic Principle :

(1) Minimize Time :-

The Dose to an individual is directly related to the duration of radiation exposure. If the time during which one is exposed to radiation is doubled, the exposure will be doubled.

* Time

Exposure = Exposure rate x Exposure time

(2) Maximize Distance :-

The Distance between the source of radiation and the person increase, radiation

exposure decreases rapidly. This decrease in exposure is calculated using the inverse square law.

If the Distance from the Source exceeds five times the Source diameter, it can be treated as a point Source.

* Radiation Protection:
Radiation protection Aprons
Radiation Protection Apron Accessories
Radiation Protection Gloves
Radiation Protection Glasses
Radiation Protection Thyroid Shields.
Radiation Protection Apron Racks
Radiation Protection Barricos & Table Shields.
Radiation Protection Drape Shields.

Ans: (4) Feature for Radiation protection Design:

(1) Protective X-ray Tube Housing:-

Every x-ray tube must be contained within a protective housing that reduces.

(2) Control Panel:-

The control penal must indicate the conditions of exposure and must positively indicate when the x-ray tube is energized.

The requirement are usually kvp and ma indicator.

* Source to Image Receptor Distance Indicator:

A Source of Distance Indicator (SID) must be provided.

Be a simple as a

type measure attached to the tube housing, or a advanced as lasers. The SID indicator must be accurate to within 2% of the indicated.

③ Callimation :

Light - localized, variable-aperature rectangular callimator should be provided. The x-ray beam and the light beam must coincide to within 2% of SID.

④ Positive Beam Limitation:

They Automatic light localized, variable - aperature callimators were required all but special x-ray imaging system. His name is (PBL) Device are no longer required but continue to be a part of most new radiographic imaging.

⑤ Beam Alignment:

Addition to proper callimation, each radiographic tube

Should be provided with a ~~minimum~~ mechanism to ensure proper alignment of the x-ray beam.

(5) Filtration :

All general purpose ~~diat~~ Diagnostic x-ray beams must have a total filteration (inherent plus added) of at least 2.5 mm. above 70 kvp. Radiographic tube between 50 and 70 kvp. must at least 1.5 mm Below 50 kvp a minimum of 0.5 mm.

x-ray tube designed for mamography have 30 eem Mo or 60 eem Rh filteration.

(6) Reproducibility :

For any given radiographic technique, the output radiation intensity should be constant from one exposure to another. The variation in x-ray intensity

not exceed 5%.

(7) Linearity :

When adjacent mA stations are used, for example 100mA and 200mA, and exposure time is adjusted for constant mAs. The maximum acceptable variation in linearity is 10% from one mA station to an adjacent mA station.

(8) Operator Shield :-

It must not be possible to expose an image receptor while the radiologic technologist stand.

(9) Mobile X-ray Imaging System :

A protective lead apron should be assigned to each mobile x-ray imaging system. The exposure switch of such an imaging system must allow the operator

to remain at least 2m from the x-ray tube during exposure.

Ans (5) Geiger- Muller Counters:

Geiger- Muller Counters (GM) is a gas-filled detector designed for maximum gas effect. The principle of GM counter are show in figure 7.8. The center wire (anode) is maintained at a high positive voltage relative to the outer cylindrical electrode (cathode). The outer electrode may be a metal cylinder or metallic film sprayed on the inside of a glass or plastic tube.

When the ionization occurs in GM counter electron are accelerate towards the center wire.

An avalanche ionization is propagates through out the glass

volume and along the entire length of the center wire.

Owing to the large charge amplification.

GM Survey meters are widely used at very low radiation levels. They are particularly applicable for leak testing and detection of radioactive Contamination.

GM counters exhibit strong energy dependence at low photon energies and are not suitable for used in pulsed radiation fields.