19BME308 - Medical Radiation Safety

UNIT II - RADIATION SAFETY IN NUCLEAR MEDICINE AND RADIOTHERAPY

2.2 Guidelines for Radiation Protection

No practice or source within a practice should be authorized unless the practice produces sufficient benefit to the exposed individuals or to society to offset the radiation harm that it might cause; that is: unless the practice is justified, taking into account social, economic and other relevant factors

Optimisation (ALARA):

All living things are exposed to ionising radiation from the natural (called background radiation) and man-made radiation sources. Ionising radiation may cause biological changes in the exposed person hence the doses to the occupational workers shall be kept As Low As Reasonably Achievable (ALARA) and doses to patients shall be optimized. Suitable control measures shall be employed to minimise radiation exposure so that maximum benefits are derived with minimum radiological risk.

Dose Limitations (Never exceed Dose Limits):

The normal exposure of individuals resulting from all relevant practices should be subject to dose limits to ensure that no individual is exposed to a risk that is judged to be unacceptable.

Dose Limitations		
Part of the body	Occupational Exposure	Public Exposure
Whole body (Effective dose)	20 mSv/year averaged over 5 consecutive years; 30 mSv in any single year	1 mSv/y
Lens of eyes (Equivalent dose)	150 mSv in a year	15 mSv/y

Skin (Equivalent dose)	500 mSv in a year	50 mSv/y
Extremities (Hands and Feet) Equivalent dose	500 mSv in a year	-
For pregnant radiation workers, after declaration of pregnancy 1 mSv on the embryo/fetus should not exceed.		

Where,

Occupational Exposure - Radiation Exposure to worker involved in a practice in which he/she is exposed due to handling of radioactive source or radiation generating equipment.

Public Exposure - Radiation Exposure to public due to above practices.

Basic Three Factors for Radiation Protection (Working Personnel & Public)

Time

- Exposure from radiation source is directly proportional to time
- Reduce period of exposure to radiation to reduce the dose received from source.

Distance

- Increase distance from source to decrease exposure rate.
- $I_1 d_1^2 = I_2 d_2^2$ (Inverse square law)
- Double the distance from the source; dose-rate falls to ¼ the original value.
- Halve the distance from the source; dose-rate increase to 4 times the original value.
- More the distance from source -Lesser the radiation

Shielding

- Use an appropriate shielding material or protection devices
- Shielding reduces exposure rate:

$$I = I_0 e^{-\mu t}$$

μ- linear attenuation coefficient of shielding material

t – Thickness of shielding material

I_0 – Initial exposure rate

I – Exposure rate after transmission from shielding material

- Use large shielding thickness (High Z materials eg Lead, Steel, Concrete, etc) - reduce the exposure rate of gamma/X-ray radiation.

Reference: *AERB - Radiation-Protection-Principle*