Al-Mustaqbal University College
Radiological Techniques Department

RADIATION PROTECTION

ALARA principles

Third Stage

Third Lecture

By
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ALARA principles

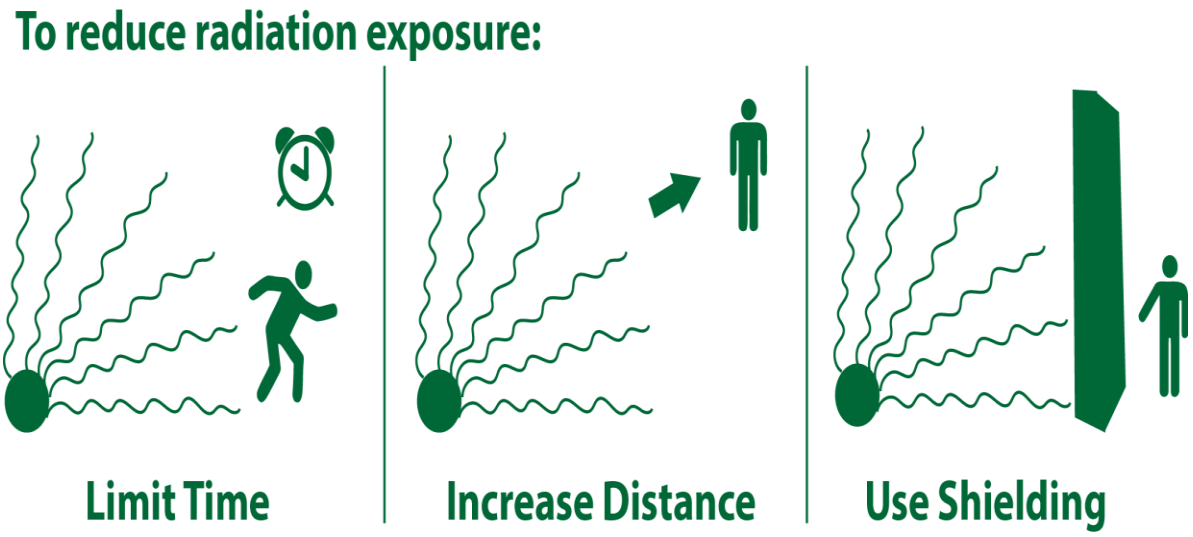
As Low As Reasonably Achievable

The guiding principle of radiation safety is “ALARA”. ALARA stands for “as low as reasonably achievable”. This principle means that even if it is a small dose, if receiving that dose has no direct benefit, you should try to avoid it.

1- Time

2- Distance

3- Shielding

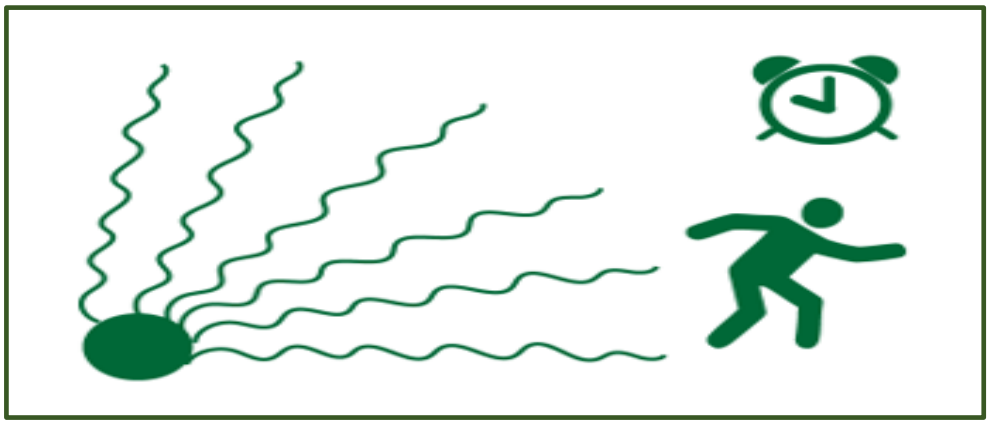


Time:

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. Although it is obvious that reducing the time spent near a radiation source will reduce one's radiation exposure, techniques to minimize time in a radiation field are not always recognized or practiced. First, not all sources of radiation produce constant exposure rates.

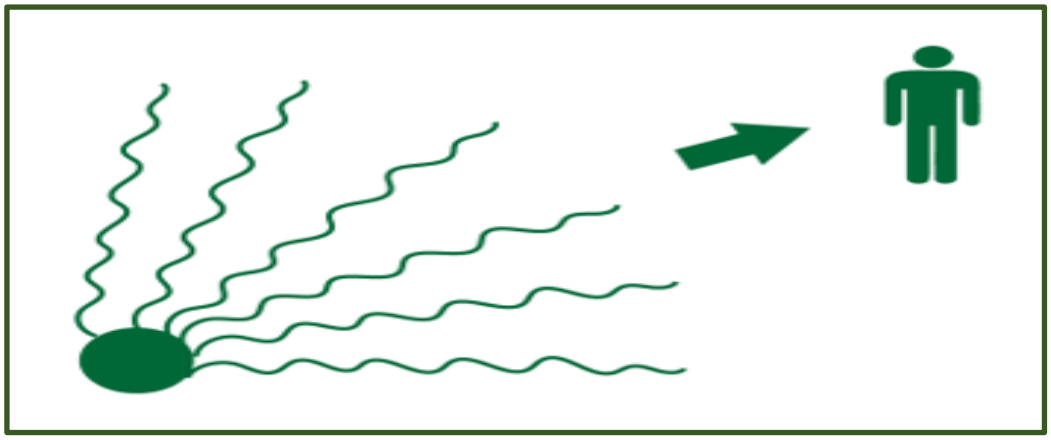
Diagnostic x-ray machines typically produce high exposure rates during brief time intervals.

Reducing the time of exposure to radiation reduces the dose received, and the percentage of reduction is directly proportional to time



Distance:

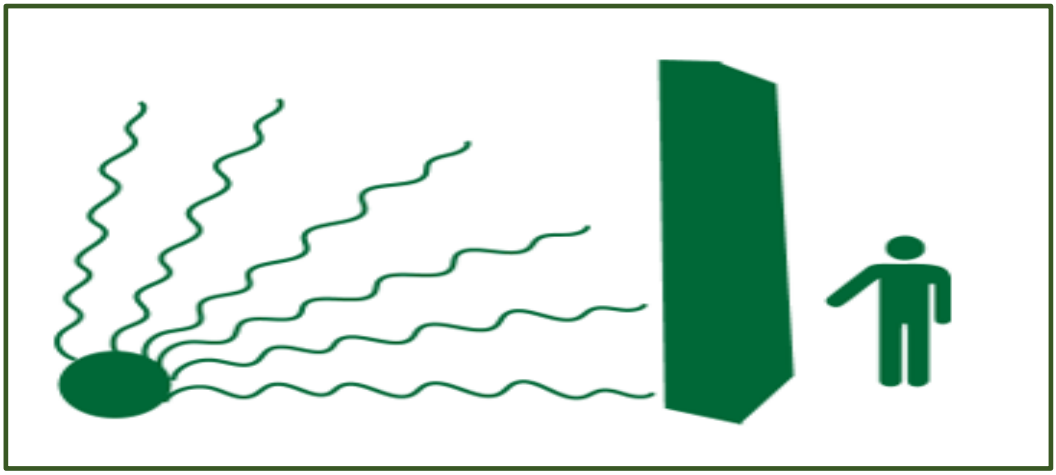
The exposure rate from a source of radiation decreases with increasing distance from the source, even in the absence of an attenuating material. In the case of a point source of radiation (i.e., a source whose physical dimensions are much less than the distance from which it is being measured), the exposure rate decreases as the distance from the source is squared. This principle is called the inverse square law and is the result of the geometric relationship between the surface area (A) and the radius (r) of a sphere: $A = 4\pi r^2$



The greater the distance between a person and the source of radiation, the smaller the amount of received dose. Accordingly, the amount of dose received decreases inversely with the square of the distance from the radiating source (inverse square law)

Shielding:

Shielding is used in diagnostic radiology and nuclear medicine to reduce exposures of patients, staff, and the public. The decision to utilize shielding, and its type, thickness, and location for a particular application, are functions of the photon energy, intensity and geometry of the radiation sources 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. In x-ray facilities, walls surrounding the room with the x-ray generator may contain lead sheets, or the plaster may contain barium sulfate. Operators view the target through a leaded glass screen, or if they must remain in the same room as the target, wear lead aprons. Almost any material can act as a shield from gamma or x-rays if used in sufficient amounts.



Shielding may be installed in a wall, floor, or ceiling of a room; this is commonly done for rooms containing x-ray imaging machines, CT machines, and sometimes rooms housing patients administered large activities. also it may be:

- in the walls of a cabinet used to store radioactive sources.
- installed around a work area, such as the dose preparation area in a nuclear medicine radiopharmacy.
- around individual sources, such as an x-ray tube or a vial or syringe of radioactive material in nuclear medicine.
- It is incorporated behind the image receptors of fluoroscopes and radiographic machines and in the gantries of CT devices.
- worn as protective aprons by people performing fluoroscopy.
- in movable barriers, such as the freestanding and ceiling-mounted shields in fluoroscopic procedure rooms.

Protective shields are used to reduce and absorb radiation, and lead is one of the most important materials used to block radiation