

Aim:

1. Radiation leakage measurement of telecobalt and brachytherapy units in source-off condition.
2. Radiation protection survey of the Teletherapy and Brachytherapy installation.

Apparatus required:

1. Radiation Survey Monitor
2. TLD, Pocket Dosimeter

Theory

Radiation safety in the handling of radiation sources and radiation-generating equipment, which only covers sealed sources and particle accelerators, is an important aspect for radiation workers and public protection. Radiation surveillance requirements and procedures for medical applications of radiation are specified for ensuring radiation safety of -

- (a) Persons handling radiation-generating equipment and sources for medical applications.
- (b) Patients who undergo medical procedures for their health benefit.
- (c) Persons connected with the patient who is either living with him or assisting him during the medical procedure.
- (d) Public members not related to the medical use of radiation.

In radiation therapy, there are two main types of treatment: teletherapy and brachytherapy. In the case of teletherapy, gamma-emitting sealed radioactive sources (Ex. Co-60) and radiation-generating equipment are used. In the case of brachytherapy sealed Ir-192, a radioactive source is used. When not used, the radioactive sources are kept inside a safe housing in the machine. However, since the intensity of gamma rays follows the exponential law of attenuation, the intensity becomes zero at infinite thickness. Tungsten or lead is mostly used as shielding material for safe housing and is adequate to bring the intensity below the tolerance value. This is confirmed by the radiation protection survey of the equipment, and it ensures the safety of the radiation worker and patient. The rooms designed to install the radiation therapy equipment are also provided with an adequate thickness of the walls, ceiling, roofs, and floors if needed to ensure the safety of the radiation worker, patient, attendant public, etc. These shielding criteria are calculated considering the patient workload, use factor, and the occupancy factor around the installation.

Maximum leakage measurement of teletherapy and brachytherapy unit: While carrying out the survey of radiation equipment and installation, the permissible dose limits for radiation workers and members of the public should be kept in mind. The weekly limit for radiation workers and members of the public is 40mR and 2mR, respectively.

Procedure:

Take a calibrated survey meter, wear a TLD Badge or pocket dosimeter, and measure the exposure rate at a 5 cm distance and 1m distance from the surface of the source head at 6 to 8 points of relevance. Tabulate the readings and report the maximum reading.

Observation:

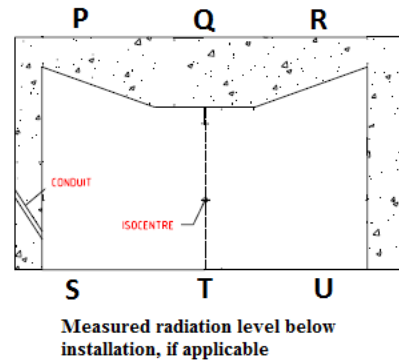
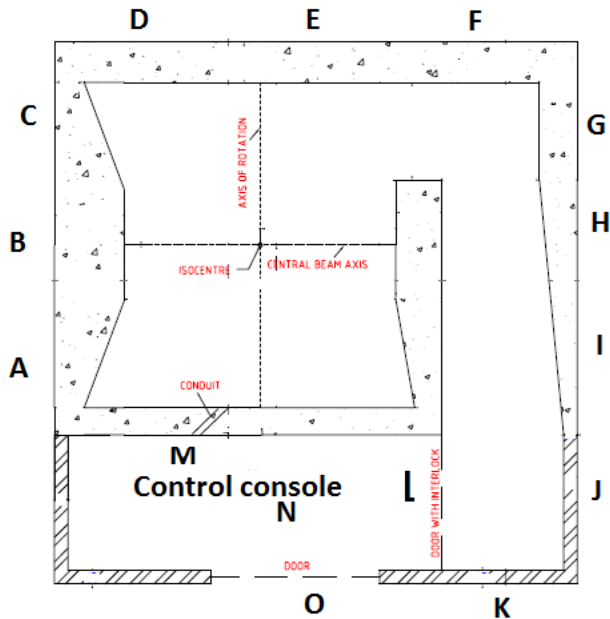
The measurement of leakage levels in off conditions for the teletherapy unit: Table -1

Equipment	Leakage Radiation Dose Rate ($\mu\text{Sv/hr}$)	
	5cm from the surface of the source housing	1m from the source
Source in the off position loaded with maximum activity	Measured: Tolerance: 200	Measured: Tolerance: 20
Note: measurements shall be averaged over an area not greater than (i) 100 cm^2 at 1 m from the source or (b) 10 cm^2 at 5 cm from the surface of the source housing.		

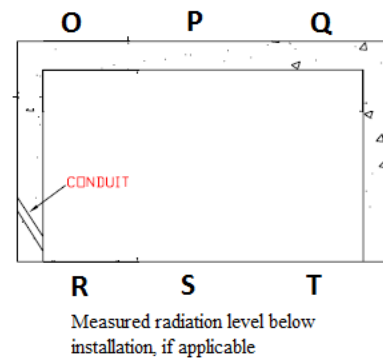
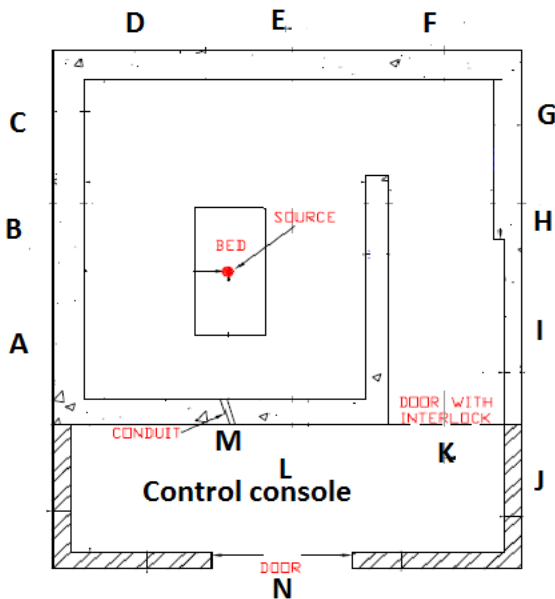
The measurement of leakage levels in off conditions for the brachytherapy unit: Table -2

Equipment	Leakage Radiation Dose Rate ($\mu\text{Sv/hr}$)	
	5cm from the surface of the source housing	1m from the source
Remote after-loading system	Measured: Tolerance: 100	Measured: Tolerance: 10
Note: measurements shall be averaged over an area not greater than (i) 100 cm^2 at 1 m from the source or (b) 10 cm^2 at 5 cm from the surface of the source housing.		

Survey of installation: Draw neat layouts of the teletherapy and brachytherapy radiation installation room (typical layout as shown below) and mark the areas occupied by radiation workers and public members as A, B, C, D, etc. Measure the maximum radiation level ($\mu\text{Sv/hr}$) for the worst-case scenario; maximum field size with phantom for secondary barrier and maximum field size without phantom for primary barrier, at cardinal gantry positions 0° , 90° , 180° , and 270° .



Typical Layout of Teletherapy Installation



Typical Layout of Brachytherapy Installation

Table – 3:

Location	Max. radiation level ($\mu\text{Sv/hr}$) for each cardinal gantry angle				Location	Max. radiation level ($\mu\text{Sv/hr}$) for each cardinal gantry angle			
	0°	90°	180°	270°		0°	90°	180°	270°
A					L				
B					M				
C					N				
D					O				
E					P				
F					Q				
G					R				
H					S				
I					T				
J					U				
K					V				

Conclusion:

Precaution:

1. Before entering a radiation zone, please confirm that the Radiation Zone Monitor is ON.
2. Please wear a TLD badge or pocket dosimeter during the survey.