Guidelines for preparation of radiotherapy site and layout drawings

July 21, 2016

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To establish a Radiotherapy facility, the user institute should go through the Regulatory requirements stipulated in the Atomic Energy (Radiation Protection) Rules, 2004 and AERB Safety Codes [AERB/RF-SC/MED-1(Rev.1)] and shall obtain requisite regulatory consent from AERB as per AERB Safety Guide for Consenting process for Radiation Facilities (AERB/SG/G-3). These documents can be downloaded from AERB website www.aerb.gov.in.

The first step to establish a Radiotherapy facility is to submit the site and layout plan of the radiotherapy installation through eLORA and get it approved from AERB. It may be noted that AERB approves the layout plans from radiation safety standpoint only and therefore, all other necessary approvals for siting, construction etc. must be obtained by the user institution from the respective municipal/Govt. agencies.

While preparing the layout plans of the Radiotherapy facility, it is advisable to take inputs from the Management, Radiation Oncologists, Medical Physicists, the Supplier of the Radiotherapy Equipment and Architecture. You may refer NCRP Report No. 151 and IAEA SRS No. 47 for planning radiation shielding requirements. In eLORA, the employer/licensee need to submit application for site and layout plan approval for each individual radiotherapy installation (i.e. separate application for each teletherapy installation, brachytherapy installation and simulator installation).

Guidance to prepare site and layout plan drawings

Following drawings in PDF file are required to be prepared and submitted for the site and layout approval application form in eLORA. While preparing the drawings it should be kept in mind that one should able to gather three dimensional understanding of the treatment room and occupancy around the installation.

1 Site plan drawing

1.1 Prepare the site layout plan drawing for the radiotherapy installation. Recommended scale 1:200.

1.2 Name of institute and address of institute ('Permanent Address' of institute as seen in your eLORA account) should be mentioned on the site layout plan drawing.

1.3 Indicate radiotherapy installation(s) in the site plan.

1.4 The location of the radiotherapy installation should be so chosen that it is away from unconnected facilities and is close to the related facilities such as Simulator Room, Mould Room, Patient Waiting Area, Treatment Planning System Room, Radiation Oncologist(s) Room, Medical Physicist (s) Room, UPS room, Change room, etc. All such connected facilities should be shown in the site layout plan.

1.5 All facilities at the vicinity of 20 m from the external walls of radiotherapy room should be shown in the site layout plan.

1.6 Indicate all the facilities around the radiotherapy room. Do not write 'Full Occupancy', 'Partial Occupancy' etc., rather write 'Ward', 'Toilet', 'Corridor', 'Accounts Office', 'Open Land open to sky' etc.

1.7 Indicate distance between external walls of radiotherapy room and institute's plot boundary. If the boundary is at far off distance and cannot be shown in the drawing, mention the distance at which boundary exists.

1.8 If the radiotherapy room is located near the plot boundary, maintain a distance of 2 to 3 meter between external walls of radiotherapy room and plot boundary for any contingency in future.

1.9 Since the site layout plan provides the information about facilities at the ground level, for radiotherapy rooms at the basement, the room location can be shown as shaded area.

2 Main drawing showing Radiotherapy Room and Control Console Room

2.1 Prepare the floor layout plan drawing for the proposed radiotherapy room.

2.2 Name of institute and address of institute ('Permanent Address' of institute as seen in your eLORA account) should be mentioned on the room drawing.

2.3 In case of multiple installations (e.g. two medical accelerator installations, etc.), show the proposed individual installation completely and other adjoining installation(s) partially.

2.4 Indicate 'Floor' of installation (e.g. Lower Basement, Ground Floor, etc.) in the drawing. It is desirable to attach Floor plans above or below the installation, if any.

2.5 The construction material to be used for radiotherapy room should be concrete of density 2.35 gm/cc. However, where structural requirements so demand, other material may be used. However, show appropriate legend and density for each construction material (e.g. concrete, column, hematite concrete, brick, etc.) indicated in the drawing.

2.6 If radiotherapy room is to be constructed in the basement and natural earth is to be used as a shielding material, declaration regarding THICKNESS of the Earth and it's LEVEL to be maintained forever in owner's property should be clearly mentioned.

2.7 Indicate OCCUPANCY around the treatment room. Do not write 'Full Occupancy', 'Partial Occupancy' etc., rather write 'Ward', 'Toilet', 'Corridor', 'Accounts Office' etc.

2.8 Ensure to indicate the following in the layout plans:

- 2.8.1 Nominal photon energies (in MV) - in case of Medical Accelerator installation.
- 2.8.2 Isocentre - in case of Teletherapy installation.
- 2.8.3 Central beam axis - as applicable, in case of Teletherapy installation.
- 2.8.4 Axis of gantry rotation - as applicable, in case of Teletherapy installation.
- 2.8.5 Primary barrier width on either side of central beam axis - in case of Teletherapy installation.
- 2.8.6 Radioisotope - in case of Brachytherapy installation.
- 2.8.7 Source position and bed position - in case of Brachytherapy installation.
- 2.8.8 Length and thicknesses of all walls.
- 2.8.9 Width of maze opening inside treatment room.
- 2.8.10 Length and width of maze area.
- 2.8.11 Width of treatment room entrance door.
- 2.8.12 Door with interlock: Entry door to the treatment room (normally wooden/glass door).
- 2.8.13 Door to secure control room.
- 2.8.14 Conduit: Normally 5 cm diameter, at an angle between 20° to 45° to the horizontal and lower end located at a height 15 cm to 20 cm from the finished floor level in the treatment room to enable cables of radiation measuring instruments to pass through from the control room to the treatment room.
- 2.8.15 Position of Gamma Zone Monitor (in case of telegamma and brachytherapy installation).
- 2.8.16 Position of LMOS (Last Man Out Switch).
- 2.8.17 Position of CCTV cameras.
- 2.8.18 Warning Lights: provided above the interlocked door to show the status "ON/OFF" of the source.

2.9 Show Control Console room: Control console should be placed adjacent to the entry to treatment room door i.e. interlocked door, so that the interlocked door is under direct supervision from the control console and there is no barrier (not even glass partition) in between the interlocked door and control console.

2.10 Show cross sectional lines (e.g. X-X', Y-Y', etc.) along the length, breadth and maze of treatment room and prepare cross sectional drawings along these lines.

3 Cross sectional drawings

3.1 Prepare the cross sectional drawings along the length, breadth and maze of treatment room, so that one can understand the thickness of ceiling of the treatment room area and maze area. Cross sectional drawing also provides the information of elevation.

3.2 Indicate Cross Section No. (e.g. X-X', Y-Y', etc.) in the drawing.

3.3 The information on Name of institute, address, occupancy (above the treatment room and control console room), legend & density of material, earth thickness (if any), Beam energy/Source details, Isocentre/source position, conduit, door etc. are to be shown clearly in line with main drawing.

3.4 Ensure consistency of wall thickness, materials and occupancy around in cross sectional drawing in line with main drawing.

4 Other plans including floor plans drawing above/beneath radiotherapy installation

4.1 Prepare a floor layout plan drawing, more essential for the installation in the basement.

4.2 Prepare additional cross sectional drawings to show elevation of the building, particularly to show the level of earth for installations at the basement and when there are construction above/below the radiotherapy room.

4.3 Prepare the floor layout plan drawing of floor above/beneath the proposed radiotherapy room/console room, showing the projection of radiotherapy room by dotted line.

4.4 All other applicable information such as Name of institute, address, occupancy, legend & density of material, earth thickness (if any), etc. are to be shown clearly in line with main drawing.

5 Other requirements while planning radiotherapy installation

5.1 Ramp

In case of Telecobalt installations, a ramp may be provided in close proximity to the teletherapy installation to facilitate easy movement of the crates carrying the unit to the teletherapy room. The ramp is also useful in future during source replacement operation, which is to be carried out once in every 5-7 years. For this work, a new Cobalt-60 source is brought in a transport container weighing 2-3 tons. This container is to be unloaded from a truck and taken into the Telecobalt room. The height and slope of the ramp should be so adjusted that the transport container can be unloaded with ease from the truck and transported into the teletherapy room on a suitable trolley.

5.2 Air Conditioning

The treatment room should be air-conditioned. In case, central air-conditioning is to be provided in the radiation therapy room, the ducts for central air conditioning should be taken along the wall of the entrance door and left at the desired location without making any opening on any wall. In case split air conditioners are to be provided in the radiation therapy room, conduits of minimum diameter consistent with the requirement and making an angle between 20° to 45° with the horizontal should be provided. The opening of these conduits in the treatment room should be at a height about 1.5m from the floor of treatment room. The details may be finalized in consultation with AC Engineers. In the case of accelerator installations special ventilation arrangements are required. It is desirable that the control room is also air-conditioned. Air conditioners for the control room may be located anywhere in its brick walls as per convenience.

5.3 Viewing System

For observing the patient under treatment and the gantry movement from the control room, appropriate viewing system must be provided. This can be achieved by providing Closed Circuit TV System (CCTV).

In addition a backup arrangement must be made, which can be achieved by either having a spare Closed Circuit TV System (CCTV) or by using mirrors and provision in the interlocked door for observing the patient conveniently from the operator's position.

5.4 Electrical Works

Electrical ducting requirements and also any pit, conduit etc., should be decided in consultation with the firm installing the unit, before commencement of the actual construction work.

5.5 Construction Restraints

It may be necessary for the installation of the unit that some portion of the wall or ceiling be constructed after bringing the crates carrying the unit into the treatment room. This may be decided in consultation with the firm installing the unit. It may also be ensured from the supplier of the unit before starting construction work that the maze/labyrinth provided in the drawing is adequate for the movement of the various components of the radiotherapy unit with or without crates.

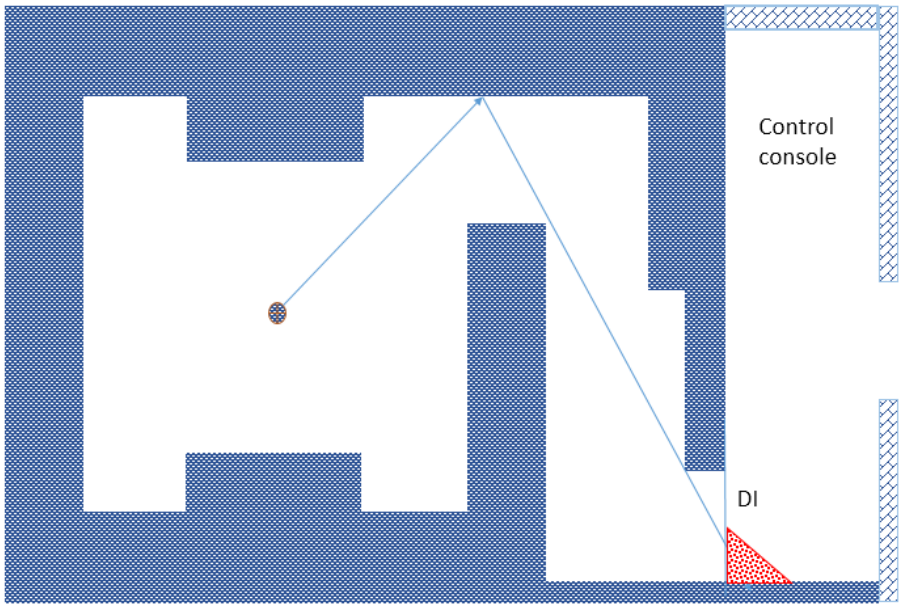
6 Starting construction work

No construction work should be undertaken by the institution unless prior approval of AERB for the specific layout of the installation has duly been obtained by the institution. The construction must be in accordance with the plan approved by AERB. In case of any deviation, that must be promptly brought to the notice of AERB for approval.

7 Common reasons for rejection of layout plans and solutions

7.1 Shorter maze length

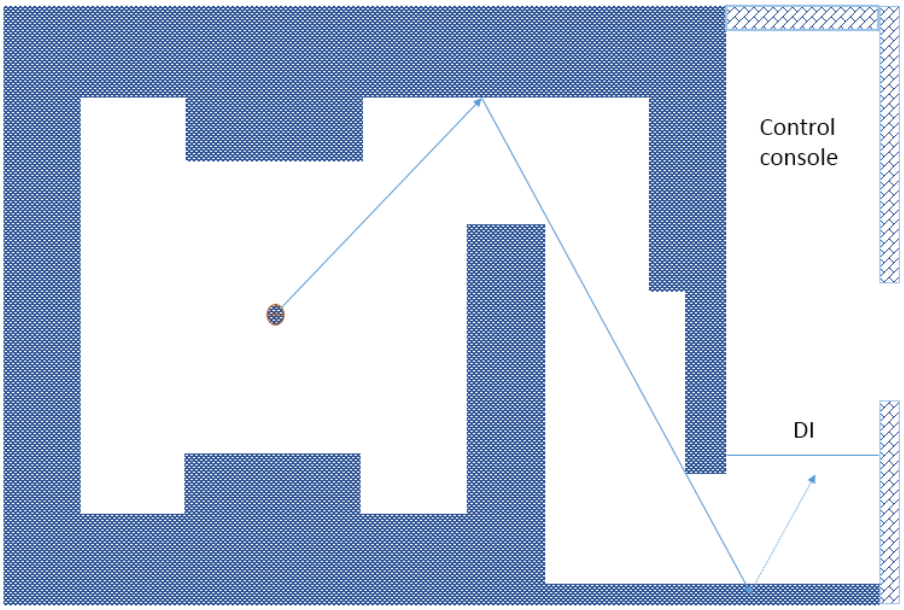
Commonly observed issue:



Hot spot at entrance of treatment room door is more pronounced in case of shorter maze length

DI: Door Interlock

Solution:

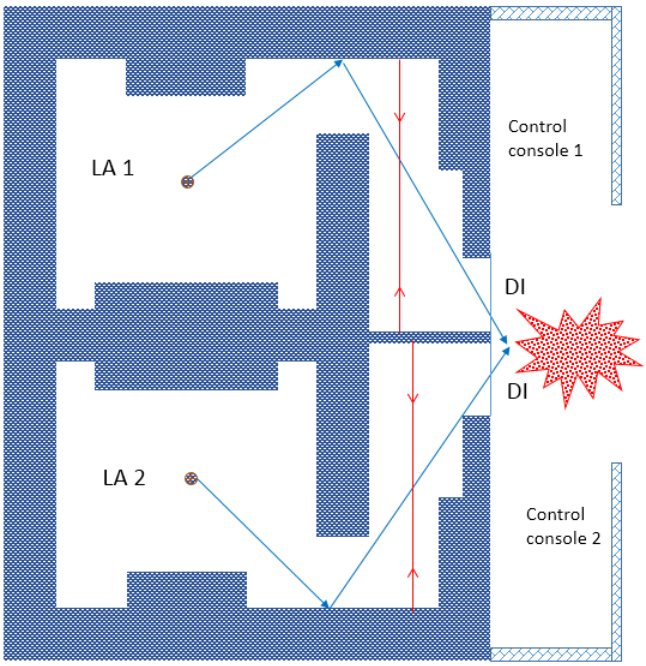


Additional bend reduces scatter dose and prevent hot spot

DI: Door Interlock

7.2 Adjacent treatment rooms

Commonly observed issue:

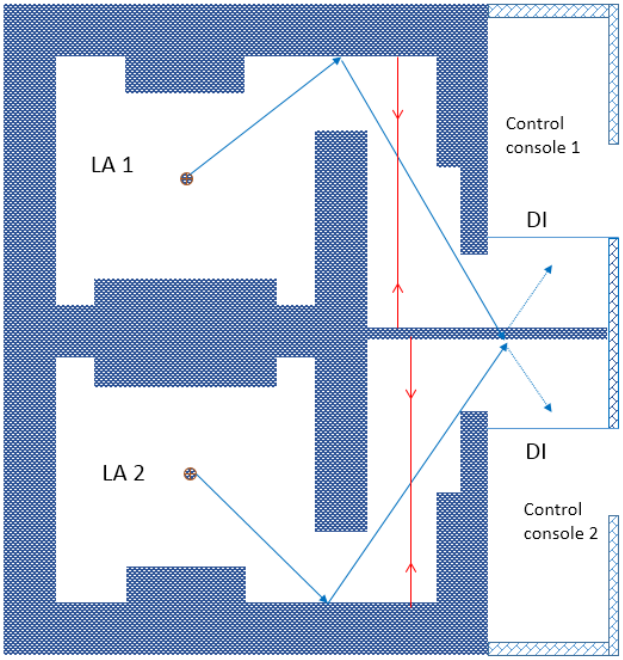


Scattered radiation dose at door from LA 1 + LA 2

Hot spot is more pronounced at the doors of adjacent treatment rooms due to decrease in maze length and common junction of doors.

DI: Door Interlock

Solution:

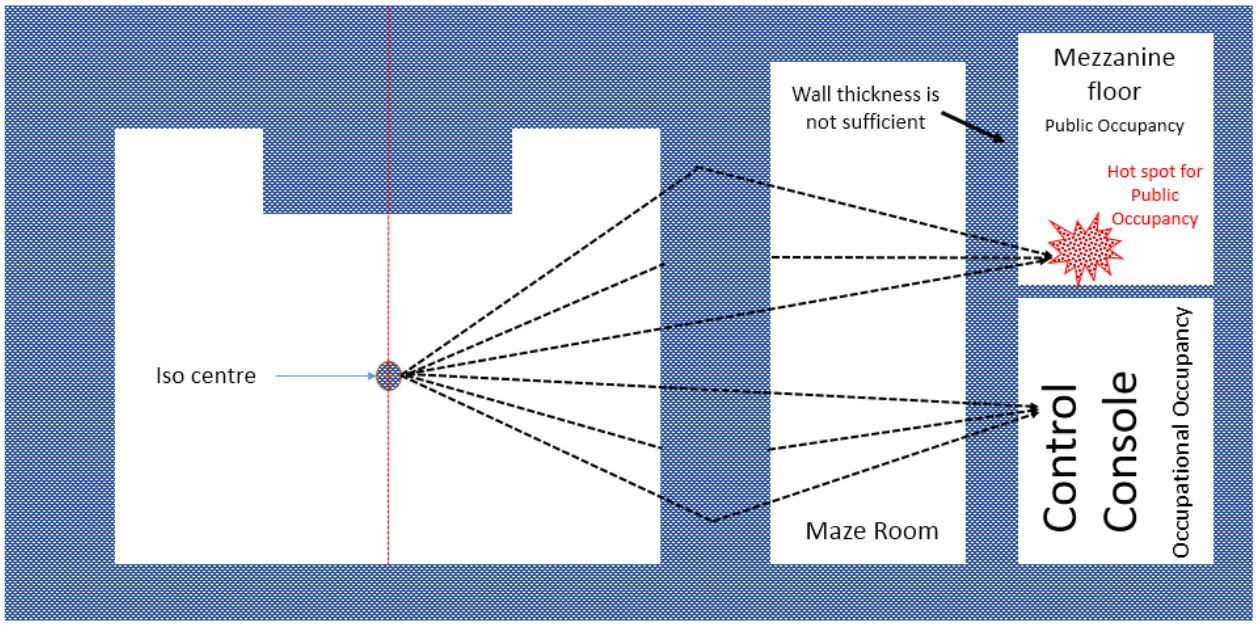


Additional bend at doors reduces scatter dose and prevent hot spot

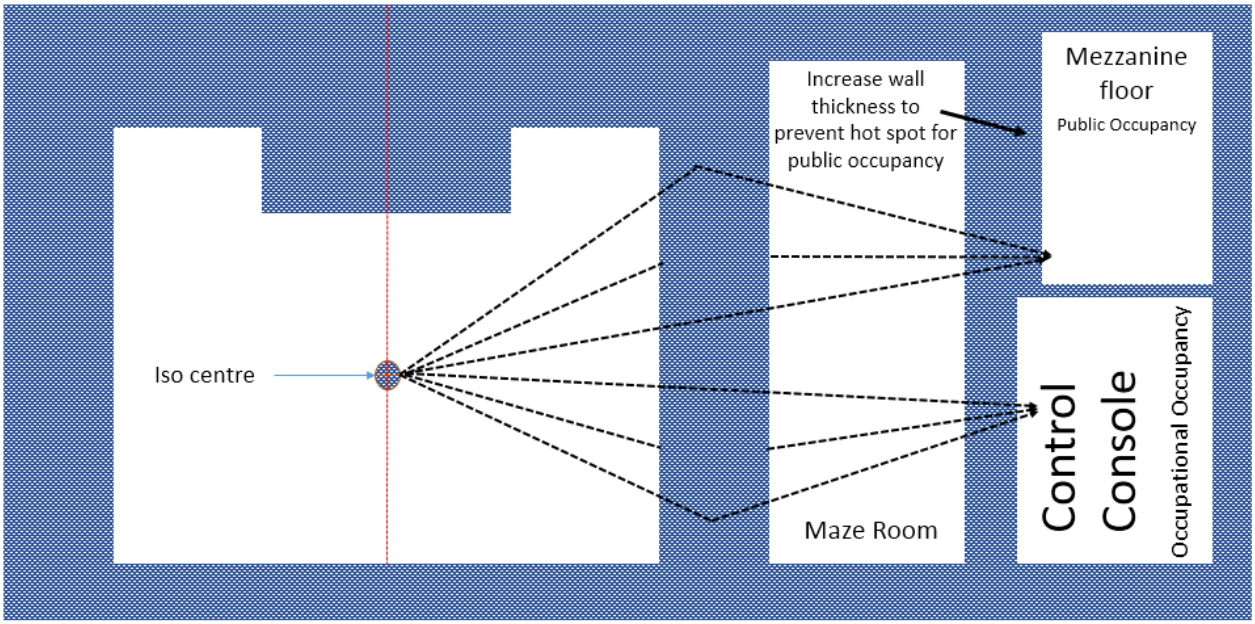
DI: Door Interlock

7.3 Construction of public occupancy places (e.g. Reception, Administrative wing, etc.) at mezzanine floor above the control console room.

Commonly observed issue:



Solution:



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