1. Purpose
   1.1. To provide basic criteria for the design and evaluation of radiation shielding for X-ray imaging facilities.
   1.2. To outline the process for requesting shielding designs and evaluations from the Office of Radiation Safety (ORS).
2. Applicability
   2.1. This guideline applies to all UConn Health facilities used for diagnostic imaging such as general radiology, fluoroscopy, dental, mammography, superficial radiotherapy (SRT) used in dermatology, intraoperative radiation therapy (IORT) and computed tomography (CT).
   2.2. This guideline does not apply to radiotherapy facilities such as linear accelerators. Site plans must be submitted for review and special requirements must be met and approved by ORS prior to start of project.
3. References
   3.1. NCRP 145, “Radiation Protection in Dentistry”.
   3.2. NCRP 147, “Structural Shielding Design for Medical X-Ray Imaging Facilities”.
4. Definitions
   4.1. ***Shielding Design*** is a report specifying the construction materials required for protection from ionizing radiation for areas in or adjacent to rooms where radiation generating devices are operated.
   4.2. ***Radiation Generating Device*** (RGD) is a device which produces ionizing radiation. Examples include X-ray, fluoroscopy, and computed tomography (CT) machines.
   4.3. ***Barrier Evaluation*** is an evaluation to determine if sufficient shielding exists for the type and frequency of imaging specified. It is also used to validate construction meets/exceeds the requirements of the shielding design.
   4.4. ***Controlled Area*** is an area where staff or other employees (radiation workers or occupationally exposed workers) may be exposed to higher levels of ionizing radiation than the general public.
   4.5. ***Uncontrolled Area*** is an area which may be occupied by the general public or staff who are not occupationally exposed or who may have an expectation of not being exposed as an occupationally exposed worker. Examples include patients, visitors, clerical staff, and radiation workers not currently working in a radiation area.
5. Shielding Design

5.1. Shielding designs can be performed by a qualified medical or health physicist or by the ORS. All shielding designs will be reviewed by the ORS.

5.2. As a minimum, designs shall meet or exceed the requirements of NCRP Report 147.

5.3. To request a shielding design from the ORS, complete/submit Attachment I, "Shielding Design Request". Attach a scaled drawing (1/4 in/ft preferred) of the imaging room and adjacent surroundings.

5.4. Include floorplans, table/bucky and equipment placement, type of imaging to be done, and typical workload (i.e., number of cases/week).

5.5. Upon receipt of a completed Attachment 1, ORS will review the proposed facility, meet with the requestor, review construction specifications and equipment layout, identify type and amount of shielding required, and provide that information to the requestor in the form of a shielding report.

5.6. The shielding report shall identify minimum shielding required for the type and frequency of imaging specified. It shall also identify the "shielding design goals" for "controlled" and "uncontrolled" areas and define the relationship of these "goals" with regards to effective dose limits for radiation workers and members of the public, as discussed in NCRP Report 147.

6. Barrier Evaluations

6.1. Barrier evaluations are done to validate design and construction and to verify if sufficient shielding exists for the type and frequency of imaging specified.

6.2. Barrier evaluations are done initially (prior to initial use), whenever an existing radiation room is modified, whenever the layout of the equipment within a radiation room has changed, or whenever the function of adjacent areas or rooms has changed.

6.3. To request a barrier evaluation, fill out Attachment 2, "Barrier Evaluation Request" and forward it to the ORS.

6.4. Include floorplans, table/bucky and equipment placement, type of imaging to be done, and typical workload (i.e., number of cases/week).

6.5. Upon receiving a completed barrier evaluation request, ORS will review and evaluate the documents for completeness, determine if the existing shielding is sufficient for the type and frequency of imaging specified, and provide results to the requestor in the form of a barrier evaluation report.

6.6. Barrier evaluation reports will indicate if sufficient shielding exists or if additional shielding will be required for the type and frequency of imaging specified.

7. Documentation

7.1. The ORS shall maintain records of all shielding designs and barrier evaluations.

_____ _____

Radiation Safety Officer Date

_____ _____

Director, Radiation Safety Date

Attachment I

Shielding Design Request - Information Form

		Project ID
Facility and Room ID	Room Function (e.g., Radiographic, Rad- Fluoro, Cath Lab, Procedure Room, etc.)	Date
Facility: Building name and Address, Architectural Room Number and Floor		

Room Floor

Below RM Use Area ☐ Earth ☐ Occupied Space	Occupancy description (e.g., Office (full), corridor, toilet)	Slab to Slab Distance Below (typical 14 to 16 ft.)
Floor Construction ☐ Normal Density Concrete ☐ Light-Weight Concrete ☐ Other: (please specify)		
Minimum Concrete Thickness	Thickness of Steel Deck (gauge)	Other Material, (e.g., Wood, Ceramic tile, etc.)

Room Ceiling

Above RM Use Area ☐ Roof ☐ Occupied Space	Occupancy (e.g., Office (full), corridor, toilet)	Slab to Slab Distance Above
Floor Above Construction ☐ Normal Density Concrete ☐ Light-Weight Concrete ☐ Other: (please specify)		
Minimum Concrete Thickness	Thickness of Steel Deck (gauge)	Other Material, (e.g., Wood, Ceramic tile, etc.)

Room Walls

Describe specific composition and thickness of walls if constructed of material other than gypsum drywall or Sheet Rock (e.g., concrete, brick, concrete block, etc.)

Equipment Mfg. Model and Room Design

Equipment Vendor (e.g., Philips, GE, Siemens etc.)	Equipment Type (e.g., Gen Rad, RF, include model)	Type of Construction ☐ Room Remodel ☐ New Construction
Project Manager	Department	Imaging Equipment Specialist / Vendor Contact

Shielding Design and Functional Details

Room workload, **(1) Radiographic:** Indicate number and type of exams per week and number of views for each (e.g.,,, 30 extremities, 2 views each, 15 chests, PA and LAT, 2 views 25 Abdomen, 4 views. Include technique, kVp, mAs is possible) and/ or **(2) Fluoroscopic:** mA minutes per week for low, medium or high use room, (e.g.,,, Radiographic Low 250, medium 500, high1000, Fluoro: Low 500, medium 1000, high 2000) (**3)** Indicate if request **is CT or Mammography.**

Radiographic Exam descriptions: Exam Type	Number of Views	kVp	mAs

Fluoroscopic Exam descriptions: Study	Estimated number per year	Estimate time/study

☐ CT or Mammography:

Attachment II

Barrier Evaluation Request - Information Form

		Project ID
Facility and Room ID	Room Function (e.g.,, Radiographic, Rad- Fluoro, Cath Lab, Procedure Room, etc.)	Date
Facility: Building name and Address, Architectural Room Number and Floor)		

Room Floor

Below RM Use Area ☐ Earth ☐ Occupied Space	Occupancy description of **all adjacent** rooms and/or spaces including the **floor below** (e.g.,, Office (full), Exam room, corridor, toilet, etc.)

Room Ceiling

Above RM Use Area ☐ Roof ☐ Occupied Space	Occupancy description of **all adjacent** rooms and/or spaces including the **floor above** (e.g.,, Office (full), Storage room, corridor, toilet, etc.)

Room and Adjacent Space Description.

Attach a drawing with description of the occupancy of adjacent rooms. (e.g.,, Barrier A = Office, Barrier B = corridor, Barrier C = control booth, etc.)

References

Equipment Vendor (e.g.,, Philips, GE, Siemens etc.)	Equipment Type (e.g.,, Gen Rad, RF, include model)	Room Remodel / New Construction
Facility Contact	Department Contract	Imaging Equipment Specialist / Contact

Room Shielding and Functional Details

Room workload, **(1) Radiographic:** Indicate number and type of exams per week and number of views for each (e.g.,,, 30 extremities, 2 views each, 15 chests, PA and LAT, 2 views 25 Abdomen, 4 views. Include technique, kVp, mAs is possible) and/ or **(2) Fluoroscopic:** mA minutes per week for low, medium or high use room, (e.g.,,, Radiographic Low 250, medium 500, high1000, Fluoro: Low 500, medium 1000, high 2000) (**3)** Indicate if request is for **CT or Mammography.**

Radiographic Exam descriptions: Exam Type	Number of Views	kVp	mAs

Fluoroscopic Exam descriptions: Study	Estimated number per year	Estimate time/study

☐ CT or Mammography: