



**STATE OF LOUISIANA  
DEPARTMENT OF ENVIRONMENTAL QUALITY  
Emergency & Radiological Services Division  
Licensing & Registrations Section  
P.O. Box 4312  
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**X-RAY SHIELDING REVIEW FORM INSTRUCTIONS**

LAC 33:XV.603.C requires that, prior to construction or modification, the floor plans and equipment arrangement of all installations utilizing X-rays for medical diagnostic or therapeutic purposes shall be submitted to the Department for review and approval. The review and approval is solely for the purpose of radiation protection, assuring that exposures to individuals in restricted and unrestricted areas are not likely to exceed the limits specified in Chapter 4 of LAC 33:XV.

Since it is very important to design rooms for efficient use, you may wish to use the services of a qualified expert to determine not only the shielding requirements but the design and layout of the room itself, to ensure that it can be used for the intended purpose. The Department suggests that if you are not familiar with the layout of the X-ray rooms, the requirements of the Louisiana Radiation Regulations, or the recommendations found in NCRP Report No. 49, then the services of a qualified expert should be obtained. If needed, the Department can supply a list of consultants in this area that may assist you in this matter.

If you believe that you can adequately design and calculate the shielding required for the X-ray room, then you must complete all items on the accompanying form before the Department can conduct a shielding review of your facility. If any of the questions do not apply to your facility, enter N/A in the space provided, and briefly describe why the question is not applicable. The Department will not review a shielding request until the appropriate fee has been paid. Please refer to Appendix A of Chapter 25 of LAC 33:XV **to determine the appropriate fee for each room**. Please make checks payable to the Department of Environmental Quality.

A copy of Appendices A and B to Chapter 6 of the Louisiana Radiation Regulations is provided for your convenience. Please pay close attention to Appendix B. Appendix C is included as an occupancy factor guide for the drawing.

If you have any questions concerning the form or the policy for shielding review, please do not hesitate to contact the Registrations & Certifications Section - Radiation for additional information at **(225) 219-3041, Fax (225) 219-3154**.

## X-RAY SHIELDING REVIEW FORM

1.

Facility Name	Phone No.	
Complete Address	Fax No.	
City	State	Zip

2. X-Ray Control Manufacturer: \_\_\_\_\_

Maximum kVp of X-ray unit: _____	kVp
Maximum mA of X-ray unit: _____	mA

If the unit is registered with the Department at another location from that stated above, list the address at which it is presently registered \_\_\_\_\_

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3. The maximum anticipated weekly workload for this X-ray room is \_\_\_\_\_ milliamp-minutes at \_\_\_\_\_ kVp (the average kVp). The maximum number of patients per week \_\_\_\_\_. This may be significantly different from number of exposures per week (see Item 7, pg. 3).

To obtain the maximum anticipated weekly workload, the following information is required:

- a. Average number of exposures performed per week;
- b. Time of exposure, e.g., 1/2 second, 2/5 second; and
- c. Average mA when making an exposure.

Multiply a, b, and c. Then divide the sum by 60.

**Example:** 
$$\frac{100 \text{ (exposures)} \times 2/5 \text{ sec. (time)} \times 300 \text{ (mA)}}{60} = 200 \text{ milliamp-minutes (WORKLOAD)}$$

4. A floor plan drawing of the X-ray room must be submitted to the Registrations & Certifications Section - Radiation. This drawing must be to scale (e.g., 1/4" = 1') and must show the following:

- A. The location of the X-ray tube in the room.
- B. The direction(s) of the X-ray beam.
- C. The location of all doors and windows.
- D. The location of the control booth and viewing window.
- E. The location of the control console.
- F. The location of the wall bucky, if present.
- G. A description of the type of areas adjacent to the X-ray room, including spaces above and below (i.e., halls, darkroom, offices, outside walls, etc. and the occupancy factors for each area). See Appendix C.
- H. The distance from the normal position of the X-ray tube to each wall of the room.
- I. The location of **unexposed** film storage.
- J. The **highlighted** locations where **lead** is used.

5. The percent of the total exposures that will be taken with the X-ray tube directed at the wall bucky is \_\_\_\_\_%, table top \_\_\_\_\_%, other \_\_\_\_\_%.

6. The structural composition and thickness of each of the walls, doors, floor and ceiling is as follows (NOTE: Include added shielding material, e.g., lead, iron, concrete, bricks, etc.):

North:

South:

East:

West:

Control Booth:

Control Booth Window:

Door(s):

Behind Wall Bucky:

**NOTE: LEAD IS REQUIRED BEHIND THE WALL BUCKY, WITH A 1 FOOT BORDER ON ALL SIDES, TO REDUCE RADIATION SCATTERED FROM THE BRICK, SHEET ROCK, ETC. MANY TIMES WITHOUT THE USE OF LEAD AS A BARRIER, THERE WILL BE INCREASED SCATTER AND INCREASED FOGGING OF FILM.**

Floor:

Ceiling:

Other:

Single Story: \_\_\_\_\_ yes \_\_\_\_\_ no (If no, give details)

7. Unexposed X-ray film will be stored \_\_\_\_\_ (Mark exact location on drawing). This film will be protected from radiation by \_\_\_\_\_ mm (thickness) of \_\_\_\_\_ (type of material).

8. This is to certify that, to the best of my knowledge, all information contained herein, including any supplements attached hereto, is true and correct.

\_\_\_\_\_  
NAME (Please print or type)

\_\_\_\_\_  
Phone Number

\_\_\_\_\_  
SIGNATURE

\_\_\_\_\_  
Date

## CHAPTER 6 – APPENDIX A

### INFORMATION ON RADIATION SHIELDING REQUIRED FOR PLAN REVIEWS

In order for the Department to provide an evaluation, technical advice, and official approval of shielding requirements for a radiation installation, the following information shall be submitted:

- A. The plans should show, as a minimum, the following:
  - 1. The normal location of the X-ray system's radiation producing equipment's radiation port, the port's travel and traverse limits, general direction(s) of the useful beam, locations of any windows and doors, the location of the operator's booth, and the location of the X-ray control panel.
  - 2. The structural composition and thickness or lead equivalent of all walls, doors, partitions, floor, and ceiling of the room(s) concerned.
  - 3. The dimensions of the room(s) concerned.
  - 4. The type of occupancy of all adjacent areas inclusive of space above and below the room(s) concerned. If there is an exterior wall, show distance to the closest area(s) where it is likely that individuals may be present.
  - 5. The make and model of the X-ray equipment and the maximum technique factors.
  - 6. The type of examination(s) or treatment(s) that will be performed with the equipment.
  - 7. The maximum anticipated number of patients per week. This is particularly important for shielding analysis using NCRP 147 guidelines regardless of whether the applicant utilizes NCRP 49 guidelines for shielding calculations.
- B. Information on the anticipated workload **and** maximum anticipated patients per week of the X-ray system(s) shall be submitted with the plans.
- C. If the services of a qualified expert have been utilized to determine the shielding requirements, a report, including all basic assumptions used, shall be submitted with the plans.

## **CHAPTER 6 – APPENDIX B**

### **DESIGN REQUIREMENTS FOR AN OPERATOR'S BOOTH**

- A. Space Requirements. The operator shall be allotted not less than 7.5 square feet (0.697 m<sup>2</sup>) of unobstructed floor space in the booth.
1. The operator's booth may be any geometric configuration with no dimension of less than two feet (0.61 m).
  2. The space shall be allotted excluding any encumbrance by the X-ray control panel, such as overhang, cables, or other similar encroachments.
  3. The booth shall be located or constructed such that unattenuated direct scatter radiation originating on the examination table or at the wall cassette does not reach the operator's station in the booth.
- B. Structural Requirements. The booth walls shall be permanently fixed barriers of at least seven feet (2.13 m) high.
1. When a door or movable panel is used as an integral part of the booth structure, it must have an interlock that will prevent an exposure when the door or panel is not closed.
  2. Shielding shall be provided to meet the requirements of LAC 33:XV, Chapter 4.
- C. X-Ray Control Placement. The X-ray control for the system shall be fixed within the booth and
1. shall be at least 40 inches (1.02 m) from any open edge of the booth wall that is nearest to the examining table; and
  2. shall allow the operator to use the majority of the available viewing windows.
- D. Viewing System Requirements
1. Each booth shall have at least one viewing device that will be so placed that:
    - a. the operator can view the patient during any exposure; and
    - b. the operator can have full view of any occupant of the room, and the operator can view any entry into the room. If any door that allows access to the room cannot be seen from the booth, then that door must have an interlock controlling the exposure that will prevent the exposure if the door is not closed.
  2. When the viewing system is a window, the following requirements also apply:
    - a. the viewing area shall be at least one square foot (0.0929 m<sup>2</sup>); and
    - b. the design of the booth shall be such that the operator's expected position when viewing the patient and operating the X-ray system is at least 18 inches (0.457 meter) from the edge of the booth; and

- c. the material constituting the window shall have the same lead equivalence as that required in the booth's wall in which it is mounted.
3. When the viewing system is by mirrors, the mirror(s) shall be so located as to accomplish the general requirements in Subsection C.1 of this Appendix.
4. When the viewing system is by electronic means:
  - a. the camera shall be so located as to accomplish the general requirements of Subsection C.1 of this Appendix; and
  - b. there shall be an alternate viewing system as a backup for the primary system.

#### **TABLE 4**

### **OCCUPANCY FACTORS FOR NON-OCCUPATIONALLY EXPOSED PERSONS**

(For use as a guide in planning shielding where other occupancy data are not available)

#### **Full Occupancy (T=1):**

Work areas such as offices, laboratories, shops, wards, nurses' stations; living quarters; children play areas; and occupied space in nearby buildings.

#### **Partial Occupancy (T= ¼):**

Corridors, rest rooms, elevators using operators, unattended parking lots.

#### **Occasional Occupancy (T=1/16):**

Waiting rooms, toilets, stairways, unattended elevators, janitors' closets, outside areas used only for pedestrians or vehicular traffic.

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The occupancy factor of occupationally exposed persons, in general, may be assumed to be 1.

It is advantageous in shielding design to take into account that the occupancy factor in areas adjacent to the radiation room usually is zero for any space more than 2.1 m (7 feet) above the floor as the height of most individuals is less. It is possible, therefore, to reduce the thickness of the wall shielding above this height provided that radiation source is below 2.1 m (7 feet). In determining the shielding requirements for wall areas above 2.1 m (7 feet), consideration must be given to the protection of any persons occupying the floor above the areas adjacent to the radiation room. The wall areas over 2.1 m (7 feet) from the floor of the radiation room must also have sufficient shielding to adequately reduce the scattering from the ceiling of adjacent rooms toward occupants.

It should be noted that the use of an occupancy factor of 1/16 may result in full-time exposures in non-controlled areas greater than 2 mR in any one hour or 100 mR in any seven consecutive days.