New Jersey
Radiation Protection Code

Chapter II
SPECIAL REQUIREMENTS

New Jersey State Department of Health
Trenton, 25

MEMBERS

of

COMMISSION ON RADIATION PROTECTION

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NEW JERSEY RADIATION PROTECTION CODE

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Promulgated by

COMMISSION ON RADIATION PROTECTION

New Jersey State Department of Health

Effective Date: February 1, 1962

Filed with the Secretary of State: November 28, 1961

RADIATION CODE INDEX

CHAPTER II—SPECIAL REQUIREMENTS

NEW JERSEY RADIATION PROTECTION CODE

Pursuant to authority vested in it under Chapter 116, P.L. 1958, the Commission on Radiation Protection does this 17th day of November 1961, promulgate and adopt Chapter II of the New Jersey Radiation Protection Code as set forth below to become effective the 1st day of February, 1962.

(Signed) Frank G. Dunnington
Chairman

NEW JERSEY RADIATION PROTECTION CODE

CHAPTER II—SPECIAL REQUIREMENTS

SECTION 17—THERAPEUTIC INSTALLATIONS

17.1 Scope

This section covers the therapeutic installations used in the healing arts.

17.2 Therapeutic X-Ray Installations Operated at Potentials Above 60 Kvp

17.2.1 Equipment

17.2.1.1 The tube housing shall be of the therapeutic type.

17.2.1.2 Permanent diaphragms or cones used for collimating the useful beam shall afford the same degree of protection as the housing. Adjustable or removable beam-limiting diaphragms or cones shall transmit not more than 5 per cent of the useful beam obtained at the maximum kilovoltage and with maximum filter.

17.2.1.3 The filter system shall be so arranged as to minimize the possibility of error in filter selection and alignment. Filters shall be secured in place to prevent them from dropping out during treatment. The filter slot shall be so constructed that the radiation escaping through it does not produce a dose rate in excess of 1r/hr at 1 meter.

17.2.1.4 The X-ray tube shall be so mounted that it cannot turn or slide with respect to the aperture. Housing shall be marked so as to permit the accurate reproduction of the target-to-skin distance.

17.2.1.5 Means shall be provided to immobilize the tube housing during stationary portal treatment.

17.2.1.6 Rectifier tubes shall be shielded or located so that no individual is exposed to radiation doses in excess of those specified in Section 7.

17.2.1.7 A timer shall be provided to terminate the exposure after a pre-set time regardless of what other exposure limiting devices are present.

17.2.1.8 Lead rubber, lead foil, or any other material used for limiting the field shall transmit not more than 5 per cent of the useful beam.

17.2.1.9 All therapeutic X-ray producing machines which nominally can operate above 100 kvp and which are purchased after the effective date of this code shall have a beam monitoring device to indicate any change in output due to incorrect filter, milliamperage or kilovoltage. The use of this monitoring device shall not be a substitute for the requirement of calibration in Section 17.2.3.1

17.2.2 Structural Design

17.2.2.1 Shielding of the therapy room shall be a permanent part of the building. Portable shields shall not be used as a substitute for structural shielding.

17.2.2.2 All wall, floor, and ceiling areas that can be struck by the useful beam, plus a border of one foot, shall be provided with primary protective barriers. All wall, floor, and ceiling areas that because of mechanical or electrical restrictions cannot be struck by the useful beam shall be provided with secondary protective barriers. The radiation levels outside these barriers shall satisfy the requirements of Section 7.

17.2.2.3 Interlocks shall be provided so that when any door to the treatment room is opened the machine will be shut off automatically or the radiation level within the room shall be reduced to a maximum of 10 mr/hr at a distance of 1 meter in any direction from the target. After such a shut-off or reduction in output, it shall be possible to restore the machine to full operation only from the control panel.

17.2.2.4 Control apparatus for the X-ray equipment shall have the required protective barrier between it and the treatment area. Access to the treatment area from the control apparatus shall be through an interlocked door.

17.2.2.5 Windows, mirror systems, or closed-circuit television viewing screens used for observing the patient shall be so located that the operator can see the patient and the control panel from the same position.

17.2.3 Conditions of Operation

17.2.3.1 The radiation field produced by the X-ray machine shall be so calibrated that the dose rate is accurately known for all operating conditions used in radiation treatment. Check claibrations shall be made on an annual basis. Recalibration shall be required after each X-ray tube replacement and after any changes or replacement in the generating apparatus which could effect a change in the dose rate.

17.2.3.2 Whenever any therapeutic X-ray machine equipped with a beam monitoring device is operated above 100 kvp, the beam monitoring device shall be used to indicate any change in output due to incorrect filter, milliamperage, or kilovoltage.

17.2.3.3 No person except the patient shall be in the treatment room during exposure.

17.2.3.4 Both the control panel and the patient shall be kept under observation during exposure.

17.2.3.5 Any machine left unattended shall have the control switch turned off and also shall have the power to the control switch disconnected.

17.2.3.6 Personnel monitoring equipment shall be used as required by Section 8.4.

17.3 Therapeutic X-ray Installations Operated at Potentials of 60 Kvp and Below

17.3.1 Equipment

17.3.1.1 Tube housing shall be of the therapeutic type.

17.3.1.2 Permanent diaphragms or cones used for collimating the useful beam shall afford the same degree of protection as the housing.

17.3.1.3 Adjustable or removable beam-limiting diaphragms or cones shall transmit not more than 5 per cent of the useful beam obtained at the maximum kilovoltage and with maximum filter.

17.3.1.4 The filter system shall be so arranged as to minimize the possiblity of error in filter selection or alignment. Filters shall be secured in place to prevent them from dropping out or becoming misaligned during treatment. The filter slot shall be so constructed that the radiation escaping through it does not produce a dose rate in excess of 1.0 r/hr at 1 meter.

17.3.1.5 For contact therapy, the leakage radiation at the surface of the tube housing shall not exceed 0.1 r/hr.

17.3.1.6 The X-ray tube shall be so mounted that it cannot turn or slide with respect to the aperture. The housing shall be marked so as to permit the accurate reproduction of the target-to-skin distance.

17.3.1.7 The tube housing shall be mechanically immobilized during stationary portal treatment.

17.3.1.8 A timer shall be used which can be accurately pre-set to terminate automatically exposures as short as one second.

17.3.1.9 There shall be on the control panel some easily discernible device which will give positive indication that the tube is energized.

17.3.1.10 Lead rubber, lead foil or any other material used for limiting the field shall transmit not more than 5 per cent of the useful beam.

17.3.2 Structural Shielding

Permanent structural shielding or portable shields shall be used as necessary to insure that no person other than the patient receives a dose in excess of the limits specified in Section 7.

17.3.3 Conditions of Operation

17.3.3.1 The radiation field produced by the X-ray machine shall be so calibrated that the dose rate is accurately known for all operating conditions used in radiation treatment. Check calibrations shall be made on an annual basis. Recalibration shall be required after each X-ray tube replacement and after any changes or replacement in the generating apparatus which could effect a change in the dose rate.

17.3.3.2 No individual other than the patient shall be permitted in the treatment room during X-ray treatment unless he wears a protective apron of a least ¼ mm lead equivalent.

17.3.3.3 The X-ray tube shall not be hand held during irradiation, except when necessary and then only if the operator wears protective gloves and apron of at least ¼ mm lead equivalent.

17.3.3.4 Apparatus constructed with beryllium or other low-filtration windows shall have a cap of 0.5 mm lead covering the aperture window of the tube housing when the apparatus is not being used.

17.3.3.5 Both the control panel and the patient shall be kept under observation during exposure.

17.3.3.6 Any machine left unattended shall have both the control switch turned off and the power to the control switch disconnected.

17.3.3.7 Personnel monitoring equipment shall be used as required by Section 8.4.

17.4 Teletherapy Apparatus Utilizing Radioactive Materials

17.4.1 Equipment

17.4.1.1 The tube housing and collimating devices shall be so constructed that at 1 meter in any direction from the source in the "off" position, the maximum dose rate shall not exceed 10 mr/hr and the average shall not exceed 2 mr/hr.

17.4.1.2 The leakage radiation shall not exceed 0.1 per cent of the useful beam when both are measured at 1 meter from the source and with the control mechanism in the "on" position. This limit does not apply to source housings where the leakage radiation at 1 meter is less than 1 r/hr.

17.4.1.3 Adjustable beam-limiting diaphragms shall allow transmission of not more than 5 per cent of the useful beam dose rate outside the useful beam.

17.4.1.4 In the "on" position, the moving part shall always come to rest with the source and the beam collimating device accurately aligned. If a liquid "on-off" device is used, repeated operation of the device shall not cause a variation of more than 5 per cent in exposure rate in the "on" position.

17.4.1.5 The control mechanism shall be of a positive design, capable of acting in any position of the housing.

17.4.1.6 Whatever the "on-off" shutter mechanism (solid, liquid, slide, wheels, or shutters), the closing device shall be so designed as to return automatically to the "off" position in the event of any breakdown or interruption of the activating force and shall stay in the "off" position when the force goes on again until reactivated from the control.

17.4.1.7 The equipment, in addition to the automatic closing device, shall be so designed that it can be manually turned off with a minimum risk of exposure. The moving parts shall be so designed that it is highly improbable for projections, breakages, loose screws, dirt, or failure of any part to impede the closing of the source.

17.4.1.8 There shall be a warning device at the housing and on the control panel that plainly indicates whether the apparatus is "on" or "off."

17.4.1.9 The controls shall be provided with a timer that automatically terminates the exposure after a pre-set time.

17.4.1.10 The beam shall be provided with a locking device to prevent unauthorized use.

17.4.2 Structural Design

17.4.2.1 Shielding of the therapy room shall be a permanent part of the building.

17.4.2.2 All wall, floor, and ceiling areas that can be struck by the useful beam, plus a border of one foot, shall be provided with primary protective barriers. All wall, floor, and ceiling areas that because of mechanical or electrical restrictions cannot be struck by the useful beam shall be provided with secondary protective barriers. The radiation levels outside these barriers shall satisfy the requirements of Section 7.

17.4.2.3 Interlocks shall be provided so that when any door to the teletherapy room is opened the teletherapy apparatus shall be shut off automatically. After such a shut-off, it shall be possible to restore the apparatus to full operation only from the control panel.

17.4.2.4 Windows, mirror systems, or closed-circuit television viewing screens used for observing the patient shall be so located that the operator can see the patient and the control panel from the same position.

17.4.3 Conditions of Operation

17.4.3.1 The output of the teletherapy apparatus shall be calibrated. It shall be recalibrated whenever the source is replaced.

17.4.3.2 No individual, except the patient, shall be in the treatment room during exposure.

17.4.3.3 Both the control panel and the patient shall be kept under observation during exposure.

17.4.3.4 Personnel monitoring equipment shall be used as required by Section 8.4.

SECTION 18—MEDICAL DIAGNOSTIC X-RAY INSTALLATIONS

18.1 Scope

This Section covers the flouroscopic and radiographic installations used in all the healing arts, except dentistry. Section 19 gives the regulations for dental radiographic installations.

18.2 Medical Fluoroscopic Installations

18.2.1 Equipment

18.2.1.1 The tube housing shall be of a diagnostic type.

18.2.1.2 The distance from the target to the panel or to the table top shall not be less than 12 inches.

18.2.1.3 A cone shall extend from the tube housing to a point as near as is practical to the panel or table top. Its walls shall provide the same degree of protection as is required of the housing.

18.2.1.4 An adjustable diaphragm system shall be provided on all fluoroscopes, except those with image intensifiers, to restrict the size of the useful beam so that the fluoroscopic screen has an unilluminated border when the diaphragm system is open to the fullest extent and the screen is 15 inches from the table top or panel. Orthodiascopes shall be exempt from the requirements of this section.

18.2.1.5 The tube mounting and the fluoroscopic screen shall be linked together so that during use the fluoroscopic screen always fully intercepts the useful beam. Orthodiascopes shall be exempt from the requirements of this section.

18.2.1.6 Adjustable diaphragms or shutters to restrict the size of the useful beam shall provide a minimum of 1.5 mm lead equivalent protection.

18.2.1.7 The total filtration permanently in the useful beam shall be equal to at least 2.5 mm aluminum equivalent, or the half-value layer shall be not less than 2.5 mm aluminum equivalent.

18.2.1.8 The fluoroscopic screen shall be covered with a transparent protective material such that under normal operating conditions the dose rate measured 5 cm from the viewer's side of the screen shall not be more than 20 mr/hr without a patient and with the screen 8 inches from the table top or panel.

18.2.1.9 With apparatus using an image intensifier, a protective shield shall be provided so that the useful beam does not produce a radiation hazard to the operator or other personnel in a fluoroscopic room.

18.2.1.10 A manually reset, cumulative timing device shall be used which will indicate elapsed time and either turn off the apparatus automatically or give an audible signal when the total exposure exceeds a predetermined limit given in one or a series of exposures. The device shall have a maximum range of 5 minutes.

18.2.1.11 For routine fluoroscopy, the exposure rate measured at the panel or table top shall not exceed 5 r/min.

18.2.1.12 A bucky slot cover and shielding between patient and fluoroscopist shall be used and shall provide protection equivalent to at least 0.5 mm of lead. Such accessory shielding shall not substitute for the wearing of a protective apron as required in Section 18.2.3.2.

18.2.2 Structural Shielding

Permanent structural shielding and/or protective barriers shall be used as necessary to insure that no person other than the patient receives a dose in excess of the limits specified in Section 7.

18.2.3 Operating Procedures

18.2.3.1 Fluoroscopic equipment shall be operated only by authorized, instructed individuals.

18.2.3.2 Protective gloves and apron of at least 1/4 mm lead equivalent shall be worn by the fluoroscopist during every examination.

18.2.3.3 Only individuals required for the fluoroscopic procedure shall be in the fluoroscopic room during exposure. The exposure of such individuals shall be controlled by the use of shielding and protective clothing as necessary to insure that they are not exposed to radiation doses in excess of those permitted by Section 7. They shall use personnel monitoring equipment as required by Section 8.4.

18.2.3.4 Orthodiascopes shall be operated so that the viewing screen shall always intercept the useful beam.

18.3 Medical Radiographic Installations

18.3.1 Equipment

18.3.1.1 The tube housing shall be of a diagnostic type.

18.3.1.2 Diaphragms or cones shall be provided for collimating the useful beam and shall provide the same degree of protection as is required of the housing.

18.3.1.3 The total filtration permanently in the useful beam shall be not less than 2.5 mm aluminum equivalent, or the half-value layer shall be not less than 2.5 mm aluminum equivalent.

18.3.1.4 An automatic device shall be provided to terminate the exposure after a pre-set time or exposure.

18.3.1.5 The exposure switch shall be a dead-man type and shall be arranged so that it can only be operated when the operator is within a shielded area. The timer switch button when depressed shall not energize the X-ray tube when the timer is in the "off" or "0" position. Exposure switches for "spot-film" devices used in conjunction with fluoroscopic tables shall be exempted from this shielding requirement, providing the requirements of Section 18.2.1.5 are satisfied.

18.3.2 Structural Shielding

Permanent structural shielding and/or protective barriers shall be used as necessary to insure that no person other than the patient receives a dose in excess of the limits specified in Section 7.

18.3.3 Operating Procedures

Only individuals required for the radiographic precedure shall be in the radiographic room during exposure. The exposure of such individuals shall be controlled by the use of shielding and protective clothing as necessary to insure that they are not exposed to radiation doses in excess of those permitted by Section 7. They shall use personnel monitoring equipment as required by Section 8.4.

18.4 Mobile or Portable Diagnostic Equipment

18.4.1 Equipment

18.4.1.1 All requirements of Section 18.3.1 apply except 18.3.1.5.

18.4.1.2 Such equipment shall be provided with collimating cones, or collimating diaphragms and spacers frames, to limit the target-to-skin distance to not less than 12 inches.

18.4.1.3 The exposure control switch shall be of the dead-man type and shall be so arranged that the operator can stand at least 6 feet from the patient for all exposures. The timer switch button when depressed shall not energize the X-ray tube when the timer is "off" or "0" position.

18.4.2 Structural Shielding

A unit used routinely in one location shall be considered a permanent installation and shall comply with the requirements of Section 18.3.2.

18.4.3 Operating Procedures

18.4.3.1 No employee who is otherwise occupationally exposed in a radiology installation shall be permitted to hold patients during exposure.

18.4.3.2 A mobile or portable fluorosopic unit may be used only if:

(a) image intensification is used,

(b) operation of the machine is impossible without a collimating cone or a diaphragm in place,

(c) the dose rate at the minimum target-to-skin distance does not exceed 5 r/min.,

(d) all individuals not required for the fluoroscopic procedure are removed from the room or protected by portable shields, and

(e) the exposure of individuals required for the fluoroscopic procedure is controlled by the use of shielding and protective clothing as necessary to insure that they are not exposed to radiation doses in excess of those permitted by Section 7.

18.4.3.3 Personnel monitoring equipment shall be used by all operating personnel.

18.4.3.4 A collimating cone, or a diaphragm and spacer frame, shall be used in all exposures to limit the size of the useful beam and to insure a target-to-skin distance of not less than 12 inches.

18.5 Chest Photofluorographic Installations

18.5.1 Equipment

18.5.1.1 All provisions of Section 18.3.1 apply.

18.5.1.2 A collimator shall restrict the useful beam to the area of the fluorographic screen.

18.5.1.3 All chest photofluorographic machines purchased after the effective date of this code shall have the fluorographic screen mechanically linked to the tube housing so that the fluorographic screen always intercepts the useful beam.

18.5.2 Structural Shielding

18.5.2.1 For permanent installations, all provisions of Section 18.3.2 apply.

18.5.2.2 For permanent installations, a primary protective barrier shall be provided wherever the useful beam can strike. If the apparatus is so designed that the useful beam can strike only the fluoroscopic screen, this barrier may be placed around the hood and camera or immediately behind the camera, thus obviating the need for primary protective barriers elsewhere.

18.5.2.3 For permanent installations, secondary protective barriers shall be provided in those walls not having primary protective barriers.

18.5.2.4 For movable installations, structural shielding and/or protective barriers shall be used as necessary to insure that no individual other than the patient shall receive a dose in excess of the limit specified in Section 7.

18.5.3 Operating Procedures

18.5.3.1 Operating procedures shall be established so that no individual other than the patient shall receive a dose in excess of the limit specified in Section 7.

18.5.3.2 Personnel monitoring equipment shall be used as required by Section 8.4.

SECTION 19—DENTAL RADIOGRAPHIC INSTALLATIONS

19.1 Equipment

19.1.1 The tubing housing shall be of a diagnostic type.

19.1.2 Diaphragms or cones shall be used for collimating the useful beam and shall provide the same degree of protection as the housing. The diameter of the useful beam at the cone tip shall be no greater than 2.75 inches.

19.1.3 A cone or spacer frame shall provide a target-to-skin distance of not less than 7 inches with apparatus operating above 50 kvp or not less than 4 inches with apparatus operating at or below 50 kvp.

19.1.4 The total filtration permanently in the useful beam shall be not less than:

KVP	Equivalent to mm Aluminum
<70	1.5
70 to 90	2.0
>90	2.5

These requirements shall be assumed to have been met if the half-value layers are not less than the aluminum equivalents listed in the table.

19.1.5 The exposure control switch shall be of the dead-man type. A device shall be provided to terminate the exposure after a pre-set time or exposure. The timer switch button when depressed shall not energize the X-ray tube when the timer is in the "off" position.

19.1.6 The control switch shall be so located, or shall be provided with a cord sufficiently long, to enable the operator to stand at least 6 feet from the patient and well out of the path of the useful beam.

19.1.7 Those diagnostic tubes which are supplied from a common high voltage supply and which have separate control switches at their respective locations shall also have a separate dead-man switch, timer, and tube voltage meter at each location. Those diagnostic tubes which are supplied from a common high voltage supply and which can be operated only from a common control panel may have only one dead-man switch, timer, and tube voltage meter.

.2 Structural Shielding

19.2.1 Permanent structural shielding and/or protective barriers shall be used as necessary to insure that no person other than the patient being X-rayed receives a dose in excess of the limit specified in Section 7.

19.2.2 When dental X-ray units are installed in adjacent rooms, or adjacent areas of the same room, protective barriers shall be provided between the rooms or areas when necessary to comply with Section 7.

.3 Operating Procedures

19.3.1 No individual shall be in the path of the useful beam except the patient being X-rayed.

19.3.2 During each exposure, the operator shall be at least 6 feet from the patient or shall be behind a protective barrier.

19.3.3 The film shall not be held by the dentist or assistant during any exposure.

19.3.4 Fluoroscopy shall not be used in dental examinations.

19.3.5 Neither the tube housing nor the pointer cone shall be hand held during exposures.

19.3.6 Personnel monitoring equipment shall be used as required by Section 8.4.

SECTION 20—FLUOROSCOPIC SHOE FITTING MACHINES

No person shall operate, permit to be operated, maintain or display any fluoroscopic shoe fitting machine.