Guidance in Bold Text
3701:1-68-06 Rule Effective Date: 8/15/2017
Non-Medical Cabinet Systems

3701:1-68-06 Non-medical cabinet systems.

In addition to the applicable rules in this chapter and Chapter 3701:1-38 of the Administrative Code, handlers of cabinet systems shall comply with the following:

(A) All cabinet system shall meet the following equipment standards:

(1) Radiation emitted from a cabinet system shall not exceed an exposure of 4.4 microgray (0.5 milliroentgen) in one hour at any point five centimeters outside the external surface.

Cabinet systems shall be designed to limit leakage radiation at 5 centimeters from the surface to no more than 0.5 milliroentgen in one hour.

Rule 3701:1-68-06(E) requires radiation area surveys to be performed annually on cabinet systems.

(2) Cabinet systems provided with at least one port shall be designed such that the insertion of any part of the human body through any port into the primary beam shall not be possible.

Cabinet systems shall be designed to prevent insertion of the human body through any port into the primary beam.

(3) Cabinet systems provided with at least one aperture shall be designed such that the insertion of any part of the human body through any aperture shall not be possible.

Cabinet systems shall be designed to prevent insertion of the human body through any aperture.

(4) Safety Interlocks:

(a) Each door shall have a minimum of two safety interlocks. One, but not both of the required interlocks shall be such that door opening results in physical disconnection of the energy supply circuit to the high-voltage generator, and such disconnection shall not be dependent upon any moving part other than the door;

Cabinet system doors shall be designed with two safety interlocks. One safety interlock must be designed to disconnect the energy supply circuit from the high-voltage generator to stop radiation production when the door is opened. The safety interlock must only depend on the movement of the door.

(b) Each access panel shall have at least one safety interlock;

Cabinet systems shall be designed with at least one safety interlock on the access panel.

(c) Following interruption of x-ray generation by the functioning of any safety interlock, use of a control provided in accordance with paragraph (A)(6)(b) of this rule shall be necessary for resumption of x-ray generation; and

If radiation generation is disrupted using a safety interlock, a control must be used to restart the production of radiation from the cabinet system.

Rule 3701:1-68-06(A)(6)(b) requires cabinet systems to have a control to initiate radiation.

(d) Failure of any single part of the enclosed fail-safe system shall not cause failure of more than one required safety interlock.

Cabinet systems shall be designed so that failure of any single part of the enclosed fail-safe system shall not cause failure of more than one safety interlock.

(5) A ground fault shall not result in the generation of x-rays.

Cabinet systems shall be designed so that a ground fault will not result in radiation generation.

(6) Controls and indicators shall provide:

(a) A key-actuated control to insure that x-ray generation is not possible with the key removed;

Cabinet systems shall have a key-actuated control to generate radiation. The cabinet system shall not be able to generate radiation without the key.

(b) A control or controls to initiate and terminate the generation of x-rays other than by functioning of a safety interlock or the main power control;

Cabinet systems shall be designed with specific control(s) to initiate and terminate radiation.

Turning the main power switch must not initiate radiation generation and tripping the safety interlocks must not be the only way to terminate radiation generation.

(c) Two independent means which indicate when and only when x-rays are being generated, unless the x-ray generation period is less than one-half second, in which case the indicators shall be activated for one-half second, and which are discernible from any point at which initiation of x-ray generation is possible. Failure of a single part of the cabinet system shall not cause failure of both indicators to perform their intended function. One, but not both, of the indicators required by this paragraph may be a milliammeter labeled to indicate x-ray tube current. All other indicators shall be legibly labeled "X-RAY ON";

Cabinet systems shall be designed with at least two independent means to indicate when and only when radiation is being generated. The two means that indicate radiation generation must be visible from the control area that initiates radiation generation.

Failure of a single part of the cabinet system shall not cause failure of both indicators to perform their intended function.

One, but not both, of the indicators may be a milliammeter labeled to indicate x-ray tube current. All other indicators shall be legibly labeled "X-RAY ON."

(d) Additional means other than milliammeters which indicate when and only when x-rays are being generated, unless the x-ray generation period is less than one-half second in which case the indicators shall be activated for one-half second, as needed to ensure that at least one indicator is visible from each door, access panel, and port, and is legibly labeled "X-RAY ON"; and

Cabinet systems shall be designed with clearly visible indicators of x-ray generation at each door, access panel, and port.

(e) Warning labels:

(i) There shall be permanently affixed or inscribed on the cabinet x-ray system at the location of any controls which can be used to initiate x-ray generation, a clearly legible and visible label bearing the statement: "CAUTION: X-RAYS PRODUCED WHEN ENERGIZED."

Cabinet systems must have an appropriate warning label located near the exposure switch or control: The label must have the words "CAUTION – X-RAYS PRODUCED WHEN ENERGIZED." or wording having similar intent.

(ii) There shall be permanently affixed or inscribed on the cabinet x-ray system adjacent to each port a clearly legible and visible label bearing the statement: "CAUTION: DO NOT INSERT ANY PART OF THE BODY WHEN SYSTEM IS ENERGIZED - X-RAY HAZARD."

Cabinet system systems with ports must have an additional warning label located on or near each port. The label must have the words "CAUTION – DO NOT INSERT ANY PART OF THE BODY WHEN SYSTEM IS ENERGIZED" or wording having similar intent.

(B) In addition to the requirements specified in paragraph (A) of this rule, cabinet systems that are designed to admit humans shall provide:

(1) A control within the enclosure for preventing and terminating x-ray generation, which is electrically and/or mechanically separated from the interlock system and cannot be reset, overridden or bypassed from the outside of the enclosure.

Cabinet systems designed to admit humans must have a control within the enclosure that can prevent or stop the radiation from generating.

This control must be electrically and/or mechanically separated from the interlock system and cannot be reset, overridden or bypassed from outside the enclosure.

(2) No means by which x-ray generation can be initiated from within the enclosure.

Cabinet systems designed to admit humans shall not have a way to initiate radiation from within the enclosure.

(3) Audible and visible warning signals within the enclosure that are actuated for at least ten seconds immediately prior to the first initiation of x-ray generation after closing any door designed to admit humans. Failure of any single part of the cabinet system shall not cause failure of both the audible and visible warning signals.

Cabinet systems designed to admit humans must have audible and visual signals within the enclosure that are activated ten seconds prior to the first initiation of radiation production after closing any admittance door.

Failure of any single part of the cabinet system shall not cause failure of both the audible and visible warning signals.

(4) A visible warning signal within the enclosure which remains actuated when and only when x-rays are being generated, unless the x-ray generation period is less than one-half second in which case the indicators shall be activated for one-half second.

Cabinet systems designed to admit humans must have a functioning visible signal inside the enclosure that illuminates when and only when radiation is being produced.

(5) All entrances into the enclosure shall be provided with a conspicuously visible warning device, which operates only when radiation is being produced.

Cabinet systems designed to admit humans must have a functioning visible signal that illuminates when and only when radiation is being produced.

(6) Signs indicating the meaning of the warning signals provided pursuant to paragraphs (B)(3) and (B)(4) of this rule and containing instructions for the use of the control provided pursuant to paragraph (B)(1) of this rule. These signs shall be legible, accessible to view, and illuminated when the main power control is in the "on" position.

Cabinet systems designed to admit humans must have signs explaining that if you see and/or hear the warning signals while in the enclosure press the stop control and immediately evacuate the enclosure.

(7) A means for a person within the enclosure to be able to egress at all times.

Cabinet systems designed to admit humans must always have a way for a person to leave the enclosure at any time. This usually means that person can leave through the admittance doors at any time. This also trips the safety interlocks to terminate radiation.

(C) In addition to the requirements specified in paragraph (A) of this rule, non-human security screening systems and cabinet x-ray systems with accessible openings shall:

(1) Have means to ensure operator presence at the control area in a position which permits surveillance of the openings and doors during generation of x-radiation.

Non-human security screening systems and cabinet systems with assessible openings must have the means for operators to be at the controls and observe the openings and doors of these systems.

(2) During an exposure or preset succession of exposures of one-half second or greater duration, provide the means to enable the operator to terminate the exposure or preset succession of exposures at any time.

Non-human security screening and cabinet systems with assessible openings must have the means to enable the operator to terminate the exposure or preset succession of exposures at any time.

(3) During an exposure or preset succession of exposures of less than one-half second duration, may provide the means to allow completion of the exposure in progress but shall enable the operator to prevent additional exposures.

Non-human security screening and cabinet systems with assessible openings may have the means to allow the completion of the exposure in progress but shall allow the operator to prevent additional exposures.

(D) Cabinet systems shall be evaluated and the results recorded every three months not to exceed fourteen weeks, by individuals qualified according to paragraph (H) of rule 3701:1-68-02 of the Administrative Code, unless the system has been locked out and tagged "DO NOT USE" and is under the administrative control of the IRRP:

Cabinet systems must be evaluated, and the results recorded at least every three months. The individual performing the evaluation must be qualified to operate cabinet system.

This evaluation does not need to be performed if the cabinet system is locked out and tagged "Do Not Use"

(1) The evaluation shall verify:

(a) Proper functioning of each interlock, control, indicator and warning signal; and

The three-month evaluation of the cabinet system must include a check for proper functioning of the interlocks and warning lights.

The results of the three-month evaluation check must be recorded.

(b) Each label is legible and properly affixed in the appropriate location.

The three-month evaluation of the cabinet system must include review to make sure the warning tags and labels are readable and affixed in the proper locations.

The results of the three-month evaluation check must be recorded.

(2) If an interlock, control, indicator or warning signal, it shall be immediately labeled as defective and repaired or replaced within seven calendar days.

If an interlock, control, or warning signal is not functioning properly, it must be immediately labeled as defective.

If the cabinet system is used, it must be repaired or replaced within seven calendar days.

Otherwise, the cabinet system must be locked out and tagged "DO NOT USE" and under the administrative control of the IRRP.

(E) Radiation area surveys shall be performed and the results recorded to confirm compliance with paragraph (A)(1) of this rule and paragraph (A) of rule 3701:1-38-14 of the Administrative Code in accordance with the following:

(1) Upon installation of the equipment, and at least annually thereafter;

A radiation area survey must be performed, and results recorded upon installation to confirm compliance with paragraph (A)(1) of this rule and with the dose limits of Chapter 3701:1-38, as required by rule 3701:1-38-14(A).

Annual radiation area surveys must be performed, and the results recorded after the initial annual radiation area survey to confirm compliance with paragraph (A)(1) of this rule and with the dose limits of Chapter 3701:1-38, as required by rule 3701:1-38-14(A).

Dose Limits:
Rule 3701:1-38-12(A) requires the licensee or registrant to limit the occupational dose to an adult, as follows:

1) An annual limit, which is the more limiting of:

- **The total effective dose equivalent being equal to 0.05 sievert (five rem); or**
- **The sum of the deep dose equivalent and the committed dose equivalent to any individual organ or tissue other than the lens of the eye being equal to 0.5 sievert (fifty rem).**

2) The annual limits to the lens of the eye, to the skin of the whole body, and to the skin of the extremities, which are:
- **A lens dose equivalent of 0.15 sievert (fifteen rem), and**
- **A shallow-dose equivalent of 0.5 sievert (fifty rem) to the skin of the whole body or to the skin of any extremity.**

Rule 3701:1-38-13(A)(1) requires total effective dose equivalent to individual members of the public from the licensed or registered operation does not exceed one millisievert (0.1 rem) in a year.

Rule 3701:1-38-13(A)(2) requires the dose in any unrestricted area from external radiation sources not exceed 0.02 millisievert (0.002 rem) in any one hour.

(2) During the performance of maintenance, calibration and other procedures if the procedures require the presence of a primary beam; and

If maintenance, calibration or other testing procedure for cabinet system requires the presence of a primary beam, an area radiation survey must be performed to confirm compliance with paragraph (A)(1) of this rule and with the dose limits of Chapter 3701:1-38, as required by rule 3701:1-38-14(A).

(3) Any time a visual inspection of the cabinet system reveals an abnormal condition.

A radiation area survey must be performed, and results recorded any time a visual inspection of the system reveals abnormal conditions to confirm compliance with paragraph (A)(1) of this rule and with the dose limits of Chapter 3701:1-38, as required by rule 3701:1-38-14(A).

(F) A physical radiation survey shall be made after each radiographic exposure and before entry of personnel into a cabinet system designed to admit humans to verify that the radiation-generating equipment is not still producing radiation.

A physical radiation survey using a radiation survey instrument must be made after each exposure for a cabinet system designed to admit humans, unless appropriate monitoring devices are being used as describe below in paragraphs (F)(1) and (F)(2) of this rule.

(1) Personnel devices providing an audible signal when activated by radiation will be acceptable for the survey, provided:

(a) Proper operation of the audible detection device is checked and recorded daily;

If personnel devices providing audible signal are used for physical radiation entry surveys, the proper operation of the devices must be checked and recorded daily.

(b) The audible device is designed so as to clearly indicate entry into a 0.02 mSv (two mrem) per hour or greater radiation field; and

If personnel devices providing audible signal are used for physical radiation entry surveys, the devices must be designed to detect entry into a two mrem per hour or greater radiation field.

(c) All personnel working with the cabinet system are equipped with such a device; or

If personnel devices providing audible signal are used for physical radiation entry surveys, all personnel working with the walk-in cabinet system are required to have and use the personnel device providing audible signal.

(2) Stationary area monitors providing an audible signal when activated by radiation will be acceptable for the survey, provided:

(a) Proper operation of the stationary detection device is checked and recorded daily;

If stationary area monitors providing audible signal are used for physical radiation entry surveys, the proper operation of the monitors must be checked and recorded daily.

(b) The stationary device is designed so as to clearly indicate entry into a 0.02 mSv (two mrem) per hour or greater radiation field; and

If stationary area monitors providing audible signal are used for physical radiation entry surveys, the monitors must be designed to detect entry into a two mrem per hour or greater radiation field

(c) Stationary area monitors are evaluated annually to determine that the audible signal operates at a 0.02 mSv (two mrem) per hour radiation field.

If stationary area monitors providing audible signal are used for physical radiation entry surveys, the monitors must be evaluated annually to determine that the audible signal operates in a two mrem per hour radiation field.

(G) The "Individual Responsible for Radiation Protection" (IRRP) shall be qualified in accordance with paragraph (B)(14) of rule 3701:1-68-01 of the Administrative Code and paragraph (H) of rule 3701:1-68-02 of the Administrative Code.

Rule 3701:1-68-02(H) requires training in the following:

- **Safe operating procedures for the equipment;**
- **Precautions and measures to take to minimize radiation exposure;**
- **Significance of various warning, safety devices, and interlocks incorporated into the systems, or the reasons they have not been**

installed on certain parts of the system and the extra precautions required in such case;

- **Recognition of the potential hazards of use, biological effects of radiation, radiation risks, and recognition of signs and symptoms of an acute localized exposure;**
- **Procedures for reporting an actual or suspected accidental exposure or other radiation safety concerns, such as any unusual occurrence or malfunction that may involve exposure to radiation; and**
- **Performing surveys where applicable.**