

## **902 KAR 100:150. Microscopic analytic x-ray.**

RELATES TO: KRS 211.842-211.852, 211.990(4)

STATUTORY AUTHORITY: KRS 194.050, 211.090, 211.844

NECESSITY, FUNCTION, AND CONFORMITY: The Cabinet for Human Resources is authorized by KRS 211.844 to provide by regulation for the possession or use of sources of ionizing or electronic product radiation and to regulate the handling and disposal of radioactive waste. The purpose of this administrative regulation is to provide radiation safety requirements for microscopic analytical x-ray equipment and operation.

Section 1. Applicability. The requirements in this administrative regulation shall apply to the use of microscopic analytical x-ray machines. The provisions of this administrative regulation are in addition to, and not in substitution for, other applicable provisions for these administrative regulations.

Section 2. Equipment.

(1) A label bearing essentially the words "CAUTION - RADIATION - THIS EQUIPMENT PRODUCES RADIATION WHEN ENERGIZED" shall be placed near a switch which energizes a tube. Labels shall use the conventional colors (magenta or purple on yellow background) and bear the conventional radiation symbol.

(2) A sign bearing the words "CAUTION - HIGH INTENSITY X-RAY BEAM" shall be placed in the area immediately adjacent to each tube housing. The sign shall be so located that it is clearly visible to a person operating, aligning or adjusting the unit or handling or changing a sample.

(3) An apparatus utilized in beam alignment procedures shall be designed in a way that excessive radiation shall not strike the operator. Particular attention shall be given to viewing devices, in order to ascertain that lenses and other transparent components attenuate the beam to an acceptable level.

(4) Open beam configurations shall be provided with a readily discernible indication of:

(a) X-ray tube "on-off" status located near the radiation source housing, if the primary beam is controlled in this manner; or

(b) Shutter "open-closed" status located near each port on the radiation source housing, if the primary beam is controlled in this manner.

(c) Warning devices shall be labeled so their purpose is easily identified. On equipment installed after July, 1986, warning devices shall have fail-safe characteristics.

(5) A device which prevents entry or a portion of an individual's body into the primary beam or causes the primary beam to be shut off, shall be provided on open-beam configurations. A registrant may apply to the cabinet for an exemption from the requirement of a safety device. The application shall include:

(a) A description of the various safety devices that have been evaluated;

(b) The reason each evaluated device cannot be used; and

(c) A description of the alternative methods that are to be employed to minimize the possibility of an accidental exposure, including procedures to assure that operators and others in the area are informed of the absence of safety devices.

(6) If a shutter mechanism is used to control the primary beam, a shutter status (open or closed) indication shall be provided in the area adjacent to the tube head so that the position of the shutter is readily discernible.

(7) If an interlock device turns off the x-ray beam, it shall not be possible to resume operation without resetting the beam "ON" switch at the control panel.

(8) The tube housing leakage radiation at a distance of five (5) centimeters from accessible points on the surface of the tube housing shall not exceed two and five-tenths (2.5) mR per hour at each maximum specified tube rating. This measurement shall be

made with a monitoring instrument appropriate for the energy range generated by the x-ray equipment, and shall be made with beam ports blocked off.

(9) Unused ports on radiation source housings shall be secured in the closed position in a manner which prevents casual opening.

(10) On open-beam configurations installed after July 1, 1986, each port on the radiation source housing shall be equipped with a shutter that cannot be opened unless a collimator or a coupling has been connected to the port.

### Section 3. Administrative Responsibilities.

(1) An individual at each facility shall be designated to be responsible on behalf of the registrant for maintaining radiation safety. This individual, designated the radiation safety officer, shall be responsible for the following:

- (a) Establishing and maintaining operation procedures so that the radiation exposure of each worker is kept as far below the maximum permissible dose as is practical;
- (b) Instructing personnel who work with or near radiation machines in safety practices;
- (c) Maintaining a system of personnel monitoring;
- (d) Arranging for establishment of radiation control areas, including placement of appropriate radiation signs and devices;
- (e) Providing for radiation safety inspection of radiation machines on a routine basis;
- (f) Reviewing modifications to x-ray apparatus, including x-ray tube housing, cameras, diffractometers, shielding, and safety interlocks;
- (g) Investigating and reporting to proper authorities cases of excessive exposure to personnel and taking remedial action; and
- (h) Being familiar with applicable administrative regulations for control of ionizing radiation.

(2) No individual shall be permitted to act as an operator of a particular machine until an individual has received training in radiation safety as it applies to that machine and is approved by the radiation safety officer. The registrant shall assure that operators shall be responsible for:

- (a) Keeping radiation exposure to himself and to others as low as is practical;
- (b) Being familiar with safety procedures as they apply to each machine;
- (c) Wearing of personnel monitoring devices, if applicable; and
- (d) Notifying the radiation safety officer of known or suspected excessive radiation exposures to himself or others.

### Section 4. Operating Procedures.

(1) Written emergency procedures pertaining to radiation safety shall be established for each x-ray producing apparatus by the radiation safety officer, and posted in a conspicuous location. These shall list the telephone number(s) of the radiation safety officer and shall include the following actions to be taken if a known, or suspected, accident involving radiation exposure occurs:

- (a) Notify radiation safety officer; and
- (b) Arrange for medical examination. Important: Notify examining physician that exposure to low energy x-rays may have occurred.

(2) Normal operating procedures shall be written and available to analytical x-ray equipment workers. No individual shall be permitted to operate analytical x-ray equipment in a manner other than specified in the procedures unless the individual has obtained written approval of the radiation safety officer.

(3) Only properly trained maintenance personnel shall be permitted to install, repair, or make other than routine modifications to the x-ray generating apparatus and the tube housing apparatus complex.

(4) If possible, x-ray diffraction and spectrographic equipment shall be placed in a room separate from other work areas.

- (5) If it is necessary to temporarily, intentionally alter safety devices (e.g., bypassing interlocks or removing shielding) this action shall be:
- (a) Specified in writing and posted near the x-ray tube housing so that other persons know the existing status of the machine; and
  - (b) Terminated as soon as possible.
  - (c) When a safety device or interlock has been bypassed, a readily discernible sign bearing the words "SAFETY DEVICE NOT WORKING," or words having a similar intent, shall be placed on the radiation source housing.
- (6) Unused tube head ports shall be secured in the closed position and shall be checked prior to use if the machine has been left unattended.
- (7) Personnel film badges or other monitoring devices shall be worn on the finger or wrist, rather than on the body. Finger or wrist dosimetric devices shall be provided to and shall be used by:
- (a) Analytical x-ray equipment workers using systems having an open-beam configuration and not equipped with a safety device; and
  - (b) Personnel maintaining analytical x-ray equipment if the maintenance procedures require the presence of a primary x-ray beam when a local component in the analytical x-ray system is disassembled or removed.
  - (c) Reported dose values shall not be used for the purpose of determining compliance with 902 KAR 100:020 unless evaluated by a qualified expert.
- (8) Analytical x-ray equipment shall not be left unattended while the tube is energized unless:
- (a) An interlock device is provided to prevent accidental entry into the primary beam; and
  - (b) The stray radiation at accessible points at a distance of ten (10) inches from the tube housing or its containment, as measured with a monitoring instrument appropriate for the energy range generated, is no greater than two (2) milliroentgen per hour.
- (9) Safety devices shall be tested at intervals not to exceed one (1) month.
- (10) Records of personnel monitoring results and safety devices shall be maintained for inspection by the cabinet.
- (1 Ky.R. 418; eff. 2-5-1975; 12 Ky.R. 1414; eff. 3-4-1986; 18 Ky.R. 1572; eff. 1-10-1992; Crt eff. 8-16-2019.)