MICHIGAN DEPARTMENT OF COMMUNITY HEALTH
RADIATION SAFETY SECTION
IONIZING RADIATION RULES

DETAILED TABLE OF CONTENTS

PART ~~6~~5. INDUSTRIAL RADIOGRAPHIC OPERATIONS AND INSTALLATIONS

R325.5281. Purpose and scope.

This part is being modified to include only industrial radiation machine requirements. Radioactive materials used in industrial radiography are under the purview of MDEQ. All additions and modifications based on the SSRCR are also edited in this manner.

Rule 281. (1) This part establishes radiation safety requirements for persons utilizing ~~sources of~~ radiation machines for industrial radiography and a classification system for industrial radiographic installations and use.

(2) This part applies to all ~~licensees and~~ registrants who use ~~sources of~~ radiation machines for industrial radiography; however, nothing in this part applies to the use of ~~sources of~~ radiation machines in the healing arts.

~~**(3)** Requirements of this part which refer to radiographic exposure devices or sealed sources apply to the use of radioactive material. Requirements which refer to sources of radiation apply to the use of radiation machines and radioactive material.~~

~~(4)~~(3) In addition to the requirements of this part, all ~~licensees and~~ registrants are subject to the applicable provisions of the other parts.

~~[*Note: The requirements of this rule that pertain to radiation machine registration, licensing, or compliance are under the purview of the Michigan Department of Consumer & Industry Services.*]~~

R325.5282. Definitions.

Rule 282. As used in this part:

(a) "Access panel" means any barrier or panel which is designed to be removed or opened for maintenance or service purposes, requires tools to open, and permits access to the interior of the cabinet.

(b) "Aperture" means any opening in the outside surface of the cabinet, other than a port, which remains open during generation of x radiation.

(c) "Cabinet x-ray system" means an x-ray system with the x-ray tube installed in an enclosure (hereinafter termed "cabinet") which, independently of existing architectural structures except the floor on which it may be placed, is intended to contain at least that portion of a material being irradiated, provide radiation attenuation, and exclude personnel from its interior during generation of x-radiation. Included are all x-ray systems designed primarily for the inspection of carry-on baggage at airline, railroad, and bus terminals, and in similar facilities. An x-ray tube used within a shielded part of the building, or x-ray equipment which may temporarily or occasionally incorporate portable shielding is not considered a cabinet x-ray system.

(d) "Door" means any barrier which is designed to be movable or opened for routine operation purposes, does not generally require tools to open, and permits access to the interior of the cabinet. For the purposes of paragraph (c)(4)(i) of this section, inflexible hardware rigidly affixed to the door shall be considered part of the door.

(e) "Exposure" means the quotient of dQ by dm where dQ is the absolute value of the total charge of the ions of one sign produced in air when all the electrons (negatrons and positrons) liberated by photons in a volume element of air having mass dm are completely stopped in air.

(f) "External surface" means the outside surface of the cabinet x-ray system, including the high-voltage generator, doors, access panels, latches, control knobs, and other permanently mounted hardware and including the plane across any aperture or port.

(g) "Floor" means the underside external surface of the cabinet.

(h) "Ground fault" means an accidental electrical grounding of an electrical conductor.

~~**(a)**~~**(i)** "Industrial radiography" means the examination of the macroscopic structure of materials by nondestructive methods utilizing ~~sources of~~ radiation machines.

~~**(b)**~~**(j)** "Installation" means a location, having boundaries specified by the ~~licensee or~~ registrant, where for a period of more than 30 days 1 or more sources of radiation are used, operated or stored. A part of a building, an entire building, a plant or plant site may be designated as an installation.

(k) **"**Port" means any opening in the outside surface of the cabinet which is designed to remain open, during generation of x-rays, for the purpose of conveying material to be irradiated into and out of the cabinet,

or for partial insertion for irradiation of an object whose dimensions do not permit complete insertion into the cabinet.

(l) "Portable Radiographic Operations" means industrial radiography that cannot be performed within a cabinet or an industrial x-ray enclosure

~~**(c)**~~**(m)** "Radiographer" means an individual who performs or who, in attendance at the site where ~~sources of~~ radiation machines are being used for portable radiographic operations, personally supervises ~~industrial~~ portable radiographic operations and who is responsible to the ~~licensee or~~ registrant for assuring compliance with the requirements of these rules and all ~~license or~~ registration conditions.

~~**(d)**~~**(n)** "Radiographer's assistant" means an individual who, under the personal supervision of a radiographer, uses ~~sources of~~ radiation machines, related handling tools, or survey instruments in portable industrial radiography operations.

~~**(e)** "Radiographic exposure device" means an instrument containing a sealed source fastened or contained therein, in which the sealed source or shielding thereof may be moved, or otherwise changed, from a shielded to unshielded position for purposes of making a radiographic exposure.~~

(o) "Safety interlock" means a device which is intended to prevent the generation of x-radiation when access by any part of the human body to the interior of the cabinet or enclosure is possible.

~~**(f)** "Storage container" means a device in which sealed sources are transported or stored.~~

~~[*Note: The requirements of this rule that pertain to radiation machine registration, licensing, or compliance are under the purview of the Michigan Department of Consumer & Industry Services.*]~~

~~**EQUIPMENT CONTROL**~~

~~**R325.5286. Locking of sources of radiation.**~~

~~**Rule 286. (1)** Each source of radiation shall be provided with a lock or outer-locked container designed to prevent unauthorized or accidental production of radiation or removal or exposure of a sealed source and shall be kept locked except when under the direct surveillance of a radiographer or radiographer's assistant, or as may be otherwise authorized by the department.~~

~~**(2)** Each storage container shall be provided with a lock and kept locked when containing sealed sources except when under the direct surveillance of a radiographer or radiographer's assistant.~~

~~**(3)** Locked sources of radiation and storage containers shall be physically secured to prevent tampering or removal by unauthorized personnel.~~

[*Note:The requirements of this rule that pertain to radiation machine registration, licensing, or compliance are under the purview of the Michigan Department of Consumer & Industry Services.*]

Applicable equipment control rules are incorporated in each of the cabinet and portable, non-cabinet equipment sections below.

R325.5287. Radiation survey instruments.

Rule 287. (1) A licensee or registrant shall maintain calibrated and operable radiation survey instruments to make physical radiation surveys as required by this part and part 5. Each radiation survey instrument shall be calibrated at intervals not to exceed 3 months and after each instrument servicing. A record of such calibration shall be maintained for examination by the department.

(2) Instrumentation required by this rule shall have a range such that 2 milliroentgens per hour through 1 roentgen per hour can be measured and shall be capable of measuring radiation of the energies and at the dose rates to be encountered.

(3) During repair or calibration of survey instruments required by this rule, spare operable and calibrated instruments shall be provided or radiographic operations shall be terminated pursuant to rule 307(1).

The survey instrument rules have been moved to the portable, non-cabinet type systems section.

R325.5289. Quarterly inventories.

Rule 289. A licensee or registrant shall conduct a quarterly physical inventory to account for all sources of radiation received or possessed by him. The records of the inventories shall be maintained for inspection by the department and shall include the quantities and kinds of radioactive material, the location of all sources of radiation, the date of the inventory, and the signature or initials of the individual certifying the accuracy of the inventory.

[*Note:The requirements of this rule that pertain to radiation machine registration, licensing, or compliance are under the purview of the Michigan Department of Consumer & Industry Services.*]

This rule was intended mainly for radioactive materials to prevent lost sources. Quarterly inventories on radiation machines is not necessary.

R325.5290. Utilization logs.

Rule 290. A licensee or registrant shall maintain for inspection by the department current logs, which show the following information for each source of radiation:

(a) A description, or make and model number, of each source of radiation or storage container in which the sealed source is located.

(b) The identity of the radiographer to whom assigned.

(c) Locations where used and dates of use.

(d) Signature or initials of the individual certifying each entry.

[*Note:The requirements of this rule that pertain to radiation machine registration, licensing, or compliance are under the purview of the Michigan Department of Consumer & Industry Services.*]

The utilization log rules have been moved to the portable, non-cabinet type systems section.

R325.5291. Inspection and maintenance.

Rule 291. (1) A licensee or registrant shall conduct a program for inspection and maintenance of sources of radiation and storage containers to assure proper functioning of components important to safety.

(2) A current checklist of inspection and maintenance of sources of radiation and storage containers indicating the date of the last inspection shall be maintained for inspection by the department.

Designed for radioactive materials, not machines.

CLASSIFICATION

The classification of industrial radiography uses is being eliminated and applicable rules are being clarified by dividing into the 2 main areas of industrial radiation machine use: cabinet x-ray systems, and portable x-ray units.

R325.5293. Class enumeration.

Rule 293. (1) For the purpose of licensing or registering and approving industrial radiographic installations they shall be classified as class AA, class A, class B or class C.

(2) For the purpose of licensing or registering and approving industrial radiography and sources of radiation intended for limited use at temporary job site locations this use shall be classified as class D operation.

R325.5294. Class AA installations.

Rule 294. (1) In class AA installations the source of radiation and objects exposed thereto shall be contained within a permanent enclosure.

(2) The enclosure shall be constructed such that the radiation exposure rate as measured in air at a distance of 5 centimeters from any point on the external surface shall not exceed 2 milliroentgens per hour with the source of radiation placed in the shortest source-to-wall radiographically usable position under conditions of maximum radiation output permitted by the design or operating characteristics of the radiographic exposure device or radiation machine.

(3) Mechanical or electrical limiters shall limit movement or alignment of the source of radiation within the enclosure if necessary to comply with subrule (2).

(4) A personnel barrier posted in accordance with rules 224 to 231 restricting access to the roof of the enclosure shall meet the requirement of subrule (2).

(5) Reliable interlocks shall be provided which will prevent anyone from opening the enclosure while the radiation machine is on or the sealed source is unshielded, or which will terminate machine operation or automatically return the sealed source to a shielded position should anyone open the enclosure.

(6) Enclosures of sufficient size to permit human occupancy shall be provided with visible or audible signals or both within the enclosure which are activated a minimum of 5 seconds before radiation machine activation or exposure of the sealed source. Persons shall at all times be able to escape from within the enclosure.

(7) A person shall not be permitted to remain within the enclosure while the radiation machine is in operation or the sealed source is unshielded.

(8) Protective enclosures and equipment shall be kept in good repair.

(9) Industrial fluoroscopy shall meet class AA requirements.

(10) Notwithstanding the provisions of subrule (2), the enclosure for industrial fluoroscopy shall be

~~constructed such that the radiation exposure rate as measured in air at a distance of 5 centimeters from any accessible point on the external surface shall not exceed 0.5 milliroentgens per hour under conditions of maximum radiation output permitted by the design or operating characteristics of the installation.~~

~~**(11)** Industrial cabinet radiography conducted in enclosures of insufficient size to permit human occupancy shall meet class AA requirements.~~

~~**(12)** Notwithstanding the provisions of subrule (2), the enclosure for industrial cabinet radiography of insufficient size to permit human occupancy shall be constructed such that the radiation exposure rate as measured in air at a distance of 5 centimeters from any accessible point on the external surface shall not exceed 0.5 milliroentgens per hour under conditions of maximum radiation output permitted by the design or operating characteristics of the installation.~~

~~**(13)** Class AA approval permits unlimited use at maximum capacity.~~

~~[*Note: The requirements of this rule that pertain to radiation machine registration, licensing, or compliance are under the purview of the Michigan Department of Consumer & Industry Services.*]~~

~~**R325.5296. Class A installations.**~~

~~**Rule 296. (1)** Class A installations shall comply with all requirements of rule 294 except for a permissible exposure rate of 7 milliroentgens per hour at any accessible external point.~~

~~**(2)** A personnel monitoring device such as a film badge dosimeter or thermoluminescent dosimeter, shall be permanently assigned to each occupationally exposed individual. This monitoring shall be continuous during employment as a radiation worker.~~

~~**(3)** Personnel exposure records shall be kept on permanent available file at the facility where the exposure occurs for inspection by the department.~~

~~**(4)** Class A approval permits unlimited use at maximum capacity.~~

~~**R325.5297. Class B installations.**~~

~~**Rule 297. (1)** Class B installations shall comply with all requirements of rule 296.~~

~~**(2)** Radiation machine current and potential controls shall be mechanically or electrically limited so as not to exceed the normal operating conditions as specified by the registrant at the time of application for registration.~~

~~**(3)** Class B approval permits unlimited use under normal operating conditions as specified by subrule (2).~~

~~**R325.5298. Class C installations.**~~

~~**Rule 298. (1)** Class C installations shall comply with all requirements of rule 296 except for a permissible exposure rate of 50 milliroentgens per hour at any accessible external point.~~

~~**(2)** The maximum weekly exposure time of sources of radiation within the enclosure shall be established by the department under the conditions specified by the licensee or registrant at the time of application.~~

~~**(3)** Warning signs shall be posted in those areas outside the enclosure in which the radiation exposure rate in air at any accessible external point exceeds 2 milliroentgens per hour with the source of radiation placed in the shortest source-to-wall radiographically usable position under conditions of maximum radiation output permitted by the design or limited operating characteristics of the radiographic exposure device or radiation machine.~~

R325.5299. Class D operations.

Rule 299. (1) Industrial radiography conducted under conditions not meeting the provisions and requirements of rules 294 to 298 shall be classified as class D operations and shall not be operated longer than 30 days unless written authorization is granted by the department.

(2) Written authorization may be granted by the department for class D operations longer than 30 days but not longer than 6 months when an undue and unnecessary hardship may result from the 30 day limitation. Written request by the licensee or registrant for this authorization is required and shall describe the hardship involved as well as provide written assurance of compliance with the requirements of these rules for class D operation.

(3) Notwithstanding subrules (1) and (2) a person routinely engaged in providing industrial radiography services with mobile or portable sources of radiation at temporary job site locations may conduct such class D operations without time limitation subject to the following conditions:

(a) The person shall hold an unexpired certificate of registration from the department or specific license from the department, the NRC or an agreement state.

(b) The person shall give written notice to the department at least 2 working days before starting radiographic work at a job site. The notice shall include the radiographer's name; a description of each source of radiation; the nature, duration and scope of use; and the exact location of each job site. If for a specific case the 2 working-day period would impose an undue hardship on the person, upon application to the department, he may arrange for other notification to comply with the intent of this requirement.

(c) These class D operations shall be limited to locations and circumstances which cannot meet the provisions and requirements of permanent installation classification without undue and unnecessary hardship.

(d) A copy of written operating and emergency procedures shall be filed with and approved by the department.

(e) Upon reasonable notice from the department the person shall submit to the department or otherwise make available copies of specific records pertaining to radiographic operations and personnel conducting these operations within this state.

(4) A fence, rope or other suitable barrier shall be erected along the 5 mR/hr contour line during class D radiographic operations to exclude unauthorized persons from the radiation area.

(5) The radiation area and high radiation area shall be posted with caution signs as specified in rules 224 to 231.

(6) A personnel monitoring device such as a film badge dosimeter or thermoluminescent dosimeter, shall be permanently assigned to each occupationally exposed individual. This monitoring shall be continuous during employment as a radiation worker.

(7) Personnel exposure records shall be kept on permanent available file for examination by the department. A copy of the most recent record including current, quarterly, annual and lifetime cumulative totals for each monitored individual present at a temporary job site shall be available at the job site for examination by the department. A current supplemental daily dosimeter log shall also be available at the job site.

(8) The inside of the driver's compartment of the transport vehicle used to transport class D radiographic exposure devices shall be conspicuously posted with emergency instructions including the procedure for notifying the Michigan Department of Public Health, the Michigan Department of State Police, and other emergency agencies in event of accident or fire and the procedure for minimizing exposure to persons in the event of an accident.

(9) Written operating and emergency procedures shall be available at each class D radiographic operation.

~~[Note:The requirements of this rule that pertain to radiation machine registration, licensing, or compliance are under the purview of the Michigan Department of Consumer & Industry Services.]~~

~~[Note:As a result of Executive Orders 1996-1 and 1996-2, the authority, powers, duties, functions, and responsibilities of the radiation machine registration, licensing, and compliance program were transferred to the Michigan Department of Consumer & Industry Services. With respect to machine sources of ionizing radiation, any reference in these rules to the Michigan Department of Public Health should now reference the Michigan Department of Consumer & Industry Services.]~~

CABINET X-RAY SYSTEMS

Based on 21CFR1020.40, Cabinet X-ray Systems (39 Federal Register 12986, April 10, 1974)

R325.5285. Cabinet equipment.

Rule 285. (1) Radiation emitted from the cabinet x-ray system shall not exceed an exposure of 0.5 milliroentgen in one hour at any point five centimeters outside the external surface.

(2) Compliance with the exposure limit in subrule (1) above shall be determined by measurements averaged over a cross-sectional area of ten square centimeters with no linear dimension greater than 5 centimeters, with the cabinet x-ray system operated at those combinations of x-ray tube potential, current, beam orientation, and conditions of scatter radiation which produce the maximum x-ray exposure at the external surface, and with the door(s) and access panel(s) fully closed as well as fixed at any other position(s) which will allow the generation of x-radiation.

(3) A cabinet x-ray system shall have a permanent floor. Any support surface to which a cabinet x-ray system is permanently affixed may be deemed the floor of the system.

(4) The insertion of any part of the human body through any port into the primary beam shall not be possible. In addition, The insertion of any part of the human body through any aperture shall not be possible.

(5) Each door of a cabinet x-ray system 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.

(6) Each access panel shall have at least one safety interlock.

(7) Following interruption of x-ray generation by the functioning of any safety interlock, use of a control provided in accordance with subrule (10)(b) of this section shall be necessary for resumption of x-ray generation.

(8) Failure of any single component of the cabinet x-ray system shall not cause failure of more than one required safety interlock.

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

(10) For all systems to which this section is applicable there shall be provided:

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

(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.

(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 component of the cabinet x-ray system shall not cause failure of both indicators to perform their intended function. One, but not both, of the indicators required by this subdivision 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 insure that at least one indicator is visible from each door, access panel, and port, and is legibly labeled ‘‘XRAY ON’’.

(11) 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

(12) 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

R325.5286. Cabinet x-ray systems designed to admit humans

RULE 286. For cabinet x-ray systems designed to admit humans there shall also be provided:

(a) A control within the cabinet for preventing and terminating x-ray generation, which cannot be reset, overridden or bypassed from the outside of the cabinet.

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

(c) Audible and visible warning signals within the cabinet which are actuated for at least 10 seconds immediately prior to the first initiation of x-ray generation after closing any door designed to admit humans. Failure of any single component of the cabinet x-ray system shall not cause failure of both the audible and visible warning signals.

(d) A visible warning signal within the cabinet 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.

(e) Signs indicating the meaning of the warning signals provided pursuant to SUBRULES (1)(C) and (D) Above and containing instructions for the use of the control provided pursuant to SUBRULE (1)(A) ABOVE.

These signs shall be legible, accessible to view, and illuminated when the main power control is in the ''on'' position.

R325.5287. Additional requirements for x-ray baggage inspection systems

These are additional provisions for systems used in public areas

Rule 287. X-ray systems designed primarily for the inspection of carry-on baggage at airline, railroad, and bus terminals, and at similar facilities, shall be provided with means, pursuant to subrules (a) and (b) below, to insure operator presence at the control area in a position which permits surveillance of the ports and doors during generation of x-radiation.

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

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

R325.5290. Conditions of operation

Rule 290. (1) A personnel monitoring device such as a film badge dosimeter or thermoluminescent dosimeter, shall be permanently assigned to each occupationally exposed individual. This monitoring shall be continuous during employment as a radiation worker.

(2) Personnel exposure records shall be kept on permanent available file at the facility where the exposure occurs.

(3) In lieu of meeting (1) and (2) above, a certified cabinet x-ray system registrant can perform a complete evaluation of the radiation exposure levels and other safety aspects of the cabinet x-ray system to determine

compliance with this part and part 4 at intervals not to exceed 1 year. Records of these evaluations shall be maintained for department inspection for 5 years after the evaluation.

Subrule 3 was added in order to be consistent with the cabinet x-ray personnel monitoring requirements in the CRCPD Suggested State Regulations without exempting this equipment from this part.

(4) Interlocks required in Rule 285(5) shall be checked for proper operation monthly. Records of these checks must be maintained for examination by the department.

(5) Film processing must be according to manufacturers' specifications in order to minimize exposure settings.

(6) Written operating and emergency procedures shall be posted on or near the cabinet x-ray system.

INDUSTRIAL X-RAY ENCLOSURES

FOR OPERATIONS THAT UTILIZE INDUSTRIAL RADIOGRAPHY OR FLUOROSCOPY IN AN ENCLOSED ROOM WHERE CABINET X-RAY SYSTEMS ARE NOT PRACTICAL.

R325.5292. Equipment.

RULE 292. (1) Following interruption of x-ray generation by the functioning of any safety interlock, use of a control provided in accordance with subrule (3)(b) of this section shall be necessary for resumption of x-ray generation.

(2) Failure of any single component of the EQUIPMENT shall not cause failure of more than one required safety interlock.

(3) For all systems to which this section is applicable there shall be provided:

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

(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.

(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 component of the EQUIPMENT shall not cause failure of both indicators to perform their intended function. One, but not both, of the indicators required by this subdivision 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 insure that at least one indicator is visible from each door, access panel, and port, and is legibly labeled ‘‘XRAY ON’’.

(4) There shall be permanently affixed or inscribed on the EQUIPMENT 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

R325.5293. Enclosures.

RULE 293. (1) Radiation emitted from the enclosure shall not exceed an exposure of 2.0 milliroentgen in one hour at any point five centimeters outside the room.

(2) For industrial x-ray enclosures there shall be provided:

(a) A control within the room for preventing and terminating x-ray generation, which cannot be reset, overridden or bypassed from the outside of the room.

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

(c) Audible and visible warning signals within the room which are actuated for at least 10 seconds immediately prior to the first initiation of x-ray generation after closing any door designed to admit humans.

Failure of any single component of the equipment shall not cause failure of both the audible and visible warning signals.

(d) A visible warning signal within the room 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.

(e) Signs indicating the meaning of the warning signals provided pursuant to subrules (2)(c) and (d) above and containing instructions for the use of the control provided pursuant to subrule (2)(a) above. These signs shall be legible, accessible to view, and illuminated when the main power control is in the ''on'' position.

(3) Each door of the enclosure 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.

R325.5xxx. Conditions of operation

Rule xxx. (1) A personnel monitoring device such as a film badge dosimeter or thermoluminescent dosimeter, shall be permanently assigned to each occupationally exposed individual. This monitoring shall be continuous during employment as a radiation worker.

(2) Personnel exposure records shall be kept on permanent available file at the facility where the exposure occurs.

PORTABLE, NON-CABINET TYPE SYSTEMS

R325.5294. Applicability.

Rule 294. For operations that cannot be performed within an enclosed, cabinet type setting without undue and unnecessary hardship.

R325.5295. Equipment.

Rule 295. Each radiation machine shall be equipped with a lock designed to prevent unauthorized or accidental production of radiation. The radiation machine shall be kept locked with the key removed at all times except when under the direct visual surveillance of a radiographer or radiographer's assistant.

R325.5296. Radiation survey instruments

Rule 296. (1) The registrant shall keep sufficient calibrated and operable radiation survey instruments at each location where radiation machines are used to make the radiation surveys required by this part and by Part 4 of these rules. instrumentation required by this section must be capable of measuring a range from 2 mrem (0.02 millisieverts) per hour through 1 Rem (0.01 sievert) per hour.

(2) The registrant shall have each radiation survey instrument, required under Rule 296(1) above, calibrated:

(a) At energies appropriate for use and at intervals not to exceed 6 months or after instrument servicing, except for battery changes.

(b) For linear scale instruments, at two points located approximately one-third and two-thirds of full scale on each scale; for logarithmic scale instruments, at mid-range of each decade, and at two points of at least one decade; and for digital instruments, at 3 points between 2 and 1000 mrem (0.02 and 10 millisieverts) per hour.

(c) So that an accuracy within plus or minus 20 percent of the true radiation dose rate can be demonstrated at each point checked.

(3) The registrant shall maintain records of the results of the instrument calibrations and retain each record for 3 years after it is made.

R325.5297. Utilization logs

Rule 297. The registrant shall maintain for inspection by the department current logs, which show the following information for each radiation machine used in portable radiographic operations:

(a) The Location, date and time of each use.

(b) The radiation machine settings (kVp, ma and time) used for each exposure.

(c) The signature or initials of the radiographer certifying each entry.

R325.5298. Conditions of operation

Rule 298. (1) A fence, rope or other suitable barrier shall be erected along the 5 mR/hr contour line during portable radiographic operations to exclude unauthorized persons from the radiation area.

(2) Radiation areas and high radiation areas shall be posted with caution signs as specified in Part 4 of these rules.

(3) The licensee or registrant may not permit any individual to act as a radiographer or a radiographer's assistant unless, at all times during radiographic operations, each individual wears, on the trunk of the body, a combination of direct reading dosimeter, an alarming ratemeter, and either a film badge or a TLD. At permanent radiographyic installations where other appropriate alarming or warning devices are in routine use, or during radiographic operations using radiation machines, the use wearing of an alarming ratemeter is not required.

(a) Pocket dosimeters must have a range from zero to 2 millisieverts (200 mrem) and must be recharged at the start of each shift. Electronic personal dosimeters may only be used in place of ion-chamber pocket dosimeters.

(b) Each film badge and TLD must be assigned to and worn by only one individual.

(c) Film badges and TLD's must be exchanged at periods not to exceed one month.

(d) After replacement, each film badge or TLD must be returned to the supplier for processing within 14 calendar days of the end of the monitoring period, or as soon as practicable. In circumstances that make it impossible to return each film badge or TLD in 14 calendar days, such circumstances must be documented and available for review by the department.

(4) Direct reading dosimeters such as pocket dosimeters or electronic personal dosimeters, must be read and the exposures recorded at the beginning and end of each shift, and records must be maintained for examination by the department.

(5) Pocket dosimeters, or electronic personal dosimeters, must be checked at periods not to exceed 12 months for correct response to radiation, and records must be maintained for examination by the department. Acceptable dosimeters must read within plus or minus 20 percent of the true radiation exposure.

(6) If an individual's pocket dosimeter is found to be off-scale, or the electronic personal dosimeter reads greater than 2 millisieverts (200 mrem), the individual's film badge or TLD must be sent for processing within 24 hours. In addition, the individual may not resume work associated with the use of sources of radiation until a determination of the individual's radiation exposure has been made. This determination must be made by the radiation protection supervisor or the radiation protection supervisor's designee. The results of this determination must be included in the records maintained for examination by the department.

(7) If a film badge or TLD is lost or damaged, the worker shall cease work immediately until a replacement film badge or TLD is provided and the exposure is calculated for the time period from issuance to loss or damage of the film badge or TLD. The results of the calculated exposure and the time period for which the

film badge or TLD was lost or damaged must be included in the records maintained for examination by the department.

(8) Each alarming ratemeter must:

(a) Be checked to ensure that the alarm functions properly before using at the start of each shift;

(b) Be set to give an alarm signal at a preset dose rate of 5 millisieverts per hour (500 mrem/hr) per hour; with an accuracy of plus or minus 20 percent of the true radiation dose rate;

(c) Require special means to change the preset alarm function; and

(d) Be calibrated at periods not to exceed 12 months for correct response to radiation. The licensee shall maintain records of alarming ratemeter calibrations for examination by the department.

(9) Personnel exposure records shall be kept on permanent available file for examination by the department. A copy of the most recent record including current, quarterly, annual and lifetime cumulative totals for each monitored individual present at a temporary job site shall be available at the job site for examination by the department.

(10) Film processing must be according to manufacturers' specifications in order to minimize exposure settings.

(11) Written operating and emergency procedures shall be available at each portable radiographic operation.

SAFETY FOR RADIOGRAPHERS AND RADIOGRAPHERS' ASSISTANTS

R325.5301. Limitations.

Rule 301. (1) A ~~licensee or~~ registrant shall not permit an individual to act as a radiographer until the individual:

(a) Has been instructed in the subjects outlined in rule 309 and has demonstrated understanding thereof.

(b) Has received copies of and instruction in the rules contained in this part and the applicable sections of part ~~5~~ 4, license or registration conditions and the licensee's or registrant's operating and emergency procedures, and has demonstrated understanding thereof.

(c) Has demonstrated competence to use the source of radiation, related handling tools, and survey instruments which will be employed in his assignment.

(2) A ~~licensee or~~ registrant shall not permit an individual to act as a radiographer's assistant until the individual:

(a) Has received copies of and instruction in the licensee's or registrant's operating and emergency procedures, and has demonstrated understanding thereof.

(b) Has demonstrated competence to use under the personal supervision of the radiographer the sources of radiation, related handling tools and radiation survey instruments which will be employed in his assignment.

R325.5302. Operating and emergency procedures.

Rule 302. A ~~licensee's or~~ registrant's written operating and emergency procedures shall include instructions in at least the following:

(a) The handling and use of ~~sources of~~ radiation machines to be employed such that an individual is not likely to be exposed to radiation doses in excess of the limits established in part ~~5~~ 4.

(b) Methods and occasions for conducting radiation surveys.

(c) Methods for controlling access to radiographic areas.

(d) Methods and occasions for locking and securing ~~sources of~~ radiation machines.

(e) Personnel monitoring and the use of personnel monitoring equipment.

~~**(f)** Transportation to field locations, including packing of sources of radiation in the vehicles, posting of vehicles, and control of sources of radiation during transportation.~~

~~**(g)** Minimizing exposure of persons in the event of an accident.~~

(f) and (g) above are for radioactive materials, not machines.

~~**(h)**~~**(f)** Procedure for notifying proper persons in the event of an accident.

~~**(i)**~~**(g)** Maintenance of records.

~~**(j)** Inspection and maintenance of sources of radiation MACHINES and storage containers.~~

~~**R325.5303. Personnel monitoring control.**~~

~~**Rule 303. (1)** A licensee or registrant shall not permit an individual to act as a radiographer or as a radiographer's assistant unless, at all times during radiographic operation, the individual wears a long-term monitoring device such as a film badge or TLD and a short-term monitoring device such as a pocket dosimeter or pocket chamber. Pocket dosimeters and pocket chambers shall be capable of measuring doses from 0 to at least 200 milliroentgens. Each long-term monitoring device shall be assigned to and worn by only 1 individual.~~

~~**(2)** Pocket dosimeters and pocket chambers shall be read and doses recorded daily. A film badge or similar device shall be immediately processed if a pocket chamber or pocket dosimeter is discharged beyond its range. All personnel exposure reports and records of pocket dosimeter and pocket chamber readings shall be maintained for inspection by the department.~~

Rule 303 applied to radioactive materials radiography.

PRECAUTIONARY PROCEDURES IN PORTABLE RADIOGRAPHIC OPERATIONS

R325.5305. Security.

Rule 305. (1) During each radiographic operation, the radiographer or radiographer's assistant shall maintain a direct surveillance of the operation to protect against unauthorized entry into a high radiation area, except where the high radiation area is equipped with interlocks as described in rule ~~294 (5)~~ 293(3), or where the high radiation area is locked to protect against unauthorized or accidental entry.

(2) A radiographer or radiographer's assistant shall not perform or permit radiographic operation unless all persons present in or entering the resulting radiation area are wearing film badges or thermoluminescent dosimeters. Radiographic operation shall cease if an unmonitored person enters the radiation area and shall not resume until the person is monitored or leaves the area.

R325.5306. Posting.

Rule 306. ~~Notwithstanding any provision in rule 233, a~~Areas in which radiography is being performed shall be conspicuously posted as required ~~by rules 224 to 231~~ in part 4 of these rules.

R325.5307. Radiation surveys and survey records.

Rule 307. (1) A radiographic operation shall not be conducted unless calibrated and operable radiation survey instrumentation as described in rule 2~~87~~96 is available and used at each site where radiographic exposures are made.

~~**(2)**A physical radiation survey shall be made after each radiographic exposure utilizing radiographic exposure devices or sealed sources of radioactive material to determine that the sealed source has been returned to its shielded condition.~~

~~**(3)** A physical radiation survey shall be made to determine that each sealed source is in its shielded condition before securing the radiographic exposure device or storage container as specified in rule 286.~~

~~Records shall be kept of these surveys and maintained for inspection by the department.~~

~~(4)~~ (2) A physical radiation survey shall be conducted to determine that the radiation machine is off before each entry into the radiographic exposure area.

~~[*Note: The requirements of this rule that pertain to radiation machine registration, licensing, or compliance are under the purview of the Michigan Department of Consumer & Industry Services.*]~~

R325.5309. Appendix A - Instruction of radiographers.

Rule 309. See rule 301.

I. Fundamentals of Radiation Safety

A. Characteristics of ~~gamma and~~ x-radiation

B. Units of radiation dose (mrem) ~~and quantity of radioactivity (curie)~~

C. Hazards of excessive radiation exposure

D. Levels of radiation from sources of radiation

E. Methods of controlling radiation dose

1. Working time

2. Working distances

3. Shielding

II. Radiation Detection Instrumentation to be Used

A. Use of radiation survey instruments

1. Operation

2. Calibration

3. Limitations

B. Survey techniques

C. Use of personnel monitoring equipment

1. Film badges, thermoluminescent dosimeters

2. Pocket dosimeters

3. Pocket chambers

III. ~~Radiographic Equipment to be Used~~

~~**A.** Remote handling equipment~~

~~**B.** Radiographic exposure devices and sealed sources~~

~~**C.** Storage containers~~

~~**D.**~~ Operation and control of x-ray equipment

IV. The Requirements of Pertinent Federal and State Regulations

V. The ~~Licensee's or~~ Registrant's Written Operating and Emergency Procedures

VI. ~~License or~~ Registration Conditions

~~[*Note: The requirements of this rule that pertain to radiation machine registration, licensing, or compliance are under the purview of the Michigan Department of Consumer & Industry Services.*]~~