DEPARTMENT OF HEALTH

Minnesota Rules, Chapter 4732 X-Ray Revision

DRAFT INDUSTRIAL RADIOGRAPHY, 1.0

4732.#### INDUSTRIAL RADIOGRAPHY.

Subpart 1. **Applicability.** A registrant's industrial radiography x-ray system must comply with the requirements of this part.

X-RAY SYSTEMS

Subp. 2. **Safety device.** A registrant is responsible for requirements of this subpart.

A. An industrial radiography x-ray system must be equipped with a locking device that will prevent unauthorized or accidental production of ionizing radiation.

B. An industrial radiography x-ray system must have a device to terminate the production of x-rays and must be located near each "x-ray on" control. The control line power switch or safety interlock system must not be used for this function.

C. When a sensor is used to automatically initiate an exposure, the "x-ray off" control must be located on the main control panel.

Subp. 3. **Warning lights and devices.**

A. A visible and discernible warning light labeled with the words "X-RAY ON, or other visible warning indicator, that indicates the industrial radiography x-ray system is producing ionizing radiation, must be:

Commented [JC(1]: ANSI N.4.3.5-4.4.1 and 4.4.2 ;and Texas Code

Commented [TP(2]: Texas:
The control panel of each radiation machine shall be equipped with a locking device that will prevent unauthorized or accidental production of ionizing radiation.

Commented [BB(3]: •Wording from analytical •Similar: OH,

(1) located near a switch that energizes an x-ray tube; and

(2) illuminated only when the tube is energized.

B. If emission of the useful beam is controlled with shutters, then the shutter device must have two visible signals of contrasting colors to indicate the shutter status. One signal must show when the shutters are fully closed, and the other signal when the shutters are not fully closed. These signals may be electrical or mechanical.

Commented [JC(4]: ANSI N43.5-2005
6.4 Shutter status indicators
If emission of the useful beam is controlled by shutters, the shutter device shall have on it two visible signals of contrasting colors to indicate the shutter status. One signal shall show when the shutters are fully closed, and the other when the shutters are not fully closed. These signals may be electrical or mechanical.

Texas 289.255_3.2015 pg. 255-29
See above

Subp. 4. **Beam ports.** Unused ports on radiation source housings must be secured in the closed position that prevents opening.

Subp. 5. **Shutters.** For an industrial radiography x-ray system designed with shutters:

A. each beam port on the radiation source housing must be equipped with shutters that cannot be opened unless either a collimator or a coupling is connected to the beam port; and

B. unused collimators on the radiation source housing must be secured in the closed position, or mechanically blocked.

Subp. 6. **Labeling.** A registrant is responsible for labeling an industrial radiography x-ray system according to this subpart.

A. An industrial radiography x-ray system must be labeled near any switch that energizes an x-ray tube with a visible and discernible sign bearing the radiation symbol and the words "CAUTION RADIATION - THIS EQUIPMENT PRODUCES

IONIZING RADIATION WHEN ENERGIZED", or other words having similar meaning.

B. An industrial radiography x-ray system must be labeled at or near the x-ray exit beam port to identify the location of the beam with the words “CAUTION - HIGH INTENSITY X-RAY BEAM", or other words having similar meaning.

Subp. 7. **Safety device evaluation**. A registrant is responsible for an evaluation of a safety device of an industrial radiography x-ray system:

A. upon installation; and

B. at intervals not to exceed 180 days.

Commented [JC(5]: NC: 3 months

C. A safety device evaluation includes:

(1) the safety device under subpart 2;

(2) the shutters;

(3) the warning lights; and

(4) the warning devices.

D. A safety device evaluation must verify that:

(1) all industrial radiography x-ray system safety devices are functioning as designed; and

(2) all labels are visible and discernible.

E. If an industrial radiography x-ray system safety device is not functioning as designed, then it must be:

(1) labeled immediately as defective; and

(2) removed from service until the safety device is repaired.

F. A registrant must maintain a record of safety device evaluations for an industrial radiography x-ray system. The record must include:

(1) the dates of evaluations;

(2) a list of the safety devices evaluated;

(3) the results of the evaluation;

(4) the name of the individual performing the evaluation; and

(5) corrective actions recommended and performed for any safety device that fails the required evaluation.

G. When an industrial radiography x-ray system is returned to service after being locked-out and tagged, it must be evaluated before use if the date of the last safety device evaluation exceeds 180 days.

H. An industrial radiography x-ray system that is locked out and tagged "DO NOT USE" by the radiation safety officer is exempt from this subpart.

Subp. 8**. Radiation emission limit**. Each x-ray tube housing must be so constructed that, with all shutters closed, the leakage radiation measured at a distance of 5 centimeters from the x-ray tube housing surface does not exceed 2.5 mrem (0.025 mSv) per hour. This limit must be met at the maximum operating parameters.

SURVEY REQUIREMENTS

Subp. 10. **Radiation protection survey.** A registrant is responsible for performing a radiation protection survey of an industrial radiography x-ray system. A radiation protection survey must be performed:

Commented [JC(6]: SSRCR; page H9, Section H.6 (j)

Commented [BB(7]: SSRCR: Sec. H.6

A. upon installation of an industrial radiography x-ray system in a permanent location;

B. after any change to the components of an industrial x-ray system; and

C. with radiation survey instruments calibrated according to part 4732.####.

Subp.11. **Area surveys.** A registrant is responsible for performing an area survey of industrial radiography x-ray system. Before use at a temporary job site, an industrial radiographer or an industrial radiographer's assistant must:

A. determine the perimeter of a restricted area to prevent a dose to an individual that exceeds the dose limits under part 4732.####; and

B. use radiation survey instruments calibrated according to 4732.####.

Commented [JC(8]: Focus Group: Is there another term or concept we can use in addition to area survey?

Commented [BB(9]: New Survey layout, also items taken from Ohio 3701:1-68-03
Extrapolated from MDH RAM

CONDITIONS OF OPERATION

Subp. 12. **Radiation safety officer; qualifications.** A radiation safety officer for industrial radiography must complete:

A. all training and testing requirements under subpart 15;

B. 2,000 hours of hands-on experience as a qualified radiographer in industrial radiographic operations; and

C. formal training in the establishment and maintenance of a radiation safety protection program.

Commented [BB(10]: •SSRCR: Sec. E.16
•Similar: NE, NM, OH, MD, AK
•OR has 160 hours with 8 radiation protection program hours.
•NC adds to the 2000 hours "with at least 40 hours of classroom training with respect to the establishment and maintenance of radiation protection programs."

Commented [BB(11]: •SSRCR: Sec. E.16
•Similar: NE, NM, OH, AK, ME, MD

Subp. 13. **Alternate qualifications.** The commissioner may consider alternatives to qualifications requirements under part 4731.4130, subpart 3.

Subp. 14. **Radiation safety officer; authority and duties.** In addition to these requirements, a radiation safety officer must comply with part 4732.####.

Commented [JC(12]: RSO requirements generally

Subp. 15. **Radiographer requirements.** A registrant may not permit an individual to act as a radiographer until the individual:

A. meets the training requirements under part subpart 19;

B. completes 320 hours of hands-on experience training;

C. has met the certification requirements under subpart 20;

D. receives copies of and instruction in:

(1) notices, instructions, and reports under part 4732.####; and

(2) the registrant's operating and emergency procedures under subpart 22.

E. demonstrates an understanding of the operating and emergency procedures under item D, subitem (3) by passing a written or oral examination covering the material;

F. receives training in:

(1) the use of the registrant's industrial radiography x-ray system;

(2) the daily inspection of devices; and

(3) the use of radiation survey instruments; and

G. demonstrates competency and understanding of the training under item F by passing a practical examination covering the material.

Subp. 16. **Radiographer's assistant requirements.** A registrant may not permit an individual to act as a radiographer's assistant until the individual:

A. receives copies of and instruction in:

(1) notices, instructions, and reports under part 4732.####; and

(2) the registrant's operating and emergency procedures under part subpart 22.

B. demonstrates an understanding of the information under item A by passing a written or oral examination covering the material;

C. develops competency to use, under the personal supervision of a radiographer, industrial radiographic x-ray systems and radiation survey instruments; and

D. demonstrates competency and understanding of the training under item C by passing a practical examination covering the material.

Subp. 17. **Refresher safety training.** A registrant must provide annual refresher safety training for each radiographer and radiographer's assistant at intervals not to exceed 12 months (365 days).

Subp. 18**. Job performance review.** Except as provided under item C, a radiation safety officer, or designee, must conduct an inspection program of the job performance of each radiographer and radiographer's assistant to monitor compliance with this chapter and the registrant's operating and emergency procedures.

A. An inspection program must:

(1) include observing the performance of each radiographer and radiographer's assistant during an actual industrial radiographic x-ray system operation; and

(2) be performed at intervals not to exceed 180 days.

Commented [JC(13]: Similar: NM, NC, OR, RI, AK, MD

Commented [JC(14]: Similar: NM, NC, OR, RI, AK, MD

B. If a radiographer or a radiographer's assistant has not participated in an industrial radiography x-ray system operation for more than 180 days since the last job performance review, then:

(1) a radiographer must redemonstrate knowledge of the training requirements under subpart 1, item F by a practical examination before participating in an industrial radiography x-ray system operation; or

(2) a radiographer's assistant must redemonstrate knowledge of the training requirements under subpart 2, item C by a practical examination before participating in an industrial radiography x-ray system operation.

C. The commissioner may consider alternatives to the requirements under item A when an individual serves as both radiographer and radiation safety officer according to part 4731.4140, subpart 4, item B.

D. A performance review is not required when an individual serves as both radiographer and radiation safety officer, and performs all radiography operations.

Commented [JC(15)]: Similar: AK, CO

Subp. 19. **Required subjects.** A radiographer must receive training in:

A. the fundamentals of radiation safety and methods of controlling radiation including:

(1) time;

(2) distance;

(3) shielding; and

(4) collimation;

B. the characteristics of radiation;

C. the units of radiation dose including:

(1) the significance of radiation dose; and

(2) the radiation protection standards;

D. the biological effects of radiation;

E. the levels of radiation from sources of radiation;

F. the applicable requirements of state regulations;

G. the registrant's written operating and emergency procedures;

H. the operation, inspection, maintenance and control of non-medical radiation-generating equipment to be used;

I. the use of radiation survey instruments including:

(1) operation;

(2) calibration; and

(3) limitations;

J. survey techniques;

K. the use of personnel monitoring equipment including:

(1) distribution, wearing and exchange procedures;

(2) typically expected exposure levels; and

(3) the procedures to keep exposure levels as low as reasonably achievable; and

L. case histories of industrial radiography x-ray system accidents.

Subp. 20. **Radiographer certification; certification programs; written examinations.** Radiographer certification, a radiographer certification program, and a written examination for

a radiographer must meet the requirements in the Council for Radiation Control Program Directors, State Suggested Regulations for Control of Radiation, Volumes I and II, Ionizing and Nonionizing Radiation, Part E, Appendix A. This document is available at http://c.ymcdn.com/sites/www.crcpd.org/resource/resmgr/docs/SSRCRs/E_2016.pdf.

Subp. 21. **Utilization Data.** A registrant must maintain a record of utilization data for each industrial radiography x-ray system that includes:

A. the manufacturer, model number, and serial number;

B. the locations and dates of use;

C. the electronic authorization or written signature of the radiographer assigned by the registrant; and

D. for permanent radiographic installations, the dates each industrial radiography x-ray system is energized.

Subp. 22. **Safety Procedures.** A registrant must develop and comply with operating and emergency procedures for an industrial radiography x-ray system.

A. Operating and emergency procedures may be maintained in electronic or written form;

B. Operating and emergency procedures must include:

(1) storage and security of an industrial radiography x-ray system to prevent unauthorized use, removal, or accidental production of ionizing radiation when the industrial radiography x-ray system is not under the control and constant surveillance of an operator or the registrant;

Commented [JC(16]: A,B,C, D are from Ohio 3701:1-68-03.

Commented [BB(17]: Similar: SSRCR E.29, AL

Commented [BB(18]: Similar: SSRCR E.29, AL (include dates removed and returned to storage),

Commented [JC(19]: Similar: SSRCR E.29, AL have of the radiographer whom assigned.

Commented [BB(20]: •SSRCR: E.29
•AL adds (or radiographic exposure device utilized)

(2) visual checks on survey meters and industrial radiography x-ray system before use on each day to verify that:

a) the equipment is in good working condition; and

b) required labeling is present.

(3) posting and controlling access to industrial radiography restricted areas.

(4) conducting an area survey;

(5) equipment malfunctions;

(6) minimizing exposure of individuals in the event of an accident;

(7) notifying proper personnel in the event of an accident; and

(8) locked out and tagged.

C. No individual may operate an industrial radiography x-ray system in any manner other than that specified in the operating procedures unless the individual has obtained written approval from the radiation safety officer.

D. Operating and emergency procedures must be available to the radiographer or radiographer assistant of an industrial radiography x-ray system.

Subp. 23. **Posting.** All areas where industrial radiography is being performed must be posted as required by 4732.####.

Subp.24. **Permanent radiographic installations.**

A. Each entrance that is used for personnel access to the high radiation area in a permanent radiographic installation must have:

(1) all entryways locked; and

Commented [TP(21]: SSRCR E.12 a
MN radioactive materials 4731.4090, subpart 1

Commented [BB(22]: SSRCR; page H8, section H.6. (h)

Commented [BB(23]: SSRCR, Sec. I.10 (f),

Commented [JC(24]: SSRCR: E.23

Commented [JC(25]: •SSRCR
E.13 Similar: AL,

(2) an entrance control; or

(3) visible and audible warning signals to warn of the presence of radiation where:

a) the visible signal must be actuated by radiation whenever the industrial radiography x-ray system is energized; and

b) the audible signal must be actuated when an attempt is made to enter the installation while the industrial radiography x-ray system is energized.

For purposes of this part, an entrance control is a device that reduces the level of radiation below the level where an individual may receive a deep dose equivalent of 1 millisievert (0.1 rem) in 1 hour at 30 centimeters from the source of radiation, or from any surface that the radiation penetrates.

Commented [JC(26]: Sec. D.1601 - Control of Access to High Radiation Areas.
a. The licensee or registrant shall ensure that each entrance or access point to a high radiation area has one or more of the following features:
i. A control device that, upon entry into the area, causes the level of radiation to be reduced below that level at which an individual might receive a deep dose equivalent of 1 millisievert (0.1 rem) in 1 hour at 30 centimeters from the source of radiation or from any surface that the radiation penetrates;

B. Entrance control devices must be tested monthly;

C. An alarm system must be tested each day for proper operation with a radiation source before the installation is used for radiographic operations. The test must include a check of both the visible and audible signals.

D. An entrance control device or an alarm that is malfunctioning must be immediately labeled as defective and repaired; and

E. A permanent radiographic installation must not be used when an alarm (or entrance control device) is not functioning as designed.

Subp.25. **Temporary job site**.

A. At least two qualified personnel must be present at a temporary job site when using an industrial radiography x-ray system. At least one of the individuals must be a radiographer and the other individual must be either a radiographer or a radiographer's assistant.

B. Only a radiographer, or a radiographer's assistant who is under the personal supervision of a radiographer, is authorized to manipulate controls or operate equipment used in a radiographic operation. Personal supervision must include:

(1) the radiographer's physical presence at the site where the industrial radiography x-ray system is being used;

(2) the availability of the radiographer to give immediate assistance if required; and

(3) the radiographer's direct observation of the radiographer's assistant's performance of the operations referred to in this part.

C. When performing a radiographic operation at a temporary job site, a radiographer or a radiographer's assistant must:

(1) post signs bearing the radiation symbol and the words "CAUTION HIGH RADIATION AREA" at the perimeter of the restricted area;

(2) restrict access by using barriers, such as rope or tape, and post signs bearing the radiation symbol and the words "CAUTION RADIATION AREA" at the perimeter of the restricted area; and

Commented [BB(27]: •Ohio 3701:1-68-03,SSRCR:E.15 •Similar: AL,

Commented [JC(28]: •Ohio 3701:1-68-03, SSRCR:E.15 Similar: AL,

Commented [JC(29]: 4731.0100, Subp. 167.(RAM definition)
Personal supervision.
"Personal supervision" means guidance and instruction by an industrial radiographer or logging supervisor who:
A.is physically present at a temporary job site;
B.is in personal contact with an industrial radiographer's assistant or logging assistant; and
C.can give immediate assistance.

Commented [BB(30]: •Ohio 3701:1-68-03 •Similar:

(3) maintain constant visual surveillance of the restricted area boundary to prevent unauthorized access.

D. During each radiographic operation, a radiographer or radiographer's assistant must maintain direct visual surveillance of the barriers to prevent unauthorized entry into a radiation area or a high radiation at a temporary job site.

E. A registrant must maintain copies of the following documents and records with an industrial radiography x-ray system:

(1) the certificate of registration;

(2) the operating and emergency procedures;

(3) the area surveys required under subpart 11;

(4) the daily dosimetry for the period of operation at the temporary job site;

(5) the current calibration records for the specific survey instruments and direct reading dosimeters used at the temporary job site. Acceptable records include labels which are affixed to the survey instrument or dosimeter;

(6) the area survey instrumentation checks and industrial radiography x-ray system checks used at the temporary job site;

(7) the radiographer's certification card; and

(8) the utilization data.

Subp. 26. **Storage and security; notification in event of theft or loss**.

A. An industrial radiography x-ray system must be:

(1) stored when not in use by being secured in a locked area of the facility; and

(2) secured against unauthorized or accidental use.

Commented [JC(31]: SSRCR:E.22, AL has same

Commented [BB(32]: •Ohio 3701:1-68-03

Commented [BB(33]: •Ohio 3701:1-68-03
•Similar:

Commented [BB(34]: •Ohio 3701:1-68-03
•Similar:

Commented [BB(35]: •Ohio 3701:1-68-03
•Similar:

Commented [JC(36]: •Ohio 3701:1-68-03
•Similar:

B. A registrant must notify the commissioner of the theft or loss of an industrial radiography x-ray system according to part 4732.####.

Subp. 27. **Records.** A registrant must maintain records under this part according to part 4732.####.

Commented [JC(37]: There will be one records provision applicable to all registrants.

Records of safety device tests, check dates, findings and corrective actions must be available for inspection and maintained. SSRCR; page H9, Section H.6 (j)