DEPARTMENT OF HEALTH

Minnesota Rules, Chapter 4732 X-Ray Revision

DRAFT INDUSTRIAL RADIOGRAPHY X-RAY SYSTEMS, 2.0 (03/09/2018)

Summary of Changes

MDH made a number of changes to the Industrial Radiography rule draft v1.0 based on the industrial focus group's review and feedback at the March 1, 2018 meeting. Substantive changes to version 1.0 are described below.

Subp. 2. Safety device.

- Deleted item C

Subp. 3. Warning lights and devices.

- Revised wording in item B

Subp. 5. Shutters.

- Deleted "either" and "or a coupling" in item A.
- Deleted item B

Subp. 7. Safety device evaluation.

- Item C (2). inserted "if applicable"

Subp. 8. Radiation emission limit.

- Deleted this subpart.

Subp. 8. Radiation protection survey. (formerly Subp. 10)

- Renumbered
- Revised first sentence inserting underscored language:
  A registrant is responsible for performing a radiation protection survey for a permanent installation *of an industrial radiography x-ray system* that includes all beam directions.
- **Item A.** Deleted "*of an industrial radiography x-ray system in a permanent location*"

Subp. 9. Area survey. (formerly Subp. 11)

- Renumbered; no changes

Subp. 10. Radiation safety officer; qualifications. (formerly Subp. 12)

- Renumbered
- Updated internal reference in item A.

- Revised item B by inserting "to include 40 hours of classroom training in the establishment and maintenance of a radiation safety protection program"
- Deleted item C

Subp. 11. Alternate qualifications. (formerly Subp. 13)

- Renumbered; no changes

Subp. 12. Radiation safety officer; authority and duties. (formerly Subp. 14)

- Renumbered; no changes

Subp. 13. Radiographer requirements. (formerly Subp. 15)

- Renumbered
- **Item A.** Updated internal reference
- **Item C.** Updated internal reference
- **Item D (2).** Updated internal reference
- **Item F.** Revised subitem (2) by inserting internal reference

Subp. 14. Radiographer's assistant requirements. (formerly Subp. 16)

- Renumbered; no changes

Subp. 15. Annual refresher safety training. (formerly Subp. 17)

- Renumbered
- Revised headnote by inserting "Annual"
- Inserted new item B

Subp. 16. Job performance review. (formerly Subp. 18)

- Renumbered
- **Item B.** Updated internal reference in subitem (1)
- **Item B.** Updated internal reference in subitem (2)
- **Item C.** Deleted "*when an individual serves as both radiographer and radiation safety officer*"

Subp. 17. Required training subjects. (formerly Subp. 19)

- Renumbered
- Revised headnote by inserting "training"
- **Item A.** Revised to read: "radiation safety and methods of minimizing radiation exposure to include"
- **Item C.** Deleted subitems (1) and (2)
- **Item E.** Deleted "*sources of radiation*" and replaced with "industrial radiography x-ray systems"
- **Item H.** Deleted "*non-medical radiation generating equipment*" and added "industrial radiography x-ray systems"

- **Item I.** Inserted new subitem - "(2) survey techniques"
- **Item J.** Deleted and added to item I

Subp. 18. Radiographer certification; certification programs; written examinations. (formerly Subp. 20)

- Renumbered
- Revised by inserting "are incorporated by reference and are not subject to frequent change. A copy of this material is available online at www.crcpd.org/page/SSRCRs."

Subp. 19. Utilization data. (formerly Subp. 21)

- Renumbered
- Inserted new item C. "C. the number of exposures;"

Subp. 20. Safety procedures. (formerly Subp. 22)

- Renumbered
- **Item B**. In subitem (2), inserted "and operability"
- **Item B.** In subitem (2) (a), inserted internal reference "under subpart 6"

Subp. 21. Posting (formerly Subp. 23)

- Renumbered; no changes

Subp. 22. Permanent radiographic installations. (formerly Subp. 24)

- Renumbered; no changes

Subp. 23. Temporary job site. (formerly Subp. 25)

- Renumbered
- **Item C.** Reversed order of subitems (1) and (2).

Subp. 24. Storage and security; notification in event of theft or loss. (formerly Subp. 26)

- Renumbered; form edits
- Revised item A for readability

Subp. 25. Records. (formerly Subp. 27)

- Renumbered; no changes

4732.#### INDUSTRIAL RADIOGRAPHY X-RAY SYSTEMS.

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.

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:

(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 industrial radiography x-ray system must have two indicators that identify the shutter status.

(1) one indicator must show when the shutters are fully closed;

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, IL

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

(2) the second indicator must show when the shutters are not fully closed; and

(3) indicators may be electrical or mechanical.

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

Commented [BB(5]: SSRCR; H13, Sec H.8.d

Subp. 5. **Shutters.** For an industrial radiography x-ray system designed with shutters, each beam port on the radiation source housing must be equipped with shutters that cannot be opened unless a collimator is connected to the beam port.

Commented [JC(6]: SSRCR Part H. H.8 pg 13

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(7]: NC, DE, IL: 3 months

C. A safety device evaluation includes:

(1) the safety device under subpart 2;

(2) the shutters, if applicable;

(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 evaluations;

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

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

Commented [JC(8]: SSRCR; page H9, Section H.6 (j)

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.

SURVEY REQUIREMENTS

Subp. 8. **Radiation protection survey.** A registrant is responsible for performing a radiation protection survey for a permanent installation of an industrial radiography x-ray system that includes all beam directions.

A. A radiation protection survey must be performed:

(1) upon installation;

(2) after any change to the components of an industrial radiography x-ray system; and

B. All radiation survey instruments used to perform a radiation protection survey must be calibrated according to part 4732.####.

Subp.9. **Area survey.** A registrant is responsible for performing an area survey of industrial radiography x-ray system.

Commented [BB(9]: Ohio 3701:1-68-03; MN Ch 4731

A. Before use at a temporary job site, an industrial radiographer or an industrial radiographer's assistant must determine the perimeter of a restricted area to prevent a dose to an individual that exceeds the dose limits under part 4732.####; and

B. All radiation survey instruments used to perform an area survey must be calibrated according to part 4732.####.

CONDITIONS OF OPERATION

Subp. 10. **Radiation safety officer; qualifications.** A radiation safety officer for industrial radiography x-ray systems must complete:

A. all training and testing requirements under subpart 13; and

B. 2,000 hours of hands-on experience as a qualified radiographer in industrial radiographic operations to include 40 hours of classroom 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 [JC(11]: •SSRCR: Sec. E.16
Similar: NE, NM, OH, AK, ME, MD

Subp. 11. **Alternate qualifications.** The commissioner may consider alternatives to qualifications requirements under part 4731.4130, subpart 3.

Subp. 12. **Radiation safety officer; authority and duties.** In addition to the requirements of this part, a radiation safety officer must comply with part 4732.####.

Commented [JC(12]: RSO requirements generally

Subp. 13. **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 17;

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

C. meets the certification requirements under subpart 18;

D. receives copies of and instruction in:

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

Commented [JC(13]: MDH will specify additional rule parts when these are developed by MDH. Review Radioactive Materials parts 4731.1000-4731.2950.

(2) the registrant's operating and emergency procedures under subpart 20; and

(3) the requirements of this part.

E. demonstrates an understanding of the operating and emergency procedures 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 visual and operability checks of an industrial radiography x-ray system under subpart 20; 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. 14. **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 20.

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.

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

Commented [JC(15]: Will specify additional rule parts when these are developed by MDH. Review Radioactive Materials parts 4731.1000-4731.2950.

Commented [JC(16]: Similar: NM, NC, OR, RI, AK, MD

Subp. 15. **Annual refresher safety training.**

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

B. For purposes of this subpart, annual refresher safety training means a review conducted or provided by a registrant for its employees on radiation safety aspects of industrial radiography. The review must include any results of internal inspections, new procedures or equipment, new or revised regulations, and accidents or errors observed by the registrant. The review must also provide opportunities to ask safety-related questions.

Commented [JC(17)]: SSRCR.

Subp. 16**. 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.

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 demonstrate competency in the training requirements under subpart 13, item F by passing a practical examination before participating in an industrial radiography x-ray system operation; or

(2) a radiographer's assistant must demonstrate competency in the training requirements under subpart 14, item C by passing 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 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(18]: Similar: AK, CO

Subp. 17. **Required training subjects.** A radiographer must receive training in:

A. radiation safety and methods of minimizing radiation exposure to include:

(1) time;

(2) distance;

(3) shielding; and

(4) collimation.

B. the characteristics of radiation;

C. the units of radiation dose;

D. the biological effects of radiation;

E. the levels of radiation from industrial radiography x-ray systems;

F. the applicable requirements of this part;

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

H. the operation, inspection, maintenance and control of industrial radiography x-ray systems to be used;

I. the use of radiation survey instruments including:

(1) operation;

(2) survey techniques;

(3) calibration; and

(4) limitations;

J. 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

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

Subp. 18. **Radiographer certification; certification programs; written examinations.**

Radiographer certification requirements, radiographer certification program requirements, and written examination for a radiographer requirements of 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 are incorporated by reference and are not subject to frequent change. A copy of this material is available online at www.crcpd.org/page/SSRCRs.

Subp. 19. **Utilization Data.** A registrant must maintain a record of utilization data for each industrial radiography x-ray system that includes:

Commented [JC(19]: A, B, C, D - Ohio 3701:1-68-03.

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

B. the locations and dates of use;

C. the number of exposures;

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

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

Subp. 20. **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 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;

(2) daily visual and operability 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 under subpart 6 is present.

c) If equipment problems are found during a daily check, then the equipment must be removed from service until it is repaired.

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

(4) conducting an area survey;

Commented [JC(20]: Similar: SSRCR E.29, AL, AZ, AK, DE, MD, IL, IA

Commented [JC(21]: Similar: SSRCR E.29, AL (include dates removed and returned to storage), AZ, AK, DE, IL, IA

Commented [JC(22]: Similar: SSRCR E.29, AL have of the radiographer whom assigned. AZ, AK, DE, IL, IA, MD

Commented [BB(23]: •SSRCR: E.29, IL
•AL "or radiographic exposure device utilized"

Commented [JC(24]: Similar: AL, AZ, AK, DE, IL, MD

Commented [TP(25]: SSRCR E.12 a
MN radioactive materials 4731.4090, subpart 1
Similar: AL, AZ, AK, CO, DE, IL, MD

Commented [JC(26]: Similar: AL, AZ, AK, CO, DE, IL

(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.

B. 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.

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

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

Subp. 21. **Posting.** All areas where industrial radiography is being performed must be posted as required by 4732.####.

Subp.22. **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

(2) an entrance control; or

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

Commented [BB(27]: Similar: AZ (had emergency)

Commented [BB(28]: Similar: AL, AZ, AK, CO, DE, IL, MD

Commented [BB(29]: Similar: AL, AZ, AK, CO, DE, IL, MD

Commented [BB(30]: SSRCR; page H8, section H.6. (h)

Commented [BB(31]: SSRCR, Sec. I.10 (f), CO

Commented [JC(32]: SSRCR: E.23
Similar: AL, AZ, AK, CO, DE, IL, ME, MD

Commented [JC(33]: •SSRCR E.13
Similar: AL,

Commented [BB(34]: Similar: AK, CO, ME, MD

Commented [BB(35]: Similar: AK, CO, DE, IL, IA, ME, MD

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(36]: 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;

Commented [BB(37]: Similar: AK, CO, DE, IL, IA, ME, MD

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 and entrance control device are not functioning as designed.

Subp.23. **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

Commented [BB(38]: •Ohio 3701:1-68-03,SSRCR:E.15
•Similar: AL, AZ, AK, CO, IL, ME, MD

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 an industrial radiography x-ray system. 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 visual observation of the radiographer's assistant's performance of the operations referred to in this part.

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

(1) 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;

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

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

Commented [JC(39]: •Ohio 3701:1-68-03, SSRCR:E.15 Similar: AL, CO

Commented [JC(40]: 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 [JC(41]: Similar: AL, AK, IL, NC, ND, TX, SSRCR E.19, and RAM 4731.4160

Commented [BB(42]: •Ohio 3701:1-68-03
•Similar:

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.

Commented [JC(43]: SSRCR:E.22, AL has same RAM 4731.4190
Similar: AL, AZ, AK, CO, ME, MD

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

Commented [BB(44]: •Ohio 3701:1-68-03

(1) the certificate of registration;

Commented [BB(45]: •Ohio 3701:1-68-03
•Similar: AK, DE, IL, ME

(2) the operating and emergency procedures;

Commented [BB(46]: •Ohio 3701:1-68-03
•Similar: AK, DE, IL, ME

(3) the area surveys required under subpart 9;

Commented [BB(47]: •Ohio 3701:1-68-03
•Similar: AK, DE, IL, ME

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

Commented [BB(48]: Similar: AK, DE, IL, ME

(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;

Commented [JC(49]: •Ohio 3701:1-68-03
•Similar: AK, DE, IL, ME

(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

Commented [BB(50]: IL

(8) the utilization data.

Commented [BB(51]: ME

Subp. 24. **Storage and security; notification in event of theft or loss**.

Commented [BB(52]: Similar: DE, IL, ME, MD

A. An industrial radiography x-ray system must be stored when not in use by:

(1) securing the x-ray system in a storage area to prevent unauthorized use; and

(2) following storage and security procedures under subpart 20, item A.

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

Subp. 25. **Records.** A registrant must maintain records under this part according to part 4732.####.

Commented [JC(53]: There will be one records provision applicable to all registrants.
Records of safety device tests, daily check dates see 4731.4270, findings and corrective actions must be available for inspection and maintained. SSRCR; page H9, Section H.6 (j)

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