MINNESOTA DEPARTMENT OF HEALTH

REGULATORY GUIDE FOR INDUSTRIAL RADIOGRAPHY

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INTRODUCTION

This guide is designed to describe the type and extent of information needed by the Minnesota Department of Health (MDH) to evaluate an application for the use of sealed sources used in industrial radiography. The term radiography as used in this guide means the examination of the structure of materials by nondestructive methods that use gamma-emitting radionuclides. The radionuclides most commonly used are Cobalt-60 and Iridium-192.

The information in this guide is not a substitute for training in radiation safety or for developing and implementing an effective radiation safety program. You should carefully study this guide and all the regulations identified in this guide and then complete the application. MDH may request additional information when necessary to provide reasonable assurance that you have established an adequate radiation protection program.

AS LOW AS REASONABLY ACHIEVABLE (ALARA) PHILOSOPHY

Every reasonable effort should be made to maintain radiation exposures and releases of radioactive material in effluents to unrestricted areas as low as is reasonably achievable (ALARA). As an applicant, you should consider the ALARA philosophy in the development of work plans involving radioactive materials.

The success of an ALARA program depends on the cooperation of each person who works at your facility. Management should make a formal policy commitment to the ALARA philosophy and implement that commitment with adequate resources.

The Radiation Safety Officer (RSO) and management are required to audit the radiological program to ensure the continued safe use of radioactive material. The RSO is also responsible for the day-to-day operations of the radiation safety program.

A model ALARA management program is contained in Appendix A to this guide. Applicants are required to consider the ALARA philosophy in the development of plans for radioactive materials.

FILING AN APPLICATION

You should apply for a license by completing the “Application for a Minnesota Radioactive Materials License.” Complete Items 1 through 4 on the form itself. For Items 5 through 11, submit the information on supplementary pages. Identify and key each sheet or document with the item number on the application. All typed pages, sketches, and, if possible, drawings should be on 8 1/2 X 11 inch paper to facilitate handling and review. If larger drawings are necessary, they should be folded to 8 1/2 X 11 inches. You should complete all items in the application in sufficient detail for MDH to determine that your equipment, facilities, training and experience, and radiation safety program is adequate to protect the health and safety of the public as well as your employees.

Please note that license applications are available for review by the general public in the MDH offices. Do not submit proprietary information unless necessary. If submittal of such information is necessary, please clearly specify the proprietary information. Failure to do so may result in disclosure of information to the public or substantial delays in processing your application.

Do not submit personal information about your individual employees unless it is necessary. For example, the training and experience of individuals should be submitted to demonstrate their ability to manage radiation safety programs or to work safely with radioactive materials. Home addresses and home telephone numbers should be submitted only if they are part of an emergency response plan. Dates of birth, social security numbers, and radiation dose information should be submitted only if specifically requested by MDH.

Submit one copy of your application to:

Radioactive Materials Unit
Minnesota Department of Health
625 Robert Street North
PO Box 64975
St. Paul, Minnesota 55164-0975

Retain one copy for yourself, as the license will be issued based on the statements and representations in your application, its supplements, and the requirements in the regulations. The statements and representations you make as if they were regulations will bind you.

The following comments apply to the indicated items on the Application for a Minnesota Radioactive Materials License.

Item 1: License Action Type

Check box A for a new license request.

Check box B for an amendment to an existing license and provide the license number. See "Amendments and Renewals to a License," section of this document.

Check box C for a renewal of an existing license and provide the license number.

Item 2: Name and Mailing Address of Applicant

List the legal name of the applicant's corporation or other legal entity with direct control over use of the radioactive material; a division or department within a legal entity may not be a licensee. An individual may be designated as the applicant only if the individual is acting in a private capacity and the use of the radioactive material is not connected with employment in a corporation or other legal entity. Provide the mailing address where correspondence should be sent.

Timely Notification of Transfer of Control

Licensees must provide full information and obtain MDH's prior written consent before transferring control of the license, directly or indirectly, or, as some licensees call it, "transferring the license." Transfers of control may be the results of mergers, contractual agreements, buyouts, or majority stock transfers. Although it is not MDH's intent to interfere with the business decisions of licensees, it is necessary for licensees to obtain prior MDH written consent. This is to ensure the following:

- Radioactive materials are possessed, used, or controlled only by persons who have valid MDH licenses.
- Materials are properly handled and secured.
- Persons using these materials are competent and committed to implementing appropriate radiological controls.

- A clear chain of custody is established to identify who is responsible for final disposal of radiography devices.
- Public health and safety are not compromised by the use of such materials.

Item 3: Address(es) Where Licensed Material Will Be Used or Possessed

Applicants must provide a specific address for each location where radioactive material will be used or stored, or dispatched. Specify the street address, city, and state or other descriptive address (such as on Highway 10, 5 miles east of the intersection of Highway 10 and State Route 234, Anytown, State) for each permanent storage or use facility and field station. A field station is a location where licensed material may be stored or used and from which the applicant will dispatch equipment to jobsites. A Post Office Box address is insufficient because MDH needs a specific address to allow an MDH inspector to find the use and/or storage location. If devices will NOT be stored at a dispatch site or field station, indicate this. In addition, the applicant should state whether a location will be used to perform radiographic operations or only for storage of sources and devices.

If a device will be used in a permanent radiographic installation, give the specific address of each location. If applicable, describe the locations outside of the installation where radiographic operations will be conducted.

If radiography equipment will be stored and/or used at a field station, give the specific address of each field station.

If radiography operations will be conducted at temporary jobsites (i.e., locations where work is conducted for limited periods of time), specify "temporary jobsites anywhere in the Minnesota where MDH maintains jurisdiction."

Item 4: Person to Be Contacted About This Application

Identify the individual who can answer questions about the application and include his or her telephone number. This is typically the proposed radiation safety officer (RSO) or knowledgeable management official. The MDH will contact this individual if there are questions about the application.

Notify MDH if the contact person or telephone number changes. This notice is for information only and does not require a license amendment or a fee.

Items 5 through 11 should be submitted on separate sheets of paper.

Item 5: Radioactive Material

Sealed Sources and Devices

Applicants must provide the manufacturer's (or distributor's) name and model number for each requested source assembly (sealed source), exposure device, and source changer. Licensees will only be authorized for radiographic exposure devices, source assemblies or sealed sources containing radioactive material and associated equipment meeting MDH requirements and specifically approved or registered by the US Nuclear Regulatory Commission (NRC) or an Agreement State. Also, identify any depleted uranium that is used as shielding material. (Radiographic exposure devices, source changers and some collimators contain depleted uranium).

The NRC or an Agreement State performs a safety evaluation of radiography source assemblies (sealed sources) exposure devices and source changers before distribution of these sources/devices to specific

licensees. The safety evaluation is documented in a Sealed Source and Device (SSD) Registration Certificate issued to the manufacturer (or distributor). Therefore, if the source assemblies, exposure devices, or source changers are approved for use by the NRC or an Agreement State, the applicant need only note the manufacturer's (or distributor's) name and model number of the sources or devices in its license application to demonstrate that the requirements are met.

Consult with the proposed supplier to ensure that sources and devices conform to the sealed source and device designations registered with the NRC or an Agreement State. To ensure that radiographic equipment is used in accordance with registration certificates, licensees may want to review the certificate, discuss with the manufacturer, or obtain a copy of the certificate. Licensees may not make modifications to exposure devices, source changers, source assemblies and associated equipment unless the design of any replacement component would not compromise the safety features of the system.

Consult with the manufacturer of the associated equipment (i.e., equipment that is used in conjunction with the exposure device that drives, guides, or comes in contact with the source) to be sure that the associated equipment is compatible with the sources and devices.

Identify each radionuclide that will be used. Identify the manufacturer (or distributor) and model number of each sealed source, source assembly, exposure device, and/or source changer to be possessed. Identify any depleted uranium that is used as shielding material.

Confirm that each sealed source, device, and source/device combination possessed is registered as an approved sealed source or device by MDH and will be possessed and used in accordance with the conditions specified in the registration certificate.

Confirm that associated equipment is compatible with the exposure devices, source changers, and sealed sources containing radioactive material.

Identify by radioisotope, manufacturer (or distributor), and model number any other sealed sources containing radioactive material (i.e., any source that will not be used for performing radiography).

Confirm that all radiographic exposure devices, source assemblies or sealed sources, and all associated equipment which meet the requirements specified in 4731.4030.[1]

[1] For information on SSD registration certificates, contact the Registration Assistant by calling NRC's toll free number (800) 368-5642 and then asking for extension 415-7217.

Table 1: Industrial Nuclear Model Ir-100 Exposure Device
(Maximum Authorization -- 120 Ci)

Element	Sealed Source	Curies	Source Changer Meeting 10 CFR 34 Requirements	Maximum Curies Authorized
Ir-192	• IN Model 32	**120 Ci**	• Amersham 550-SU • IN IR-50	120 Ci 120 Ci
Ir-192	• IN Model 33	**120 Ci**	• Amersham 550-SU • IN IR-50	120 Ci 120 Ci
Ir-192	• Amersham 87703	**120 Ci**	• Amersham 550-SU • Sentinel (Amersham) 650L • Amersham 820 • Amersham 855 • IN IR-50	120 Ci 240 Ci 1,000 Ci 960 Ci 120 Ci
Ir-192	• Amersham 87704	**120 Ci**	• Amersham 550-SU • Amersham 650 • Amersham 820 • Amersham 855	120 Ci 240 Ci 1,000 Ci 960 Ci
Ir-192	• SPEC G-40F	**120 Ci**	• Amersham 550-SU • SPEC C-1 • IN IR-50	120 Ci 150 Ci 120 Ci
Ir-192	• SPEC G-40T	**120 Ci**	• Amersham 550-SU • SPEC C-1 • IN IR-50	120 Ci 150 Ci 120 Ci

Table 2. Spec Model 150 Exposure Device
(Maximum Authorization -- 150 Ci)

Element	Sealed Source	Curies	Source Changer	Curie Authorization
Ir-192	• SPEC G-60	**240 Ci**	• SPEC C-1	150 Ci

Table 3: Sentinel (Amersham) Model 680 System Exposure Device
(Maximum Authorization -- 110 Ci)

Element	Sealed Source	Curies	Source Changer	Curie Authorization
Co-60	• Amersham A424-14	**110 Ci**	• Amersham 770 • Amersham 771	550 Ci 110 Ci
Co-60	• Amersham 943	**110 Ci**	• Amersham 770 • Amersham 771	550 Ci 110 Ci

Table 4: Sentinel (Amersham) Model 660 System Exposure Device (Maximum Authorization -- 140 Ci)

Element	Sealed Source	Curies	Source Changer	Curie Authorization
Ir-192	IN Model 7	100 Ci	Amersham 550-SU Sentinel (Amersham) 650L Amersham 820 Amersham 855 IN IR-50 SPEC C-1	120 Ci 240 Ci 1,000 Ci 960 Ci 120 Ci 150 Ci
Ir-192	CIS-US 702	120 Ci	Amersham 550-SU IN IR-50 SPEC C-1	120 Ci 120 Ci 150 Ci
Ir-192	Amersham 91813	20 Ci	Sentinel (Amersham) 650L	240 Ci
Ir-192	Amersham A424-22	240 Ci	Amersham 550-SU Sentinel (Amersham) 650L Amersham 820 Amersham 855	120 Ci 240 Ci 1,000 Ci 960 Ci
Ir-192	Amersham A424-9	240 Ci	Amersham 550-SU Sentinel (Amersham) 650L Amersham 820 Amersham 855 IN IR-50 SPEC C-1	120 Ci 240 Ci 1,000 Ci 960 Ci 120 Ci 150 Ci

Financial Assurance and Recordkeeping for Decommissioning

Licensees are required to maintain decommissioning records related to structures where devices are used or stored. Records relating to leaking sources must also be maintained. Licensees must transfer these records important to decommissioning either to any new licensee before licensed activities are transferred or assigned, or to MDH before the license is terminated.

The requirements for financial assurance are specific to the types and quantities of radioactive material authorized on a license. Most industrial radiography applicants and licensees do not need to comply with the financial assurance requirements because the thresholds for sealed sources containing radioactive material are 3.7×10^5 Bq (10,000 curies) of Cobalt-60 and 3.7×10^6 Bq (100,000 curies) of Cesium-137 or radioactive material with half-lives less than 120 days (e.g., Iridium-192). Thus, a licensee would need to possess hundreds of sources before the financial assurance requirements would apply. Since the standard industrial radiography license does not specify the maximum number of sources that the licensee may possess (allowing the licensee flexibility in obtaining sources/devices as needed without amending its license), it contains a condition requiring the licensee to limit its possession of sources to quantities not requiring financial assurance for decommissioning. Applicants and licensees desiring to possess sources exceeding the threshold amounts must submit evidence of financial assurance.

The same regulation also requires that licensees maintain records important to decommissioning in identified locations other than at any temporary jobsite. All industrial radiography licensees need to maintain records of structures and equipment where devices are used or stored. As-built drawings showing modifications to structures and equipment fulfill this requirement. If drawings are not available, licensees may substitute appropriate records (e.g., a sketch of the room and building, or a narrative description of the area) concerning the areas and locations. In addition, industrial radiography licensees who have experienced unusual occurrences (e.g., leaking sources or other incidents that involve spread of contamination, such as S-tube breakthrough) also need to maintain records about contamination that remains after cleanup or contamination that may have spread to inaccessible areas.

State the following in your application: "We shall maintain drawings records important to decommissioning. These records will be provided to a new licensee before licensed activities are transferred or to MDH before the license is terminated."

If financial assurance is required, submit evidence.

Item 6: Purpose(s) for Which Licensed Material Will Be Used

Sources and devices will be used only for the purposes for which they were designed and in accordance with the manufacturer's recommendations for use as specified in an approved Sealed Source and Device (SSD) Registration Certificate.

The typical license authorizes persons to perform source exchanges and to conduct industrial radiography at temporary jobsites, field stations, and/or permanent radiographic installations. Unusual uses will be evaluated on a case-by-case basis and the authorized use condition will reflect approved uses. Applicants who plan to perform radiographic operations on lay-barges or underwater must specifically request these operations.

Specify the purposes for which the sources and device(s) will be used other than those included in the manufacturer's recommendations, as specified on the SSD Registration Certificate.

In addition, specify any plans to perform radiography underwater or on lay-barges.

Item 7: Individual(s) Responsible for Radiation Safety Program

Radiation Safety Officer (RSO)
RSOs and potential designees responsible for ensuring that the licensee's radiation safety program is implemented in accordance with approved procedures must have adequate training and experience.

The person responsible for the radiation protection program is called the RSO. MDH believes the RSO is the key to overseeing and ensuring safe operation of the licensee's radiography program. The RSO needs independent authority to stop operations that he or she considers unsafe. He or she must have sufficient time and commitment from management to fulfill certain duties and responsibilities to ensure that radioactive materials are used in a safe manner.

The RSO may delegate certain day-to-day tasks of the radiation protection program to other responsible individuals (potential designees). For example, a large testing company with multiple field stations may appoint individuals designated as site RSOs who assist the RSO and are responsible for the day-to-day activities at the field stations. Licensees may also appoint other individuals who may step in as an emergency contact when the RSO is unavailable. The potential designees do not need to meet the required RSO qualifications; however, these individuals should be qualified, experienced radiographers who are adequately knowledgeable of the activities to which they are assigned. Applicants do not have to identify other responsible individuals if day-to-day tasks, etc. will not be delegated.

MDH requires the name of the RSO on the license to ensure that licensee management has always identified a responsible, qualified person and that the named individual knows of his or her designation as RSO. Provide MDH with a copy of an organizational chart showing the RSO (and other designated responsible individuals) to demonstrate that he or she has sufficient independence and direct communication with responsible management officials. In addition, show in the organizational chart the position of the individual who signs the application.

To be considered eligible for the RSO position, an individual must be a qualified radiographer, have a minimum of 2,000 hours (one year full-time field experience) of hands-on experience as a qualified

radiographer, and have formal training in establishing and maintaining a radiation protection program[2]. This should be a course specifically designed to provide training in running a radiation safety program, a basic radiation safety course is not acceptable. While a course particular to industrial radiography would be highly encouraged, this is not required. Acceptable training programs would be a classroom course typical of those provided through universities or commercial training facilities. Hands-on experience means experience in all areas considered to be directly involved in the radiography process. This includes taking radiographs, surveying device and radiation areas, transporting the radiography equipment to temporary jobsites, posting work sites, radiation area surveillance, completing and maintaining records, etc. Excessive time spent in only one or two of these operations (film development and/or area surveillance) should not be counted toward the 2,000 hours. Experience with radiography using x-rays can be included; however, the majority of experience should be in isotope radiography.

Provide the name of the proposed RSO and other potential designees who will be responsible for ensuring that the licensee's radiation safety program is implemented in accordance with approved procedures[3]. Demonstrate that the RSO has sufficient independence and direct communication with responsible management officials by providing a copy of an organizational chart by position, demonstrating day-to-day oversight of the radiation safety activities.

Provide the following:

- The specific training and experience of the RSO and other potential designees.
- Include the specific dates of certification and/or training in radiation safety.
- Documentation to show that the RSO has a minimum of 2,000 hours of hands-on experience as a qualified radiographer in industrial radiographic operations.
- Documentation to show that the RSO has obtained formal training in the establishment and maintenance of a radiation protection program.

OR

- Alternative information demonstrating that the proposed RSO is qualified by training and experience (e.g., Board Certification by the American Board of Health Physicists, completion of a bachelor's and/or master's degree in the sciences with at least one year of experience in the conduct of a radiation safety program of comparable size and scope).
- Documentation to show that the RSO has obtained formal training in the establishment and maintenance of a radiation protection program.

Item 8: Training for Individuals Working in or Frequenting Restricted Areas (Radiographers and Radiographers' Assistants)

Radiographers and radiographer's assistants must have adequate training and experience. A radiographer is a person who performs or personally supervises industrial radiography. This person is responsible for ensuring compliance with MDH regulations and the safe use of radioactive materials.

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[2] MDH will consider individuals with alternative training and experience as RSOs. For example, a person certified in health physics or industrial hygiene with previous experience in managing a radiation safety program of comparable size and scope could be considered as an individual case. The qualifications, training, and experience required of the RSO may vary depending upon the complexity of the applicant's operations and number of radiography personnel.

[3] It is important to notify MDH and obtain a license amendment before making changes in the designation of the RSO responsible for the radiation safety program. If the RSO leaves the organization before an amendment is approved by the MDH, a potential designee, who meets the RSO qualification requirements, is responsible for ensuring that the licensee's radiation safety program is implemented in accordance with the license and MDH regulations. Alternative responses will be reviewed against the criteria listed above.

A radiographer is an individual who has been certified by a certifying entity to ensure he/she has met established radiation safety, testing, and experience criteria.

A radiographer's assistant is an individual who, under the direct supervision (in the physical presence) of the radiographer, uses radiographic equipment (sealed sources containing radioactive material or related handling tools, exposure devices, and radiation survey instruments) in performing industrial radiographic operations.

4731.4140 describes specific training requirements for radiographers and radiographer's assistants. It requires that all radiographers are certified. It also addresses annual refresher training and semiannual audits of radiographers and radiographer's assistants.

The applicant must submit a description of its training program for radiographers and radiographer assistants.

Because 4731.4140 contains different requirements for radiographers and radiographer's assistants, include training programs for each. When describing the training programs for these positions, include the sequence of events from the time of hiring through the designation of individuals as radiographers or radiographer's assistants. Experienced radiographers who have worked for another licensee should receive formal instruction similar to that given to prospective radiographer's assistants. This instruction must include training in your operating and emergency procedures, in the use of your exposure devices and associated equipment, and in the use of survey meters and other radiation monitoring devices.

Instructors who provide classroom training to individuals in the principles of radiation and radiation safety should have knowledge and understanding of these principles beyond those obtainable in a course similar to the one given to prospective radiographers. Individuals who provide instruction in the hands-on use of radiography equipment should be qualified radiographers with at least one year of experience in performing radiography, or should possess a thorough understanding of the operation of radiographic equipment (e.g., a manufacturer's service representative).

An internal inspection program (audit program) of the job performance of each radiographer and radiographer's assistant ensures that MDH rules, license requirements, and the licensee's operating and emergency procedures are followed. The audit must include observation of the performance of each radiographer and radiographer's assistant during an actual industrial radiographic operation at intervals not to exceed 6 months. If a radiographer or radiographer's assistant has not participated in an industrial radiographic operation for more than 6 months, the individual must demonstrate knowledge of the training requirements by practical examination before participating in a radiographic operation. The person conducting internal inspections should have a minimum of one year of actual experience as a radiographer.

Submit an outline of the training to be given to prospective radiographers and radiographer's assistants. Submit your procedures for experienced radiographers who have worked for another licensee.

Provide a copy of a typical examination and the correct answers to the examination questions. Indicate the passing grade.

Specify the qualifications of your instructors in radiation safety principles and describe their experience with radiography. If training will be conducted by someone outside the applicant's organization, identify the course by title and provide the name and address of the company providing the training.
Describe the field (practical) examination that will be given to prospective radiographers and radiographer's assistants. The MDH suggests using the checklist in Appendix B as a source of potential areas to review during the field examination.

Describe the annual refresher training program, including topics to be covered and how the training will be conducted.

Submit your procedures for verifying and documenting the certification status of radiographers and for verifying that their certification remains valid. As a minimum your procedures for newly hired, previously certified individuals should require documentation that you contacted the certifying entity and confirmed the certification. Your procedures should also ensure you are aware of certification expiration dates, and that individuals with expired certifications do not act as radiographers.

Submit a description of your program for inspecting the job performance of each radiographer and radiographers' assistant at intervals not to exceed six months.

Item 9: Facilities and Equipment

Annotated Drawing for Storage of Devices

Submit an annotated drawing of the room or rooms and adjacent areas where the radiographic exposure device will be stored. Include the following:

- The scale. Use the same scale (preferably 1/4 inch = 1 foot) for all drawings.
- The type, thickness, and density of shielding materials on all sides of the storage area, including the floor and roof.
- Types of posting and their locations.
- The locations of entrances and other points of access into the installation.
- Security controls to prevent unauthorized access.
- A description of the nature of the areas adjacent to the installation, and the distance to these areas.
- The results of dose calculations or actual radiation measurements adjacent to, above, and below the installation.

Submit an annotated drawing of the room or rooms and adjacent areas where the radiographic exposure device will be stored. Include the following:

- Identify its location and describe the visible and audible signal system.
- Submit the results of radiation level calculation or actual radiation measurements adjacent to, above, and below the installation. For determination of installation adequacy, provide information showing that the radiation level in all directions around the installation, including the roof, will not exceed 2.0 mrem (0.02 mSv) in any one hour. Identify the type of source, including isotope, amount, and the location of the source within the facility for the calculations or measurements. Take into account the highest quantity of radioactive material that will be used in the facility and any limitations on source positioning.
- Identify limitations on positioning of sources or type and amount of radioactive material that may be used in the installation to ensure that areas adjacent to, above, and below the installation will be unrestricted areas during performance of radiography.

Permanent Radiographic Installations

A permanent radiographic installation is an enclosed shielded room, cell, or vault in which radiography may be performed. A facility is considered “permanent” if it is intended to be used for radiography, even if radiography is rarely performed there. The nature of the facility, rather than the frequency of use, determines a permanent radiographic installation. All radiographic operations conducted at locations of use authorized on the license must be conducted in a permanent radiographic installation, unless specifically authorized by NRC. If licensees need to perform radiography at their place of business outside of a permanent facility due to unique circumstances (the item to be radiographed is too large for the facility), then the NRC must authorize this method of use. In this case two individuals must be present whenever radiographic operations occur outside of a permanent installation.

The one primary (and perhaps the most important) reason licensees have for conducting radiography in a permanent radiographic installation is that they can limit access restrictions imposed at a work location. In order to ensure this control a permanent radiographic installation, if located on the ground, must be enclosed by a minimum of four shielded walls (otherwise the floor must also be shielded). The use of materials that do not realistically provide shielding, do not qualify. Areas outside of the facility generally should qualify as unrestricted areas. While the area outside of an installation should qualify as an unrestricted area (i.e., not exceed 2mr/hr), the regulation did not specify radiation limits in order to allow for design flexibility for moving equipment into and out of the installation, or other considerations.

Radiation levels slightly exceeding these levels outside of the facility should only be considered or allowed when the higher levels are due to “sky shine” or the need for equipment movement. If the roof of the facility does not qualify as a restricted area, or if no roof exists, mechanical access restrictions (fence, etc.) must be utilized and additional administrative controls must imposed to ensure that unwanted access can be gained only through extraordinary effort. All entrance ways into the facility must be interlocked with 10 CFR Part 34 required control devices. Unless all entrance ways are locked, at least one radiographer must be present at the facility whenever radiography is being conducted.

A field station is a facility where licensed material may be stored and/or used and from which equipment is dispatched. Radiographic operations may be conducted in a permanent radiographic installation or at the place of business in the same manner as described above.

A restricted area is an area that licensees limit access for the purpose of protecting individuals from undue risks from exposure to radiation and radioactive materials. A restricted area cannot include areas used as residential quarters. Consequently, industrial radiography devices must not be stored in motel rooms or similar locations.

Requirements for a permanent radiographic installation:

- ***Audible-visible signals***
  Each access point is equipped with a visible-audible signal system. The visible signal is activated by radiation whenever the source is exposed. The audible signal will sound if anyone tries to enter the installation while the source is exposed. The requirement for the visible-audible signal system is in addition to other measures that may be taken to prevent access to the installation, such as locked doors.

  As an alternative to the visible-audible alarm system, it is acceptable to use a control system that will reduce the radiation level if the entrance to a high-radiation area is opened while the source is out. The system must be automatic and independent of radiography personnel action. If this alternative is planned, provide a description of the system.

- ***Diagram depicting the shielding, layout, and audible-visual alarms***
  A diagram of the installation is helpful in evaluating the shielding and determining compliance with regulations regarding restricted and unrestricted areas, location of access points, and locations of audible-visible signals.

- ***Calculations or survey results of radiation levels***
  For a determination of installation adequacy, provide information showing that the radiation level in all directions around the installation, including the roof, will not exceed a dose of 0.02 mSv (2 mrem) in any one hour. Take into account the highest quantity of radioactive material that will be used in the installation and any limitations on source positioning in the installation.

  Radiation levels in all directions around the installation that are below 0.02 mSv (2 mrem) in any one hour are considered acceptable. If the radiation levels will exceed 0.02 mSv (2 mrem) in any one hour, then steps should be taken (use lower-activity source, use collimator, or move setup farther away) to reduce the radiation to the acceptable level.

A radiation level on the roof that exceeds 1.0 mSv (100 mrems) in one hour at 30 cm from the surface is considered a “high radiation area” and requires special precautions to control access to the area. Licensees should make efforts to lower a radiation level exceeding 1.0 mSv (100 mrems) in any one hour by using additional shielding, collimators, or other engineering controls. The roof of a fixed radiography cell is a potentially occupied area, and applicants must demonstrate that no individual member of the public could receive effective doses in excess of 0.02 mSv (2 mrems) in any one hour or 1 mSv (100 mrems) in a year.

If radiography is planned in a permanent radiography installation or installations (including field stations with permanent exposure cells), provide the following information for each installation:

- The scale. Use the same scale (preferably 1/4 inch = 1 foot) for all drawings.
- The type, thickness, and density of shielding materials on all sides of the storage area, including the floor and roof.
- Types of posting and their locations.
- The locations of entrances and other points of access into the installation.
- Security controls to prevent unauthorized access.
- A description of the nature of the areas adjacent to the installation, and the distance to these areas.
- The results of dose calculations or actual radiation measurements adjacent to, above, and below the installation.

Submit an annotated drawing of the room or rooms and adjacent areas where the radiographic exposure device will be stored. Include the following:

- Identify its location and describe the visible and audible signal system.
- Submit the results of radiation level calculation or actual radiation measurements adjacent to, above, and below the installation. For determination of installation adequacy, provide information showing that the radiation level in all directions around the installation, including the roof, will not exceed 2.0 mrem (0.02 mSv) in any one hour. Identify the type of source, including isotope, amount, and the location of the source within the facility for the calculations or measurements. Take into account the highest quantity of radioactive material that will be used in the facility and any limitations on source positioning.
- Identify limitations on positioning of sources or type and amount of radioactive material that may be used in the installation to ensure that areas adjacent to, above, and below the installation will be unrestricted areas during performance of radiography.

Survey Equipment

Describe your survey instruments. Instrumentation must include the range from 2.0 milliroentgen (0.02 mSv) per hour to 1.0 roentgen (10 mSv) per hour and must be calibrated every six months. Electronic calibrations alone are not acceptable. Records of equipment problems and maintenance performed must be retained for three years. Battery changes are not considered “maintenance.”

In order to assure that the radiation surveys are accomplished, you must maintain an adequate number of appropriate radiation survey instruments that are both calibrated and operable at each location where radioactive material is present.

If you are using an outside contractor to calibrate your survey instruments, provide the name, address, and license number of the company or individual. If you are calibrating your own instruments, request the specific regulatory guide for calibrating instruments from MDH.

Item 10: Radiation Safety Program

You, as the licensee, are responsible for the conduct of your radiation safety program and for all actions of your employees. In addition to the information in this regulatory guide, the appendices to this regulatory guide may be useful in developing your program:

Leak Testing of Sealed Sources

Each sealed source must be tested for leakage at intervals not to exceed six months. The leak test should be performed at six-month intervals. The instrumentation should be sufficiently sensitive to detect 0.005 microcuries of radioactivity.

The following options are available for leak testing:

1. Engage the services of a consultant or commercial facility to take samples, evaluate the samples, and report the results to you.

2. Use a commercial leak test kit. You take the smear and send the smear to the kit supplier, who reports the results to you.

3. Perform the entire leak test sequence yourself, including the smears and measurement.

For Option 1, specify the name, address, and license number of the consultant or commercial organization.

For Option 2, specify the name, address, and license number of the kit supplier. In your application, you should state that the test samples will be taken by the individuals specified in Item 8 who are responsible for your radiation safety program. Commit to Appendix D.

For Option 3, indicate how the test sample will be taken. Specify the instrumentation that will be used for measurement. An instrument capable of making quantitative measurements should be used. Hand-held survey meters will not normally be considered adequate for measurements. Include a sample calculation for conversion of the measurement data to microcuries. You should also specify the individual who will make the measurement and his or her qualifications. The individual should have prior experience in making quantitative measurements, and this experience should be documented in your application. Commit to Appendices D.

Maintenance

Each licensee must inspect radiographic exposure devices, storage containers, and source changers before each day or shift of use. The licensee must also conduct a program of inspection and maintenance of radiographic exposure devices, storage containers, and source changers to ensure proper functioning of components important to safety. Inspections and maintenance should be accomplished at intervals not to exceed three months. If instruments are stored for longer than three months, maintenance should be performed before use. You must commit to a program of inspection and maintenance and submit the procedures.

Transportation of Devices

The transport of licensed material must be carried out in accordance with the applicable requirements of the Department of Transportation (DOT).

It is your obligation to obtain a copy of the DOT regulations on transportation of radioactive materials. The requirements for package labeling are in 49 CFR Part 172, subpart E of the DOT regulations.

General requirements for shipping and packaging radioactive material are in 49 CFR Part 173, subpart I. Write to the following address for a copy of these regulations:

US Government Bookstore
120 Bannister Road
Kansas City, MO 64137
(816) 765-2256

You should state that packaging and transport of the device will be carried out in accordance with the applicable DOT regulations.

The following items should be covered in the instructions to personnel:

- Labeling containers appropriately (i.e., when to use labels Radioactive White I, Radioactive Yellow II, or Radioactive Yellow III.)
- Securing the exposure device or storage container within the transport vehicle.
- Preparation of shipping papers. The instructions should specify that the papers must be completed before transporting licensed material and must be accessible in the driver's compartment at all times.
- Placarding both sides (the front and the back of the vehicle) with “RADIOACTIVE” placards if the package being transported requires a Radioactive Yellow III label.
- If an exposure device is transported in an overpack, the procedures should include instructions that the overpack must be properly marked with the shipping name and identification number, and labeled (Radioactive White I or Radioactive Yellow II).

Inventories

State that you will conduct inventories at intervals not to exceed three months to account for all sealed sources and devices containing depleted uranium received and possessed under your license. You should maintain records of the inventories for at least two years from the date of the inventory. The records should include the radionuclide and amount of material in each source; the manufacturer’s name, model number, and serial number of each device containing depleted uranium or radioactive material; and the location of each device and date of inventory.

Operating and Emergency Procedures

You should state on your application that you will provide the operating and emergency procedures to each person who uses the device. Submit the detailed operating and emergency procedures to MDH for review. See Appendix G for sample operating and emergency procedures.

Item 11: Waste Management

The only option for disposal of the licensed material contained in industrial radiography devices is to transfer the material to an authorized recipient. You should state that disposal will be by transfer of the radioactive material to a licensee specifically authorized to possess it. Authorized recipients include the original suppliers of the device, a commercial firm licensed by an Agreement State or the NRC to accept radioactive waste from other persons, or another specific licensee authorized to possess the licensed material. No one else is authorized to dispose of your licensed material.

Item 12: License Fee

If this is an application for a new license, the full fee must be included with this application. An application received without a fee or with an inadequate fee may be returned to you or delayed in processing. Fees for processed applications are not refundable. Make check or money order payable to the Minnesota Department of Health.

For license renewals, the fee is due on the date your license expires.

Item 13: Certification

Individuals acting in a private capacity are required to sign and date the *Application for Radioactive Materials License*. Otherwise, representatives of the corporation or legal entity filing the application should sign and date the form. Representatives signing an application must be authorized to make binding commitments and to sign official documents on behalf of the applicant. Signing the application acknowledges management's commitment and responsibilities for the radiation protection program. NRC will return all unsigned applications for proper signature. When the application references commitments, those items become part of the licensing conditions and regulatory requirements.

AMENDMENTS TO A LICENSE

After you are issued a license, you must conduct your program in accordance with (1) the statements, representations, and procedures contained in your application, (2) the terms and conditions of the license, and (3) the MDH rules.

It is your obligation to keep your license current. You should anticipate the need for a license amendment as far in advance as possible. If any of the information provided in your application is to be modified or changed, submit a signed application for a license amendment and include the appropriate amendment fee.

The licensee may not place into effect any amendment until receiving written verification from MDH that the amendment has been approved.

RENEWAL OF A LICENSE

An application for the renewal of a license should be filed at least 30 days before the license expiration date. This will ensure that the license does not expire before MDH has taken the final action on the application. The application for the renewal should not reference material that was previously submitted.

If you do not wish to renew your license and cannot dispose of all the licensed radioactive material in your possession before the expiration date, you must request a license renewal for storage only of the radioactive material. The renewal is necessary to avoid violating MDH rules that do not allow you to possess licensable material without a valid license.

IMPLEMENTATION

The information in this regulatory guide is *guidance*, not requirement. The Minnesota Department of Health reviews each application to ensure that users of radioactive material are capable of complying with MDH rules. This guide provides one set of methods approved by MDH for meeting the regulations and represents the minimum acceptable standards.

INSPECTIONS

MDH conducts initial inspections of new radiological programs between six and 12 months after licensed material is received and operations have begun. Subsequent routine inspections of licenses are scheduled after the initial inspection. The routine inspections are scheduled at intervals corresponding to frequency indicated in NRC Inspection Manual Chapter 2800.

APPENDIX A
TRAINING

The following guidance may be used to develop a training program. If you use the frequency and subject listings to develop your training program, the application should state, “We will establish and implement the model training program published in Appendix A to MDH Regulatory Guide for Industrial Radiography."

If you prefer, you may develop your own training program. If you do so, carefully review the requirements of 4731.4000. State in your application, “We have established a training program for your review that is appended as Appendix A.” Provide a detailed outline of each topic covered in the course.

The safety course for prospective radiographers requires at least 40 hours of classroom instruction. Regardless of whether you choose to implement the model program or one of your own, you should do the following:

- Identify the course segments by title and instructor.
- Submit a description of each demonstration provided in the course.
- If any equipment or visual aids are used, provide a description. These may include filmstrips, videotapes, movies, dummy sources, survey instruments, and handling equipment.
- Provide a copy of books, training manuals, workbooks, and handouts used in the course. If these resources are available commercially, you may instead provide the title, author(s), and publishing companies.
- Submit a copy of a typical examination together with the correct answers to the examination questions. Indicate the passing grade and describe the re-instruction to be given in areas in which individuals are found deficient. Indicate the frequency at which the test will be periodically changed. Provide the security measures taken to protect the examination and the answers.

Records of training will include the date of training. These records will be retained for three years.

INSTRUCTOR QUALIFICATIONS

Identify the instructor who will instruct in the classroom, and the topics in which they will provide instruction.

Submit specific information about the qualifications of the instructors. Include the location and date of their training in the principles of radiation and radiation safety, and identify their industrial radiography experience. The person who instructs individuals in the classroom on the principles of radiation and radiation safety should have knowledge and understanding beyond that obtainable in a course similar to the one provided to the radiographers. Alternatively, that person should possess a thorough understanding of the operation of radiographic equipment (e.g., a manufacturer's service representative).

MODEL PROCEDURE

Personnel will be instructed:

- Before assuming duties in the vicinity of radioactive material,
- During annual refresher training, and
- Whenever there is a significant change in duties, regulations, or terms of the license.

Instruction for individuals in attendance will include the following subjects:

- Applicable regulations and license conditions.
- Areas where radioactive material is used or stored.
- Potential hazards associated with radioactive material in each area where the employee will work.
- Appropriate radiation safety procedures.
- Licensee's in-house work rules.
- Each individual's obligation to report unsafe conditions to the RSO.
- Appropriate response to emergencies or unsafe conditions.
- Worker's right to be informed of occupational radiation exposure.
- Locations of notices, copies of pertinent regulations, and copies of the current license (including applications and applicable correspondence).
- Review of operating procedures.
- Question and answer period.

APPENDIX B
MODEL SIX-MONTH RADIOGRAPHER/RADIOGRAPHER TRAINEE INSPECTION CHECKLIST

Date:	Time:	
Radiographic Location:		
Radiographer/Radiographer Assistant:		
Device Model Number:	Serial Number:	
Survey Meter	**Yes**	**No**
Sufficient number of functional meters?	☐	☐
Calibrated?	☐	☐
(List date):		
Daily source check?	☐	☐
Surveys	**Yes**	**No**
Was radiation area boundary surveyed?	☐	☐
Was a physical radiation survey completed after each radiographic exposure to ensure the source has returned to a shielded condition?	☐	☐
Was a physical radiation survey completed prior to securing radiography exposure device?	☐	☐
Were records available and legible?	☐	☐
Dosimetry	**Yes**	**No**
OSD used?	☐	☐
TLD used?	☐	☐
Film Badge used?	☐	☐
Pocket Dosimeter used?	☐	☐
Calibrated? (List date):	☐	☐
Recharged at the beginning of the shift?	☐	☐
Initial reading recorded?	☐	☐
Alarming Ratemeters used?	☐	☐
Calibrated? (List date):	☐	☐
Were other individuals working within the restricted area wearing film badges, TLDs, or OSDs?	☐	☐
Were other individuals working within the restricted area wearing dosimeters and alarming ratemeters?	☐	☐

Postings	**Yes**	**No**
Was the restricted area posted with the appropriate "CAUTION (or DANGER): RADIATION AREA" sign(s)?	☐	☐
Was the high-radiation area posted with the appropriate "CAUTION (or DANGER): HIGH RADIATION AREA" sign(s)?	☐	☐
Access Control	**Yes**	**No**
Was direct surveillance of the restricted area properly controlled to prevent unauthorized entry?	☐	☐
Was the high radiation area under continuous direct observation except where entry had been prevented?	☐	☐
Exposure Device and Source	**Yes**	**No**
Was the radiographer working with proper inspected and operable equipment?	☐	☐
Was the exposure device labeled with the licensee's name, address, and telephone number?	☐	☐
Was label legible?	☐	☐
Was the exposure device labeled with the chemical symbol and mass number of the source?	☐	☐
Did the radiographer have the leak test record?	☐	☐
Control of Radioactive Material	**Yes**	**No**
Were device(s) are kept locked except when under direct surveillance?	☐	☐
When locked and not under direct surveillance, was the exposure device secured to prevent tampering and removal?	☐	☐
Transportation	**Yes**	**No**
Was the package properly marked?	☐	☐
Were shipping papers prepared?	☐	☐
Were shipping papers readily accessible while in transit?	☐	☐
Were shipping papers properly placed when vehicle is not occupied?	☐	☐
Were two independent barriers used?	☐	☐
Operating and Emergency Procedures	**Yes**	**No**
Did the radiographer/radiographer assistant possess and use a copy of the operating and emergency procedures and MDH rules and regulations for protection against radiation?	☐	☐
Was the utilization log properly filled out?	☐	☐
Did the radiographer/radiographer's assistant have sufficient knowledge of safety rules? (Determined by asking questions.)	☐	☐
Did radiographers have certification cards?	☐	☐

Summary

APPENDIX C

SUGGESTED INDUSTRIAL RADIOGRAPHY AUDIT CHECKLIST

All areas indicated in audit notes may not be applicable to every license and may not need to be addressed during each audit. For example, licensees do not need to address areas that do not apply to their activities and activities that have not occurred since the last audit need not be reviewed at the next audit.

Audit History	**4731**	**N/A**	**Yes**	**No**
Were previous audits conducted annually?	2010	☐	☐	☐
Are records of previous audits maintained?	2500	☐	☐	☐
Deficiencies identified?		☐	☐	☐
Were the deficiencies corrected?		☐	☐	☐
Organization and Scope of Program	**4731**	**N/A**	**Yes**	**No**
Radiation Safety Officer		☐	☐	☐
If the RSO was changed, was license amended?		☐	☐	☐
Does new RSO meet MDH training requirements?	4130	☐	☐	☐
Is RSO fulfilling all duties?		☐	☐	☐
Is the written agreement in place for a new RSO?		☐	☐	☐
Are there multiple locations of use?		☐	☐	☐
Are all locations listed on the license?		☐	☐	☐
If multiple locations authorized, list locations audited.		☐	☐	☐
Were annual audits performed at each location? If no, explain.		☐	☐	☐
Licensed Material	**4731**	**N/A**	**Yes**	**No**
Isotope, quantity, and use as authorized?		☐	☐	☐
Are all exposure device models and types listed on license?		☐	☐	☐
Are all source changer models and types listed on license?		☐	☐	☐
Are exposure devices, source changers, and sealed sources described in the Sealed Source and Device Registration (SSDR) Certificate?		☐	☐	☐
Are copies of the SSDR Certificates possessed or accessible?		☐	☐	☐
Are manufacturer's manuals for operation of devices possessed?		☐	☐	☐
If control of license was transferred, was MDH consent obtained prior to the transfer?		☐	☐	☐
Radiation Safety Program	**4731**	**N/A**	**Yes**	**No**
Content and implementation reviewed annually by the licensee?	2020	☐	☐	☐
Records of reviews maintained?		☐	☐	☐

Training, Retraining, and Instruction to Workers	**4731**	**N/A**	**Yes**	**No**
Have workers been provided with required instructions?		☐	☐	☐
Is the individual's understanding of current procedures and regulations adequate?		☐	☐	☐
Training program implemented?	1020	☐	☐	☐
Operating procedures?	4140	☐	☐	☐
Emergency procedures?	4150	☐	☐	☐
Periodic training required and implemented?		☐	☐	☐
Was refresher training provided, as needed?	1020 4140	☐	☐	☐
Are initial and periodic training records maintained for each individual?		☐	☐	☐
Specific training				
Written tests completed by all radiographers and radiographer trainees		☐	☐	☐
Oral tests		☐	☐	☐
All radiographers completed on-the-job training		☐	☐	☐
Records maintained		☐	☐	☐
Workers cognizant of requirements for:				
Radiation Safety Program?	2010	☐	☐	☐
Annual dose limits?	2020 2090 2095	☐	☐	☐
10% monitoring threshold?	2210	☐	☐	☐
Dose limits to embryo/fetus and declared pregnant worker?	2080	☐	☐	☐
Workers observed conducting radiographic operations?		☐	☐	☐
Workers observed performing routine maintenance of an exposure device?		☐	☐	☐
Radiographers are familiar with:		☐	☐	☐
The rules contained in 4731.2000 and 4731.4000?		☐	☐	☐
The appropriate conditions of the license or registration?		☐	☐	☐
Copies of operating and emergency procedures are furnished to radiographer trainees and radiographers?	4140	☐	☐	☐
Facilities	**4731**	**N/A**	**Yes**	**No**
Facilities are as described in the license application?		☐	☐	☐
Permanent radiographic installations meet MDH requirements?	4100	☐	☐	☐
Visible and audible radiation signals?		☐	☐	☐
Visible signal actuates if entry is attempted when source is exposed?		☐	☐	☐
Audible signal actuates if entry is attempted when source is exposed?		☐	☐	☐
System tested daily with radiation source?		☐	☐	☐
Records maintained for two years?		☐	☐	☐
Entrance controls are as described 4731 part 2000?		☐	☐	☐
High radiation areas posted?		☐	☐	☐
Storage and use of radioactive material		☐	☐	☐
Adequate method to prevent unauthorized individuals from entering restricted area?	4050	☐	☐	☐
Radioactive material secured to prevent unauthorized removal or access?		☐	☐	☐
Sources locked in devices?		☐	☐	☐
Personnel Radiation Monitoring	**4731**	**N/A**	**Yes**	**No**
Film badges, TLDs, OSDs	4170	☐	☐	☐
Supplier NVLAP approved?		☐	☐	☐

Dosimeters exchanged at required frequency?		☐	☐	☐
Dosimetry records maintained?		☐	☐	☐
Dosimeters	4170	☐	☐	☐
Read and recorded at start of each shift?		☐	☐	☐
Daily readings recorded?		☐	☐	☐
Dosimeters checked for response (±20%) at intervals not to exceed 12 months?		☐	☐	☐
Off-scale dosimeter procedure and records?		☐	☐	☐
Alarming Ratemeters	4170	☐	☐	☐
Checked that alarm functions properly at start of each shift?		☐	☐	☐
Preset at 500 mrem (5 mSv) per hour?		☐	☐	☐
Calibrated to ±20% at intervals not to exceed 12 months?		☐	☐	☐
Records maintained?		☐	☐	☐
Dose(s) exceeded regulatory limits?		☐	☐	☐
ALARA program implemented?		☐	☐	☐
Written description of ALARA program available?		☐	☐	☐
Review of Records and Reports?				
Auditor reviewed personnel monitoring records for period to _____		☐	☐	☐
Prior dose determined?	2520	☐	☐	☐
Were occupational limits met?	2020	☐	☐	☐
MDH Form 5 or equivalent provided to all monitored employees?	2520 2540	☐	☐	☐
If a worker declared her pregnancy during the audit period, then was the dose in compliance and were the records maintained?	2030 2540	☐	☐	☐
Records of exposures, monitoring, and evaluations maintained?	2500 2510 2540	☐	☐	☐
Control of Radioactive Material and Access to Radiation Areas	**4731**	**N/A**	**Yes**	**No**
Were device(s) are kept locked except when under direct surveillance?	4050	☐	☐	☐
When locked and not under direct surveillance, was the exposure device secured to prevent tampering and removal?	4050	☐	☐	☐
Was direct surveillance of the restricted area properly controlled to prevent unauthorized entry?	4190	☐	☐	☐
Was the high radiation area under continuous direct observation except where entry had been prevented?	4190	☐	☐	☐
Radiation Survey Instruments	**4731**	**N/A**	**Yes**	**No**
Survey instruments possessed?	4060	☐	☐	☐
Calibrations completed before first use?		☐	☐	☐
Instrument calibrated annually (intervals not to exceed 6 months)?		☐	☐	☐
Calibrations within 20 percent on each scale or decade of interest?		☐	☐	☐
Calibration records maintained?		☐	☐	☐
Area Surveys	**4731**	**N/A**	**Yes**	**No**
Area or facility surveys conducted	4180	☐	☐	☐
Records maintained		☐	☐	☐
Survey after each exposure, including device, guide tube, ensuring source has returned to the shielded position		☐	☐	☐
Survey of device when place in storage to ensure source is in shielded position		☐	☐	☐
Protection of members of the public		☐	☐	☐

Adequate surveys made to demonstrate		☐	☐	☐
The TEDE to the individual likely to receive the highest dose does not exceed 100 mrem (1.0 mSv) in a year, or		☐	☐	☐
That if an individual were continuously present in an unrestricted area, the external dose would not exceed 2 mrem (0.02 mSv) in any hour and 100 mrem (1.0 mSv) in a year		☐	☐	☐
Unrestricted area radiation levels do not exceed 2 mrem (0.02 mSv) in any one hour		☐	☐	☐
Records maintained		☐	☐	☐
Leak Tests	**4731**	**N/A**	**Yes**	**No**
Sealed sources	4070			
Leak test method approved		☐	☐	☐
Leak tests performed at 6-month interval		☐	☐	☐
Leakage is less than 0.005 microcuries (185 Becquerels (Bq))		☐	☐	☐
Depleted uranium (DU) shielding with S-tubes				
Test every 12 months		☐	☐	☐
DU is less than 0.005 microcuries (185 Bq)		☐	☐	☐
Records maintained for three years	4240	☐	☐	☐
Inventory	**4731**	**N/A**	**Yes**	**No**
Inventories	4080	☐	☐	☐
Conducted quarterly (not to exceed 3 months)		☐	☐	☐
Contain all required information		☐	☐	☐
Most recent inventory conducted on:				
Utilization Logs				
Utilization logs maintained		☐	☐	☐
Contain **all** required information		☐	☐	☐
Records of inventories retained?	4250	☐	☐	☐
Equipment	**4731**	**N/A**	**Yes**	**No**
Radiography devices, source assemblies and source changers in use meet requirements		☐	☐	☐
Associated equipment in use complies with		☐	☐	☐
Source changers and storage containers have radiation level less than 200 mrem/hr (2 mSv) on surface and 10 mrem/hr (0.1 mSv) at one meter		☐	☐	☐
Equipment exempted by specific license condition is used in accordance with license commitments and authorization		☐	☐	☐
Radioactive Waste	**4731**	**N/A**	**Yes**	**No**
Sources transferred to authorized individuals?	2400	☐	☐	☐
Name of organization:	2450 3105 4220			
Records of surveys and material accountability are maintained?	2510 2560	☐	☐	☐

Receipt And Transfer of Radioactive Material	**4731**	**N/A**	**Yes**	**No**
Describe how packages are received and by whom.		☐	☐	☐
Written package opening procedures established and followed?	2350	☐	☐	☐
Records of receipt/transfer maintained?	2510 3115	☐	☐	☐
Transportation (10 CFR 71.5(a) and 49 CFR 171-189)	**4731**	**N/A**	**Yes**	**No**
Shipments are:				
Delivered to common carriers;		☐	☐	☐
Transported in own private vehicle;		☐	☐	☐
Both;		☐	☐	☐
No shipments since last audit.		☐	☐	☐
Packages:				
Authorized packages used?		☐	☐	☐
Performance test records on file?		☐	☐	☐
Two labels (White-I, Yellow-II, Yellow-III) with TI, Nuclide, Activity, and Hazard Class?		☐	☐	☐
Properly marked (Shipping Name, UN Number, Package Type, RQ, Name and Address of consignee)?		☐	☐	☐
Closed and sealed during transport?		☐	☐	☐
Shipping Papers:		☐	☐	☐
Prepared and used?		☐	☐	☐
Proper Shipping Name, Hazard Class, UN Number, Quantity, Package Type, Nuclide, Radioactive Material, Physical and Chemical Form, Activity, Category of Label, TI, Shipper's Name, Certification and Signature, Emergency Response Phone Number?		☐	☐	☐
Readily accessible during transport?		☐	☐	☐
Internal Audits	**4731**	**N/A**	**Yes**	**No**
Audits/inspections of each radiographer and radiographer assistants conducted at six-month intervals or after as appropriate?	4140	☐	☐	☐
Equipment check before use each day?	4090	☐	☐	☐
Equipment inspection and maintenance performed at three-month intervals?		☐	☐	☐
Records maintained?	**4270**	☐	☐	☐
Notification and Reports	**4731**	**N/A**	**Yes**	**No**
In compliance with 4731.2600, 4731.3110 (theft or loss)?	2620	☐	☐	☐
In compliance with 4731.2610, 4731.3110 (incidents)?	3110	☐	☐	☐
In compliance with 4731.2620, 4731.3110 (overexposures and high radiation levels)?	4250	☐	☐	☐
Aware of MDH phone number?		☐	☐	☐
Notifications Since Last Audit	**4731**	**N/A**	**Yes**	**No**
Any Notifications since last audit?		☐	☐	☐
MDH notified within 30 days after Radiation Safety Officer (RSO) stops work or changes name?		☐	☐	☐
MDH notified within 30 days after:				
licensee's mailing address changes;		☐	☐	☐

licensee's name changes without a transfer of control of the license		☐	☐	☐
Amendments Since Last Audit	**4731**	**N/A**	**Yes**	**No**
Any Amendments since last audit?		☐	☐	☐
Posting and Labeling	**4731**	**N/A**	**Yes**	**No**
MDH Form, "Notice to Workers" is posted?	1010	☐	☐	☐
Other posting and labeling per 4731.2310, 4731.2330 and not exempted by 4731.2320, 4731.2340?		☐	☐	☐
Containers or devices labeled?	4030	☐	☐	☐
Recordkeeping for Decommissioning	**4731**	**N/A**	**Yes**	**No**
Records of information important to the safe and effective decommissioning of the facility maintained in an independent and identifiable location until license termination?	3080	☐	☐	☐
Records include all information outlined in?	3080	☐	☐	☐
Bulletins and Information Notices	**4731**	**N/A**	**Yes**	**No**
Bulletins, Information Notices, etc., received?		☐	☐	☐
Appropriate action in response to Bulletins, Information Notices, Generic Letters, etc.?		☐	☐	☐

Special License Conditions or Issues

Special license conditions or issues to be reviewed:

Evaluation:

Audits and Findings	
Summary of findings:	
Corrective and preventive actions:	
Audit conducted by: _____	Date: _____

APPENDIX D
MODEL PROCEDURE FOR LEAK TESTING SEALED SOURCES

You may use the following model procedure to leak test sealed sources. If you follow the model procedure for taking leak test samples for analysis by a contractor, you may state on your application, "We will establish and implement the model procedure for leak testing sealed sources published in Appendix D to the MDH Regulatory Guide for Industrial Radiography."

You may develop your own procedure for review. If you do so, you should consider for inclusion all the features in the model and carefully review the requirements of Minnesota Rules. State on your application, "We have developed a leak test procedure for your review that is appended as Appendix D," and submit your leak test procedure.

MODEL PROCEDURE FOR TAKING LEAK TEST SAMPLES

1. Make a list of all sources to be tested. This should include at least the isotope, the activity on a specified date, and the physical form.

2. If you will be testing sources greater than a few millicuries, set out a survey meter, preferably with a speaker, so you can monitor your exposure rate.

3. Prepare a separate wipe sample for each source. A cotton swab, injection prep pad, filter paper, or tissue paper is suitable. Number each wipe so you will know for which source it is to be used. Samples should be taken as follows:

    a. For small sealed sources, it may be easier to wipe the entire accessible surface area. Pay particular attention to seams and joints.

    b. For larger sealed sources and devices, take the wipe near the radiation port and on the activating mechanism.

    c. If you are testing radium sources, they should also be checked for radon leakage. Submerging the source in a vial of fine-grained charcoal or cotton for a day can do this. Then remove the source and analyze the absorbent sample as described below. A survey should be done to be sure that sources are adequately shielded during the leak test period.

MODEL PROCEDURE FOR ANALYZING LEAK TEST SAMPLES

The samples will be analyzed as follows:

1. Select an instrument that is sufficiently sensitive to detect the 0.005 microcuries. For beta sources, a proportional flow counter, liquid scintillation counter, or thin-end-window GM survey meter may be appropriate. For gamma sources, A GM instrument or a scintillation detector with either a ratemeter or scaler may be appropriate. Dose calibrators used in nuclear medicine are not sufficiently sensitive.

2. To estimate the detection efficiency of the analyzer used to assay the wipe samples, assay a check source that has the same isotope as the sealed source and whose activity the supplier certifies. If one is not available, it will be necessary to use a certified check source with a different isotope that has a similar spectrum. If calculations demonstrate that the instrument is not sufficiently sensitive to detect 0.005 microcuries, a different instrument must be used.

3. Assay the wipe sample. It must be in the same geometry relative to the detector as was the certified check source.

4. Record the wipe sample in counts per minute. Then calculate and record the estimated activity in microcuries on the wipe sample.

5. Continue the same analysis procedure for all wipe samples.

6. If the wipe sample activity is 0.005 microcuries or greater, notify the RSO. The source must be withdrawn from use to be repaired or disposed of in accordance with MDH rules.

7. Record model number and serial number (if assigned) of each source tested, radionuclide and estimated activity, measured activity of each test sample in microcuries, description of method used to test each sample, date of test, and signature of RSO. Maintain records for three years.

APPENDIX E
DAILY MAINTENANCE CHECK OF RADIOGRAPHIC EQUIPMENT

The radiographer or radiographer's assistant shall perform a daily maintenance check of the exposure device and related radiographic equipment. This inspection will be performed before using the equipment on each day the equipment is to be used. Report defective equipment to the RSO immediately. Do **not** attempt to use defective equipment. After the inspection, document the results of the inspection.

- Inspect the survey meter. If batteries are low, replace, and then check for operability. If you are not able to correct a problem with the survey meter, obtain another meter and start over.
- Check the survey meter with a check source (or check with camera) as indicated on the survey meter[4]. If the reading is not acceptable, obtain another meter and start again.
- Inspect the remote-control radiographic equipment as follows:

    - Inspect the cables for cuts, breaks, and broken fittings.
    - Carefully inspect approximately one foot of the drive cable immediately next to the male connector. Take care not to introduce any dirt or dust on the drive cable during this inspection. In addition to the previously mentioned items, the examination of the cable should look for any of the following:

        - excessive or uneven wearing
        - fraying
        - unraveling
        - nicks
        - kinks or bends
        - loss of flexibility (abnormal stiffness)
        - excessive grit or dirt
        - stretching

    - Inspect the crank unit for damage and loose hardware.
    - Check operation of the control for freedom of drive cable movement.
    - Inspect the guide tube for cuts, crimps, and broken fittings.
    - Survey for radiation levels and record readings. The radiation levels should be about the same as those in the previous day's inspection, unless there has been a source change.
    - Check that all safety plugs are in place.
    - Inspect the exposure device for damage to fittings, lock, fasteners, and labels.
    - Check for any impairment of the locking mechanism.

- Record the results of the daily inspection.

[4] The RSO or calibration vendor should determine the acceptable meter reading for each survey meter and post the expected reading on each instrument. This reading shall be obtained and noted at the time of calibration

APPENDIX F
TRANSPORTATION

The following information summarizes The Department of Transportation training requirements and provides a reference to other DOT regulations.

US Department of Transportation Training Requirements

The *Federal Hazardous Materials Transportation Law* requires the training of all hazardous material (HAZMAT) employees. "Hazardous material" means a substance or material capable of posing an unreasonable risk to health, safety, or property when transported in commerce. The training requirements are to increase a HAZMAT employee's safety awareness. As such, training is considered an essential element in reducing hazardous material incidents. As it pertains to a medical facility, a HAZMAT employee is any person who directly affects hazardous material transportation safety including a person who:

- loads, unloads, or handles hazardous material;
- marks packages for use in the transportation of hazardous material;
- prepares hazardous material for transportation;
- is responsible for safety of transporting hazardous material; or
- operates a vehicle used to transport hazardous material.

Each employer must train, test, certify, and retain records of current training for each HAZMAT employee to ensure knowledge of hazardous materials and the Hazardous Material Regulations as well as to ensure that the employee can perform assigned HAZMAT functions properly. (See 49 CFR 172.700 through 172.704.) HAZMAT training must include:

- general awareness/familiarization
- function-specific;
- safety;
- security awareness;
- In-depth security training, if a security plan is required; and
- driver training (for each HAZMAT employee who will operate a motor vehicle).

Initial training

A new employee, or an employee who changes job functions, may perform HAZMAT job functions before completing training, provided:

- the employee does so under the direct supervision of a properly trained and knowledgeable HAZMAT employee; and
- the HAZMAT training is completed within 90 days of employment of change in job function.

Recurrent Training

Training is required at least once every three years. The three-year period begins on the actual date of training. Relevant training received from a previous employer or source may be used to satisfy the requirements provided a current record of training is obtained from the previous employer or other sources.

Training records

Training records must include the following information:

- HAZMAT employee's name;
- completion date of most recent training;
- training materials (copy, description, or location);
- name and address of HAZMAT training; and

- certification that the HAZMAT employee has been trained and tested.

49 CFR References

Licensed material must be transported in accordance with DOT regulations. The major areas in the DOT regulations that are most relevant for transportation of Type A or Type B quantities of licensed material are:

- Table of Hazardous Materials and Special Provisions 49 CFR 172.101: Purpose and use of hazardous materials table;
- Shipping Papers 49 CFR 172.200-204: Applicability, general entries, description of hazardous material on shipping papers, additional description requirements, shipper's certification;
- Package Marking 49 CFR 172.300, 49 CFR 172.301, 49 CFR 172.303, 49 CFR 172.304, 49 CFR 172.310, 49 CFR 172.324: Applicability, general marking requirements for non-bulk packagings, prohibited marking, marking requirements, radioactive material, hazardous substances in non-bulk packaging;
- Package Labeling 49 CFR 172.400, 49 CFR 172.401, 49 CFR 172.403, 49 CFR 172.406, 49 CFR 172.407, 49 CFR 172.436, 49 CFR 172.438, 49 CFR 172.440: General labeling requirements, prohibited labeling, Class 7 (radioactive) material, placement of labels, label specifications, radioactive white-I label, radioactive yellow-II label, radioactive yellow-III label;
- Placarding of Vehicles 49 CFR 172.500, 49 CFR 172.502, 49 CFR 172.504, 49 CFR 172.506, 49 CFR 172.516, 49 CFR 172.519, 49 CFR 172.556: Applicability of placarding requirements, prohibited and permissive placarding, general placarding requirements, providing and affixing placards: highway, visibility and display of placards, general specifications for placards, RADIOACTIVE placard;
- Emergency Response Information 49 CFR 172.600, 49 CFR 172.602, 49 CFR 172.604: Applicability and general requirements, emergency response information, emergency response telephone number;
- Training 49 CFR 172.702, 49 CFR 172.704: Applicability and responsibility for training and testing, training requirements;
- Shippers – General Requirements for Shipments and Packaging 49 CFR 173.403, 49 CFR 173.410, 49 CFR 173.411, 49 CFR 173.412, 49 CFR 173.413, 49 CFR 173.415, 49 CFR 173.416, 49 CFR 173.433, 49 CFR 173.435, 49 CFR 173.441, 49 CFR 173.471, 49 CFR 173.475, 49 CFR 173.476: Definitions, general design requirements, industrial packages, additional design requirements for Type A packages, requirements for Type B packages, authorized Type A packages, authorized Type B packages, requirements for determining A1 and A2 values for radionuclides and for the listing of radionuclides on shipping papers and labels, table of A1 and A2 values for radionuclides, radiation level limitations, requirements for U.S.
- NRC-approved packages, quality control requirements prior to each shipment of Class 7 (radioactive) materials, approval of special form Class 7 (radioactive) materials; and
- Carriage by Public Highway 49 CFR 177.816, 49 CFR 177.817, 49 CFR 177.834(a), 49 CFR 177.842: Driver training, shipping papers, general requirements (packages secured in a vehicle), Class 7 (radioactive) material.

For additional transportation information, licensees may consult DOT's "A Review of the Department of Transportation Regulations for Transportation of Radioactive Materials" or contact the DOT at <http://www.dot.gov>.

APPENDIX G
OPERATING AND EMERGENCY PROCEDURES

You may use the following model procedure to leak test sealed sources. If you follow the model procedure for Operating and Emergency Procedures, you may state on your application, "We will establish and implement the model procedure for Operating and Emergency Procedures published in Appendix G to the MDH Regulatory Guide for Industrial Radiography."

You may develop your own procedure for review. If you do so, you should consider for inclusion all the features in the model and carefully review the requirements of the Minnesota Rules. State on your application, "We have developed operating and emergency procedures for your review that is appended as Appendix G," and submit your operating and emergency procedures.

MODEL OPERATING AND EMERGENCY PROCEDURES

Handling and Use of Sources of Radiation
Procedures should include systematic procedures for the handling and use of devices containing sources of radiation so that an individual will not receive an exposure in excess of the limits specified in 4731.2000.

Methods and Occasions for Conducting Radiation Surveys
The procedures should identify

- when surveys will be made.
- what should be surveyed.
- acceptable radiation levels.

Necessary surveys include the following:

- Surveys that verify that the source has been returned to the shielded position. These surveys are conducted after each exposure. This survey should include both the source tube, if one is used, and the device.
- Surveys of the restricted area perimeter. NOTE: It is not necessary to perform a survey of the perimeter of the high radiation area. Exposure levels may be determined by calculation, in keeping with the ALARA concept.
- Determination of radiation levels at the external surfaces of temporary storage facilities.
- Determination of radiation levels in the cab of transportation vehicles and around vehicles used for transporting sources and devices.
- Determination that sources are in safe storage positions before securing radiographic exposure devices or storage containers.
- Determinations that the containers prepared for shipment comply with the regulations of the Department of Transportation.

Methods of Controlling Access to Radiographic Areas

- Procedures should ensure that a second radiographer observes the operations and is capable of providing immediate assistance to prevent unauthorized entry.
- Include procedures to control access to areas in which radiographic operations are being performed such as posting, constant surveillance of perimeter of the restricted area, and steps to follow when unauthorized personnel enter the restricted area.

Methods and Occasions for Locking and Securing Radiographic Exposure Devices, Storage Containers and Sealed Sources

- The procedures should contain instructions for securing the source at the time of the survey to determine that the source has been returned to the shielded position after each exposure. This is usually accomplished by locking the device. However, other methods may be preferred.
- You should state that the radiographic exposure device will be stored in a locked enclosure (transport vehicle, store room, closet, shed, etc.) in a way that will prevent access by unauthorized persons. You should keep in mind that the radiographic exposure device needs to be in storage or physically watched by an authorized user at all times. It is not acceptable for a radiographic exposure device to be chained to a post or left lying unattended at the place of use during lunch or breaks, because the radiographic exposure device would then be accessible to unauthorized persons.
- Provide instructions and procedures for storage of sources and devices at both permanent and temporary job sites including posting of storage areas, and surveys around the storage area. Any area outside the storage area should be considered an unrestricted area.

Personnel Monitoring

Procedures should state that personnel are required to wear direct-reading pocket dosimeters, alarm rate-meters, and personnel monitoring devices (film badges, TLDs, or OSDs) when they are engaged in radiographic operations. Personnel should be instructed to charge pocket dosimeters at the start of each workday so the dosimeters are capable of reading full scale. Readings should be recorded at the beginning and end of each workday. Alarm rate-meters should be tested at the start of each shift to ensure that the alarm functions properly (audibly). Include instructions regarding how and where dosimetry devices are to be stored when not in use.

Include instructions for action taken in the case of a lost, damaged, or off-scale pocket dosimeter.

Transportation to Field Locations, Including Packaging of Sources of Radiation in the Vehicles, Posting of Vehicles, and Control of Sources of Radiation during Transportation

- The transportation of radioactive material over public highways in exposure devices or storage containers is subject to US Department of Transportation regulations (DOT).
- The procedures should contain instructions on how exposure devices and storage containers should be secured within a transporting vehicle to prevent movement and possible damage to, or loss of, the exposure device or storage container.
- Instructions for surveys should be available in and around the vehicle. For the passenger compartment, it is recommended that the radiation level not exceed 2 milliroentgens (mR) per hour. Although it is not specifically required for transport, there are occasions when the vehicle may be used for storage. In that case, the area outside the vehicle should be considered an unrestricted area so that a specification of the radiation level of 2 mR per hour at any external surface of the vehicle should be provided. When a vehicle is used for storage, it must be posted with a "Caution, Radioactive Material" sign.

Minimizing Exposure of Individuals in the Event of an Accident

These procedures must contain clear and specific instructions concerning emergencies. In general, the steps to be taken by radiography personnel should be limited to:

- Surveying the area;
- Establishing the restricted area;

- Notifying appropriate persons; and
- Maintaining direct surveillance and control over the area until the situation is corrected.

The Procedure for Notifying Proper Personnel in the Event of an Accident or Unusual Occurrence
Procedures should be provided with the name of appropriate personnel to contact in case of an accident or unusual occurrence. MDH telephone numbers should be included. Procedures should contain instructions to radiography personnel, outlining the records that must be maintained during the course of their work. This would include, but not necessarily be limited to, the following:

- Dosimeter records;
- Utilization records;
- Survey records; and
- Records of the daily inspection and maintenance of radiographic equipment.

The Daily Inspection and Maintenance of Radiographic Exposure Devices, Storage Containers, Survey Meters and Personnel Monitoring Devices
These procedures should contain specific instructions for the radiographer to perform daily inspections of radiographic equipment. These checks may not be as detailed as the quarterly inspection and preventive maintenance, but should follow the guidelines recommended by the manufacturer of the equipment. A checklist should be provided for the radiographer, listing the items to be covered in the daily inspection. If the equipment manufacturer's procedures are to be followed, this should be included as a part of the operating procedures, not merely referenced.

Identifying and Reporting Defects and Noncompliance
If radiography personnel discover any malfunction or defect in radiography equipment, instructions should require management notification so it can take appropriate reporting action.

SUMMARY OF REVISIONS

REVISION	SECTION	DESCRIPTION