USE OF RADIONUCLIDES IN THE HEALING ARTS

4731.1200 Applicability for the use of radionuclides in the healing arts. This rule contains the requirements and provisions for the medical use of radioactive material and for the issuance of specific licenses authorizing the medical use of radioactive material. The requirements and provisions of 4731.1200-4731.1220 are in addition to and not in substitution for other requirements in Chapter 4731. Nothing in 4731.1200-4731.1220 relieves the licensee from complying with applicable state, FDA, other federal requirements governing radioactive drugs or devices.

4731.1201 License for Medical Use of Radioactive Materials

Subpart 1. **License required.** Licensing requirements can be found in 4731.0300-4731.0320.

A. A person may manufacture, produce, acquire, receive, possess, prepare, use or transfer radioactive material for medical use only in accordance with a specific license issued by the commissioner or NRC, or an agreement state or as allowed in 4731.1201, subp. 1, B,(1) and (2), below.

B. A specific license is not needed for an individual who:

(1) receives, possesses, uses, or transfers radioactive material in accordance with the regulations in Chapter 4731 under the supervision of an authorized user as provided in 4731.1202, subp 4, unless prohibited by license condition; or

(2) prepares unsealed radioactive material for medical use in accordance with the regulations Chapter 4731 under the supervision of an authorized nuclear pharmacist or authorized user as provided in 4731.1202, subp. 4, unless prohibited by license condition.

Subp 2. **Application for license, amendment, or renewal.**

A. An application must be signed by the applicant's or licensee's management.

B. An application for a license for medical use of radioactive materials as described in 4731.1211, subparts 1 and 3, 4731.1212, subparts 1,2, and 4, 4731.1213, subp. 1, and 1201, subp 7, must include:

(1) an application on form 4731.3004, 4, that includes the facility diagram, equipment, and training and experience qualifications of the Radiation Safety Officer, authorized user(s), authorized medical physicist(s), and authorized nuclear pharmacist(s); and

(2) procedures required by 4731.1203, subp. 6, and 4731.1210, subparts 1,2, and 4, as applicable.

C. A request for a license amendment or renewal must include:

(1) an application on 4731.3004, 4, or a letter requesting the amendment or renewal; and

(2) procedures required by 4731.1203, subp. 6, and 4731.1210, subparts 1, 2, and 4, as applicable.

D. In addition to the requirements in 4742.1202, subp.2, B and C, above, an application for a license or amendment for medical use of radioactive material as described in 4731.01210, subp. 7 must also include information regarding any radiation safety aspects of the medical use of the material that is not addressed in 4731.1201-4731.1206.

(1) the applicant must also provide specific information on:

(a) radiation safety precautions and instructions;

(b) methodology for measurement of dosages or doses to be administered to patients or human research subjects; and

(c) calibration, maintenance, and repair of instruments and equipment necessary for radiation safety.

(2) the applicant or licensee must also provide any other information requested by the commissioner for review of the application.

E. An applicant that satisfies the requirements specified in 4731.0310, subp. 2 may apply for a Type A specific license of broad scope.

Subp 3. **License amendments.** A licensee shall apply for and must receive a license amendment:

A. Before the licensee receives, prepares, or uses radioactive material for a type of use that is permitted under 4731.1200-4731,1220, but not authorized on the licensee's current license, issued under Chapter 4731;

B. Before the licensee permits anyone to work as an authorized user, authorized nuclear pharmacist or authorized medical physicist under the license, except an individual who is:

(1) an authorized user who meets the requirements in.:

(a) 4731.1207, subparts 1 A, 2 A, 3 A, 4 A, 5 A, 12 A, 13 A, 14 A, and 4731.0152, subp. 1, D;

(2) an authorized nuclear pharmacist who meets the requirements in 4731.0152, subp. 1, D and subp. 7, B;

(3) an authorized medical physicist who meets the requirements in 4731.0152.subp. 1, D, and subp. 7, A;

(4) identified as an authorized user, an authorized nuclear pharmacist, or authorized medical physicist:

(a) on the commissioner, NRC or agreement state license or equivalent permit that authorizes the use of radioactive material in medical use or in the practice of nuclear pharmacy, respectively;

(b) on a permit issued by the commissioner, NRC, an agreement state specific license of broad scope that is authorized to permit the use of radioactive material in medical use or in the practice of nuclear pharmacy;

(c) on a permit issued by a commissioner master material licensee that is authorized to permit the use of radioactive materials in medical use or in the practive of nuclear pharmacy; or

(d) by a commercial nuclear pharmacy that has been authorized to identify authorized nuclear pharmacists.

C. Before radiation safety officers are changed, except as provided in 4731.1202, subp. 1, C;

D. Before radioactive material is ordered in excess of the amount, or radionuclide or form that is different than the radionuclide or form authorized on the license;

E. Before additions or changes are made to the areas identified in the application or on

the license, except for areas where radioactive material is used in accordance with 4731.1212, subparts 1 and 2;

F. Before address(es) identified in the application or on the license are changed; and

G. Before revision of procedures required by 4731.1203, subp. 6, and 4731.1210, subparts 1, 2, and 4. as applicable, where such revision reduces radiation safety.

Subp 4. **Notification of license changes**

A. A licensee shall provide the commissioner a copy of

(1) the board certification,

(2) the commissioner or agreement state license,

(3) the permit issued by a commissioner's master material licensee; or

(4) the permit issued by a commissioner's master material licensee broad scope licensee for each individual, no later than 30 days after the date that the licensee permits the individual to work as an:

(a) authorized user,

(b) authorized nuclear pharmacist, or

(c) authorized medical physicist, under 4731.1201, subp. 3, B.

B. A licensee shall notify the commissioner by letter no later than 30 days after:

(1) an authorized user, an authorized nuclear pharmacist, a radiation safety officer, or an authorized medical physicist permanently discontinues performance of duties under the license or has a name change;

(2) the licensee's mailing address changes;

(3) the licensee's name changes, but the name change does not constitute a transfer of control of the license as described in 4731.0300, subp. 1,G; or

(4) the licensee has deleted or otherwise changed the areas where radioactive material is used in accordance with 4731.1212, subparts 1 and 2.

C. The licensee shall mail the documents required in this part to the Radiation Control Unit, Asbestos, Indoor Air, Lead, and Radiation Section, Minnesota Department of Health.

Subp 5. **Exemptions regarding Type A specific licenses of broad scope.**

A licensee possessing a Type A specific license of broad scope for medical use is exempt from:

A. The provisions of 4731.1202, subp. 2, D regarding the need to fille an amendment to the license for medical use of radioactive materials as described in 4731.1201, subp. 7.

B. The provisions of 4731.1201, subp. 3, B;

C. The provisions of 4731.1201, subp. 3, E regarding additions to or changes in the areas of use only at the addresses specified in the license;

D. The provisions of 4731.1201, subp. 4, A;

E. The provisions of 4731.1201, subp. 4, B, (1), for an authorized user, an authorized nuclear pharmacist, or an authorized medical physicist;

F. The provisions of 4731.1201, subp. 4, B, (4); and

G. The provisions of 4731.1211, subp. 2, A.

Subp 6. **License issuance.**

A. The commissioner may issue a license for the medical use of radioactive material if:

(1) the applicant has filed form 4731.3004, 4. in accordance with the instructions in 4731.1201, subp. 2;

(2) the applicant has paid any applicable fee as provided in 4731.0104, subp. 1 ;

(3) the commissioner finds the applicant equipped and committed to observe the safety standards established by the commissioner in this chapter for the protection of the public health and safety; and

(4) the applicant meets the requirements of 4731.0300-4731.0320.

B. The commissioner may issue a license for mobile medical services if the applicant:

(1) meets the requirements in 4731.1201, subp. 6, A, above; and

(2) provides assurances that individuals or human research subjects to whom unsealed radioactive material or radiation from implants containing radioactive material will be administered may be released following treatment in accordance with 4731.1204, subp, 2.

Subp 7 **Other medical uses of radioactive material or radiation from radioactive material.** A licensee may use radioactive material or a radiation source approved for medical use which is not specifically addressed in 4731.1200-4731.1220, if:

A. The applicant or licensee has submitted the information required by 4731.1201, subp. 2, B - D; and

B. The applicant or licensee has received written approval from the commissioner in a license or license amendment and uses the material in accordance with the regulations and specific conditions the commissioner considers necessary for the medical use of the material.

4731.1202 Radiation Safety Program

Subpart 1. **Authority and responsibilities for the radiation safety program.**

A. In addition to the radiation safety program requirements of 4731.0131, subp. 1, a licensee's responsible administrator must approve in writing:

(1) requests for license application, renewal, or amendments before submittal to the commissioner

(2) any individual before allowing that individual to work as authorized user, authorized nuclear pharmacist, authorized medical physicist; and

(3) radiation safety program changes that do not require a license amendment and are permitted under 4731.1202, subp. 2

B. A licensee's management shall appoint a Radiation Safety Officer, who agrees, in writing, to be responsible for implementing the radiation safety program. The licensee, through the Radiation Safety Officer, shall ensure that radiation safety activities are being performed in accordance with licensee-approved procedures and regulatory requirements.

C. For up to 60 days each year, a licensee may permit an authorized user or an individual qualified to be a Radiation Safety Officer, under 4731.0128, subp, 7 and 4731.0152, subp. 1, D, to function as a temporary Radiation Safety Officer and to perform the functions of a Radiation Safety Officer, as provided in 4731.1202, subp. 1, G, below, if the licensee takes the actions

required by 4731.1202, subp.1, B, E, G, and H, below and notifies the commissioner in accordance with 4731.1201, subp. 4, B.

D. A licensee may simultaneously appoint more than one temporary Radiation Safety Officer in accordance with 4731.1202, subp 1, C, above, if needed to ensure that the licensee has a temporary Radiation Safety Officer that satisfies the requirements to be a Radiation Safety Officer for each of the different types of uses of radioactive material permitted by the license.

E. A licensee shall establish in writing the authority, duties, and responsibilities of the Radiation Safety Officer.

F. Licensees that are authorized for two or more different types of uses of radioactive materials under 4731.1202, E, F, and H, or two or more types of units under 4731.1202, H, shall establish a Radiation Safety Committee to oversee all uses of radioactive material permitted by the license. The committee must include an authorized user of each type of use permitted by the license, the Radiation Safety Officer, a representative of management who is neither an authorized user nor a Radiation Safety Officer. The committee may include other members the licensee considers appropriate.

G. A licensee shall provide the Radiation Safety Officer sufficient authority, organizational freedom, time resources, and management prerogative, to:

(1) identify radiation safety problems;

(2) initiate, recommend, or provide corrective actions;

(3) stop unsafe operations; and,

(4) verify implementation of corrective actions.

H. A licensee shall retain a record of actions taken pursuant to 4731.1202, subp. 1, A, B, and E above, in accordance with 4731.1214, subp. 1, C.

Subp 2. **Radiation safety program changes.**

A. A licensee may revise the facility radiation safety program without commissioner approval if:

(1) the revisions do not require an amendment under 4731.1201, subp. 3;

(2) the revisions are in compliance with the regulations and the license;

(3) the revisions have been reviewed and approved by the Radiation Safety Officer and licensee's responsible administrator; and

(4) the affected individuals are instructed on the revised program before the changes are implemented.

B. A licensee shall retain a record of each change in accordance with 4731.1214, subp. 1,

Subp 3. **Radiation review committee**. Every facility in which radioactive material and medical accelerators are used must have a committee which coordinates the use of radioactive material and medical accelerators within the facility and ensures the radiation safety of the patients and persons involved during the use of the radioactive material and accelerators.

Subp 4. **Preparation of radioactive material under supervision.**

A. A licensee that permits the receipt, possession, use, or transfer of radioactive material by an individual under the supervision of an authorized user or as allowed by 4731.1201, subp.

B, shall:

(1) instruct the supervised individual in the licensee's written radiation protection procedures, written directive procedures, regulations of this chapter, and license conditions with respect to the use of radioactive material; and

(2) require the supervised individual to follow:

(a) the instructions of the supervising authorized user for medical uses of radioactive material,

(b) written radiation protection procedures established by the licensee, regulations of this chapter; and

(c) license conditions with respect to the medical use of radioactive material.

B. A licensee that permits the preparation of radioactive material for medical use by an individual under the supervision of an authorized nuclear pharmacist or physician who is an authorized user, as allowed by 4731.1201, subp. 1, B, (2), shall:

(1) instruct the supervised individual in the preparation of radioactive material for medical use, as appropriate to that individual's use of radioactive material; and

(2) require the supervised individual to follow:

(a) the instructions of the supervising authorized user or authorized nuclear pharmacist regarding the preparation of radioactive material for medical use,

(b) the written radiation protection procedures established by the licensee and the regulations of this chapter, and

(c) license conditions.

C. A licensee that permits supervised activities under 4731.1202, subp. 4, A and B, above, is responsible for the acts and omissions of the supervised individual.

Subp 5. Reserved

Subp 6. **Written directives**

A. A written directive must be prepared, dated, and signed by an authorized user prior to administration of :

(1) I-131 sodium iodide greater than 30 Microcuries (1.11 Megabequerels Mbq),

(2) any therapeutic dosage of unsealed radioactive material, or

(3) any therapeutic dose of radiation from radioactive material.

If because of the emergent nature of the patient's condition, a delay in order to provide a written directive would jeopardize the patient's health, an oral directive is acceptable. The information contained in the oral directive must be documented as soon as possible in writing in the patient's record. A written directive must be prepared within 48 hours of the oral directive.

B. The written directive must contain the patient or human research subject's name and the following:

(1) for any administration quantities greater than 30 microcuries (1.11 MBq) of sodium iodide I-131: the dosage;

(2) for an administration of a therapeutic dosage of an unsealed radiopharmaceutical other than sodium iodide I-131: the radiopharmaceutical, dosage, and route

of administration;

(3) for gamma stereotactic radiosurgery: the total dose, treatment site, and values for the target coordinate settings per treatment for each anatomically distinct treatment site.

(4) for teletherapy: the total dose, dose per fraction, number of fractions, treatment site;

(5) for high dose-rate remote afterloading brachytherapy: the radionuclide, treatment site, dose per fraction, number of fractions, and total dose; or

(6) for all other brachytherapy:

(a) prior to implantation: treatment site, the radionuclide, and dose; and

(b) after implantation but before completion of the procedure: the radionuclide, treatment site, number of sources, and the total source strength and exposure time, or the total dose.

C. A written revision to an existing written directive may be made if the revision is dated and signed and signed by an authorized user before the administration of the dosage of unsealed radioactive material, the brachytherapy dose, the gamma stereotactic radiosurgery dose, the teletherapy dose, or the next fractional dose. If, because of a patient's condition:

(1) a delay in order to provide a written revision to an existing written directive would jeopardize the patient's health, an oral revision to an existing written directive is acceptable; and

(2) the oral revision must be documented as soon as possible in the patient's record; and

(3) a revised written directive must be signed by the authorized user within 48 hours of the oral revision.

D. The licensee shall retain the written directive in accordance with 4731.1214, subp. 1, E.

Subp. 7. **Procedures for administrations requiring a written directive.**

A. For any administration requiring a written directive, the licensee must develop, implement, and maintain written procedures to provide high confidence that:

(1) the patient's or human research subject's identity is verified before each administration; and

(2) each administration is in accordance with the written directive.

B. The procedures required by 4731.1202, subp. 7, A, must, at a minimum, address:

(1) verifying the identity of the patient or human research subject;

(2) verifying that the administration is in accordance with the treatment plan, if applicable, and the written directive;

(3) checking both manual and computer-generated dose calculations; and

(4) verifying that any computer-generated dose calculations are correctly transferred into the consoles of therapeutic medical devices authorized by 4731.1211, subp. 3.

C. A licensee shall retain a copy of the procedures required under 4731.1202, subp 7, A, above, in accordance with 4731.1214, subp. 1, H.

4731.1203 Requirements for Patient or Human Subject Research Program.

Subpart 1. **Provisions for the protection of human research subjects.**

A. A licensee may conduct research involving human research subjects only of the licensee uses radioactive materials specified on the license and for the uses authorized on the license.

B. If the research is conducted, funded, supported, or regulated by a federal or another agreement state agency that has implemented the Federal Policy for the Protection of Human Subjects (Federal Policy), the licensee must, before conducting research:

(1) obtain review and approval of the research from an "Institutional Review Board, " as described in the Federal Policy; and

(2) obtain "informed consent" as described in the Federal Policy, from the human research subject.

C. If the research will not be conducted, funded, supported, or regulated by a federal or another agreement state agency , the licensee must, before conducting research, apply for and receive a specific amendment to the license for medical use obtained from the commissioner. The amendment request must include a written commitment that the licensee will, before conducting research:

(1) obtain review and approval of the research from an "Institutional Review Board," as defined and described in the Federal Policy; and

(2) obtain "informed consent," as defined in the Federal Policy from the human research subject.

D. Nothing in 4731.1203, subp. 1 relieves licensees from complying with the other rules in 4731.1200-4731.1220.

Subp 2. **Safety instruction for patients and human research subjects who have been given unsealed radioactive materials and who cannot be released under 4731.1204, subp. 2.** In addition to 4731.0151, subp. 1:

A. A licensee must provide radiation safety instruction, initially and at least annually, to personnel caring for patients or human research subjects who cannot be released under 4731.1204, subp. 2. To satisfy this requirement, the instruction must be commensurate with the duties of the personnel and include:

(1) patient or human research subject control;

(2) visitor control including:

(a) routine visitation to hospitalized individuals in accordance with 4731.0126,subp. 1, A; and

(b) visitation authorized in accordance with 4731.0126, subp. 1, C;

(3) contamination control;

(4) waste control; and

(5) notification of the Radiation Safety Officer, or his designee and the authorized user, if the patient or the human research subject has a medical emergency or dies.

B. A licensee shall retain a record of individuals receiving instruction in accordance with 4731.1214, subp. 1, B.

Subp 3. **Safety precautions for patients and human research subjects receiving unsealed radioactive material and who cannot be released under 4731.1204, subp 2.**

A. For each patient or human research subject that cannot be released in accordance with 4731.1204, subp. 2, a licensee must:

(1) quarter the patient or the human research subject in either:

(a) a private room with a private sanitary facility; or

(b) a room, with a private sanitary facility, with another individual who also has received therapy with unsealed radioactive material and who also has received therapy with unsealed radioactive material and who also cannot be released under 4731.1204, subp. 2;

(2) visibly post the patient's or the human research subject's room with a "Radioactive Materials" sign;

(3) note on the door or in the patient's or human research subject's chart where and how long visitors may stay in the patient's or human research subject's room; and

(4) either:

(a) monitor material and items removed from the patient's or the human research subject's room to determine that their radioactivity cannot be distinguished from the natural background radiation level with a radiation detection survey instrument set on its most sensitive scale and with no interposed shielding, or

(b) handle such material and items as radioactive waste.

B. A licensee must notify the Radiation Safety Officer or his or her designee, and the authorized user as soon as possible if the patient or human research subject has a medical emergency or dies.

Subp 4. **Safety instruction for patients and human research subjects receiving brachytherapy.** In addition to the requirements in 4731.0151, subp. 1:

A. The licensee must provide radiation safety instruction initially and at least annually, to personnel caring for patients or human research subjects that are receiving brachytherapy therapy and cannot be release in accordance with 4731.1204, subp. 2. To satisfy this requirement, the instruction must be commensurate with the duties of the personnel and include the following information:

(1) size and appearance of the brachytherapy source;

(2) safe handling and shielding instructions;

(3) patient or human research subject control;

(4) visitor control, including both:

(a) routine visitation of hospitalized individuals in accordance with 4731.0126,subp.1, A; and

(b) visitation authorized in accordance with 4731.0126, subp. 1, C; and

(5) notification of the authorized user and Radiation Safety Officer, or his or her designee, and an authorized user if the patient or the human research subject has a medical emergency or dies.

B. A licensee must retain a record of individuals receiving instruction in accordance with 4731.1214, subp. 1, B.

Subp 5. **Safety precautions for patients and human research subjects receiving brachytherapy.**

A. For each patient or human research subject receiving brachytherapy and cannot be released under 4731.1204, subp. 2, a licensee must:

(1) not quarter the patient or the human research subject in the same room as an individual who is not receiving radiation therapy; and

(2) visibly post the patient's or human research subject's room with a "Radioactive Materials" sign; and

(3) note on the door or in the patient's or human research subject's chart where and how long visitors may stay in the patient's or human research subject's room.

B. A licensee must have available applicable emergency response equipment available near each treatment room to respond to a source:

(1) dislodged from the patient; and

(2) lodged within the patient following removal of the source applicators.

C. A licensee shall notify the Radiation Safety Officer, or his or her designee, and an authorized user as soon as possible, if the patient or human research subject has a medical emergency or dies.

Subp 6. **Safety procedures and instructions for remote afterloader units, teletherapy units, and gamma stereotactic radiosurgery units.**

A. A licensee must:

(1) securing the unit, the console, the console keys, and the treatment room when not in use or unattended;

(2) permit only individuals approved by the authorized user, Radiation Safety Officer, or authorized medical physicist to be present in the treatment room during treatment with the source(s);

(3) prevent dual operation of more than one radiation producing device in a treatment room if applicable; and

(4) develop, implement, and maintain written procedures for responding to an abnormal situation when the operator is unable to place the source(s) in the shielded position, or remove the patient or human research subject from the radiation field with controls from outside the treatment room. These procedures must include:

(a) instructions for responding to equipment failures and the names of the individuals responsible for implementing corrective actions;

(b) the process for restricting access to and posting of the treatment area to minimize the risk of inadvertent exposure; and

(c) the names and telephone numbers of the authorized users, the authorized medical physicist, and the Radiation Safety Officer to be contracted if the unit or console operates abnormally.

B. A copy of the procedures required by 4731.1203, subp. 6, A, (4), above, must be physically located at the unit console.

C. A licensee must post instructions at the unit console to inform the operator of:

(1) the location of the procedures required by 4731.1203, subp. 6, A, (4), above;

and

(2) the names and telephone numbers of the authorized users, the authorized medical physicist, and the Radiation Safety Officer to be contracted if the device or console unit or console operates abnormally.

D. A licensee must provide instruction and practice drills, initially and at least annually, to all individuals who operate the unit, as appropriate, to the individual's assigned duties, in:

(1) the procedures identified in 4731. 1203, subp. 6, A, (4), above, and

(2) the operating procedures of the unit.

E. A licensee shall ensure that operators, authorized medical physicists, and authorized users participate in drills of the emergency procedures, initially and at least annually.

F. A licensee shall retain a record of individuals receiving instruction required by 4731.1203, subp. 6, D, above, in accordance with 4731.1214, subp. 1, B.

G. A licensee must retain a copy of the procedures required by 4731.1203, subp. 6, A, (4), and D, (2), in accordance with 4731.1214, subp. 6, D.

Subp 7. **Safety precautions for remote afterloaders, teletherapy units, and gamma stereotactic radiosurgery units.**

A. A licensee must control access to the treatment room by a door at each entrance.

B. A licensee must equip each entrance to the treatment room with an electrical interlock system that will:

(1) prevent the operator from initiating the treatment cycle unless each treatment room entrance door is closed;

(2) cause the source(s) to be shielded when an entrance door is opened; and

(3) prevent the source(s) from being exposed following an interlock interruption until all treatment room entrance doors are closed and the source(s) on-off control is reset at the console.

C. A licensee must require any individual entering the treatment room to assure, through the use of appropriate radiation monitors, that radiation levels have returned to ambient levels.

D. Except for low-dose remote afterloader units, a licensee must construct or equip each treatment room with viewing and intercom systems to permit continuous observation of the patient or the human research subject from the treatment console during irradiation.

E. For licensed activities where sources are placed within the patient's or human research subject's body a licensee must only conduct treatments which allow for expeditious removal of a decoupled or jammed source.

F. In addition to the requirements specified in 4731. 1203, subp. 7, A - E, above, a licensee must;

(1) for medium dose-rate and pulsed dose-rate remote afterloader units, require:

(a) an authorized medical physicist and either an authorized user or a physician, under the supervision of an authorized user, who has been trained in the operation and emergency response for the unit to be physically present during the initiation of all patient treatments involving the unit; and

(b) an authorized medical physicist and either an authorized user or an individual, under the supervision of an authorized user, who has been trained to remove the

source applicator(s) in the event of an emergency involving the unit, to be immediately available during continuation of all patient treatments involving the unit.

(2) for high dose-rate remote afterloader devices, require:

(a) an authorized user and an authorized medical physicist to be physically present during the initiation of all patient treatments involving the unit; and

(b) an authorized medical physicist and either an authorized user or a physician, under the supervision of an authorized user, who has been trained in the operation and emergency response for the unit , to be physically present during continuation of all patient treatments involving the unit.

(3) for gamma stereotactic radiosurgery units, require an authorized user and an authorized medical physicist to be physically present throughout all patient treatments involving the unit.

(4) notify the Radiation Safety Officer, or his/her designee, and an authorized user as soon as possible if the patient or human research subject has a medical emergency or dies.

G. The licensee must have applicable emergency response equipment available near each treatment room to respond to source:

(1) remaining in the unshielded position; or

(2) lodged within the patient following completion of the treatment.

4731.1204 Radiation Safety Surveys on Patients or Human Research Subjects.

Subpart 1. **Radiation surveys of patients and human research subjects treated with remote afterloaders.**

A. Before releasing a patient or a human research subject from licensee control, a licensee must survey the patient or the human research subject and the remote afterloader device with a portable radiation detection survey instrument to confirm theat the sources(s) has been removed from the patient or human research subject and returned to the safe shielded position.

B. A licensee must retain a record of patient or human research subject surveys in accordance with 4731.1214, subp. 2, C.

Subp 2. **Release of individuals containing unsealed radioactive materials or implants containing radioactive material.**

A. A licensee may authorize the release from its control of any individual who has been administered radioactive materials or implants containing radioactive material if the total effective dose to any other individual from exposure to the released individual is not likely to exceed 0.5 rem (5mSv).

NUREG-1556, Vol 9(draft), "Consolidated Guidance About Materials Licenses: Program-specific Guidance About Medical Licenses," describes methods for calculating doses to other individuals and contains tables of activities not likely to cause doses exceeding 0.5 rem(5mSv).

B. A licensee must provide the released individual, or the individual's parent or guardian, with instructions, including written instructions:

(1) on actions recommended to maintain doses to other individuals as low as is reasonably achievable if the total effective dose equivalent to any other individual is likely to exceed 0.1 rem (1mSv).

(2) on actions to be taken if the total effective dose equivalent to a breast-feeding infant or child could exceed 0.1 rem (1mSv) assuming there were no interruption of breast-feeding. The instructions must also include:

(a) guidance on the interruption or discontinuation of breast-feeding; and

(b) information on the potential consequences, if any, of failure to follow the guidance.

C. A licensee must maintain a record of the basis for authorizing the release of the individual, in accordance with 4731.1214, subp. 2, C, (1).

D. The licensee must maintain a record of instructions provided to breast-feeding women in accordance with 4731.1214, subp. 2, C, (2).

4731.1205 Radiation Safety Surveys for Equipment.

Subpart 1 **Radiation surveys**

A. In addition to the survey requirement in 4731.0132, subp. 2, a person licensed under Chapter 4731 must make surveys to ensure that the maximum radiation levels and average radiation levels from the surface of the main source safe with the source(s) in the shielded position do not exceed the levels stated in the Sealed Source and Device Registry.

B. The licensee must make the survey required by 4731.1205, subp. 1, A, above, at installation of a new source and following repairs to the source(s) shielding, the source(s) driving unit, or other electronic or mechanical component that could:

(1) expose the source,

(2) reduce the shielding around the source(s), or

(3) compromise the radiation safety of the unit or the source(s).

C. A licensee must retain a record of the radiation surveys required by 4731.1205, subp. 1, A, above, in accordance with 4731.1214, subp. 6, B

Subp 2. **Five-year service for teletherapy and gamma stereotactic radiosurgery units.**

A. A licensee must have each teletherapy unit and gamma stereotactic radiosurgery unit fully inspected and serviced during source replacement or at intervals not to exceed 5 years, whichever comes first, to assure proper functioning of the source exposure mechanism.

B. This inspection and servicing may be performed only by persons specifically licensed to do so by the commission, NRC or an agreement state.

C. A licensee must keep a record of the servicing in accordance with 4731.1214, subp. 6. C.

Subp 3. **Therapy-related computer systems.** The licensee shall perform acceptance testing on the treatment planning system of therapy-related computer systems in accordance with published protocols accepted by nationally recognized bodies. At a minium, the acceptance testing must include, as applicable, verification of:

A. The source-specific input parameters required by the dose calculation algorithm;

B. The accuracy of dose, dwell time, and treatment time calculations at representative points;

C. The accuracy of isodose plots and graphic displays; and

D. The accuracy of the software used to determine sealed source positions from

radiographic images; and

E. If electronic transfer is used, the accuracy of electronic transfer of the treatment delivery parameters to the treatment delivery unit from the treatment planning system.

4731.1206 Radiation safety program requirements. In addition to the requirements in 4731.0311, the following provisions are required.

Subpart 1. **Labeling of vials and syringes**

Each syringe and vial that contains unsealed radioactive material must be labeled to identify the radioactive drug. Each syringe shield and vial shield must also be labeled unless the label on the syringe or vial is visible when shielded.

Subp 2. **Surveys for ambient radiation exposure rate.**

A. In addition to surveys required in 4731.0132, a licensee must survey with a radiation detection survey instrument at the end of each day of use. A licensee must survey all areas where unsealed radioactive materials requiring a written directive were prepared for use or administered.

B. A licensee does not need to perform the surveys required by 4731.1206, subp. 2, A in an area(s) where patients or human research subjects can not be released pursuant to 4731.1204, subp. 2..

C. A licensee must retain a record of each survey in accordance with 4731.0169, subp. 4.

Subp 3. **Provision of mobile service**

A.. A licensee providing mobile service must:

(1) obtain a letter signed by the management of each client for which services are rendered that permits the use of radioactive material at the client's address of use and clearly delineates the authority and responsibility of the licensee and the client;

(2) check instruments used to measure the activity of unsealed radioactive material for proper function before medical use at each address of use or on each day of use, whichever is more frequent. At a minimum, the check for proper function required here must include a constancy check;

(3) check survey instruments for proper operation with a dedicated check source before use at each client's address; and

(4) before leaving a client's address of use, survey all areas of use to ensure compliance with requirements in 4731.0101-4731.0195.

B. A mobile nuclear medicine service may not have radioactive material delivered from the manufacturer or the distributor to the client unless the client has a license allowing possession of the radioactive material. Radioactive material delivered to the client must be received and handled in conformance with the client's license.

C. A licensee providing mobile nuclear services shall retain the letter required in 4731.1206, subp. 3, A, (1), and the record of each survey required in 4731.1206, subp. 3, A, (4),in accordance with 4731.1214, subp. 1, A.

Subp 4. **Decay-in-storage**

A. licensee may hold radioactive material with a physical half-life of less than 120

days for decay-in-storage before disposal without regard to its radioactivity, if the licensee:

(1) monitors radioactive material at the surface before disposal; and

(2) determines that its radioactivity cannot be distinguished from the background radiation level with an appropriate radiation detection survey meter set on its most sensitive scale and with no interposed shielding;

(3) removes or obliterates all radiation labels, except for radiation label on materials that are within containers and that will be managed as biomedical waste after they have released from the licensee.

B. A licensee shall retain a record of each disposal permitted under 4731.1206, subp. 4, A. in accordance with 4731.1214, subp. 3, E.

Subp 5. **Installation, maintenance, and repair for therapeutic medical devices**

A. Only a person specifically licensed by the commissioner, the NRC, or agreement state shall install, maintain, adjust, or repair a remote afterloader unit, teletherapy, unit, or gamma stereotactic radiosurgery unit that involves work on the source(s) shielding, the source(s) driving unit, or other electronic or mechanical component that could expose the source(s), reduce the shielding around the source(s), or compromise the radiation safety of the unit or the source(s).

B. Except for low dose-rate remote afterloader units, only a person specifically licensed by the commissioner, the NRC, or an agreement state shall install, replace, relocate, or remove a sealed source or source contained in other remote afterloader units, teletherapy units, or gamma stereotactic radiosurgery units.

C. For a low dose-rate remote afterloader unit, a person specifically licensed by the commissioner, the NRC or an agreement state or an authorized medical physicist shall install, replace, relocate, or remove a sealed source(s) contained in the unit.

D. A licensee shall retain a record of the installation, maintenance, adjustment, and repair of remote afterloader units, teletherapy units, and gamma stereotactic radiosurgery units in accordance with 4731.1214, subp. 4, G.

4731.1207 Training for Certain Medical Procedures

Subpart 1 **Training for uptake, dilution, and excretion studies.** Except as provided in 4731.0152, subp. 8, the licensee shall require the authorized user of unsealed radioactive material for the uses authorized under 4731.1212, subp. 1, to be a physician who:

A. Is certified by a medical speciality board whose certification process includes all of the requirements in 4731.1207, subp. 1, C, and whose certification has been recognized by the commissioner, NRC or an agreement state; or

B. Is an authorized user under 4731.1207, subpart 2 or subpart 3, or equivalent NRC or agreement state requirements; or

C. Training and experience

(1) has completed 60 hours of training and experience in basic radionuclide handling techniques applicable to the medical use of unsealed radioactive material for uptake, dilution, and excretion studies. The training and experience must include:

(a) classroom and laboratory training in the following areas:

((1)) radiation physics and instrumentation;

((2)) radiation protection;

((3)) mathematics pertaining to the use and measurement of radioactivity;

((4)) chemistry of radioactive material for medical use; and

((5)) radiation biology; and

(b) work experience, under the supervision of an authorized user who meets the requirements in 4731,1207, subparts 1, 2, and 3, or equivalent NRC or agreement state requirements, involving:

((1)) ordering, receiving, and unpacking radioactive materials safely and performing the related radiation surveys;

((2)) calibrating instruments used to determine the activity of dosages and performing checks for proper operation of survey meters;

((3)) calibrating, measuring, and safely preparing patient or human research subject dosages;

((4)) using administrative controls to prevent a medical event involving the use of unsealed radioactive material;

((5)) using procedures to contain spilled radioactive material safely and using proper decontamination procedures; and

((6)) administering dosages of radioactive drugs to patients or human research subjects; and

(2) has obtained written certification, signed by a preceptor authorized user, that the requirements in 4731.1207, subpart 1, 2 or 3, or equivalent NRC or agreement state requirements, that the individual has satisfactorily completed the requirements in 4731.1207, subp. 1, C, (1) above, and has achieved a level of competency sufficient to independently function as an authorized user for the medical uses authorized in 4731.1212, subp. 1;

Subp 2. **Training for Imaging and localization studies.** Except as provided in 4731.0152, subp. 8, the licensee shall require the authorized user of unsealed radioactive materials for the uses authorized under 4731.1212, subp. 2, to be a physician who:

A. Is certified by a medical specialty board whose certification process includes all of the requirements in 4731.1207, subp. 2, C, below, and whose certification has been recognized by the commissioner, NRC, or an agreement state; or

B. Is an authorized user under 4731.1207, subp. 3, or NRC, equivalent agreement state requirements; or

C. Training and experience

(1) has completed 700 hours of training and experience in basic radionuclide handling techniques applicable to the medical use of unsealed radioactive material for the imaging and localization studies. The training and experience must include at a minimum:

(a) classroom and laboratory training in the following areas:

((1)) radiation physics and instrumentation;

((2)) radiation protection;

((3)) mathematics pertaining to the use and measurement of radioactivity;

((4)) chemistry of radioactive materials for medical use;

((5)) radiation biology; and

(b) work experience, under the supervision of an authorized user, who meets the requirements in 4731.1207, subparts 2 and 3, or equivalent NRC or agreement state requirements, involving:

((1)) ordering, receiving, and unpacking radioactive materials safely and performing the related radiation surveys;

((2)) calibrating dose instruments used determine the activity of dosages and performing checks for proper operation of survey meters;

((3)) calculating, measuring and safely preparing patient or human research subject dosages;

((4)) using administrative controls to prevent a medical event involving the use of unsealed radioactive material;

((5)) using procedures to safely contain spilled radioactive material safely and using proper decontamination procedures;

((6)) administering dosages of radioactive drugs to patients or human research subjects; and

((7)) eluting generator systems, appropriate for preparation of radioactive drugs for imaging and localization studies, measuring and testing the eluate for radionuclidic purity, and processing the eluate with reagent kits to prepare labeled radioactive drugs; and

(2) has obtained written certification, signed by a preceptor authorized user, that the requirements in 4731.1207, subparts 2 and 3, or equivalent NRC or agreement state requirements, that the individual has satisfactorily completed the requirements in 4731.1207, subp. 2, C, (1), above and has achieved a level of competency sufficient to function independently as an authorized user for the medical uses authoroized in 4731.1212, subparts 1 and 2.

Subp 3. **Training for use of unsealed radioactive material for which a written directive is required.** Except as provided in 4731.0152, subp 8, the licensee shall require the authorized user of unsealed radioactive material for the uses authorized under 4731.1212,subp. 4, to be a physician who:

A. Is certified by a medical specialty board whose certification process includes all of the requirements in 4731.1207, subp. 3, B, below, and whose certification has been recognized by the commissioner, NRC, or an agreement state; or

B. Training and experience

(1) has completed 700 hours of training and experience in basic radionuclide handling techniques applicable to the medical use of unsealed radioactive material requiring a written directive. The training and experience must include:

(a) classroom and laboratory training in the following areas:

((1)) radiation physics and instrumentation;

((2)) radiation protection;

((3)) mathematics pertaining to the use and measurement of radioactivity; and

((4)) chemistry of radioactive materials for medical use; and

((5)) radiation biology; and

(b) work experience, under the supervision of an authorized user who meets the requirements in 4731.1207, subp. 3, A, 4731.1207, subp. 3, B, or equivalent NRC, or agreement state requirements. A supervising authorized user, who meets the requirements of 4731.1207, subp.3, B, must have experience in administering dosages in the same dosage category or categories, i.e. 4731. 1207, subp. 3, B, (2), (g), ((1)), ((2)), ((3)), and ((4)), as the individual requesting authorized user status. The work experience must involve:

((1)) ordering, receiving, and unpacking radioactive materials safely and performing the related radiation surveys;

((2)) calibrating instruments used to determine the activity of dosages, and performing checks for proper operation of survey meters;

((3)) calculating, measuring, and safely preparing patient or human research subject dosages;

((4)) using administrative controls to prevent a medical event involving the use of radioactive material;

((5)) using procedures to contain spilled radioactive material safely and using proper decontamination procedures;

((6)) eluting generator systems, measuring and testing the eluate for radionuclidic purity, and processing the eluate with reagent kits to prepare labeled radioactive drugs; and

((7)) administering dosages of radioactive drugs to patients or human research subjects involving a minimum of three cases in each of the following categories for which the individual is requesting authorized user status:

((a)) oral administration of less than or equal to 33 millicuries (1.22 GBq) of sodium iodide I-131;

((b)) oral administration of greater than 33 millicuries (1.22 GBq) of sodium iodide Experience with at least 3 cases in 4731.1207, subp. 3, B, (2), (g), ((2)), also satisfies the requirement in category 4731.1207, subp. 3, B, (2), (g), ((1)), above;

((c)) parenteral administration of any beta emitter or a photon-emitting radionuclide with a photon energy less than 150 keV; and/or

((d)) parenteral administration of any other radionuclide; and

(2) has obtained written certification that the individual has satisfactorily completed the requirements in 4731.1207, subp. 3, B, above, and has achieved a level of competency sufficient to function independently as an authorized user for the medical users authorized under 4731.1212, subp. 4. The written certification must be signed by a preceptor authorized user who meets the requirements of 4731.1207, subp. 3, A, or 4731.1207, subp. 3, B, or equivalent NRC or agreement state requirements. The preceptor authorized user, who meets the requirements in 4731.1207, subp. 3, B, must have experience in administering dosages in the same dosage category or categories , i.e., 4731.1207, subp. 3, (2),(g), ((1)), ((2)), ((3)), or ((4)), as the individual requesting authorized user status.

Subp 4 **Training for use of manual brachytherapy sources**. Except as provided in 4731.0152, subp. 8, the licensee shall require the authorized user of a manual brachytherapy

source for the uses authorized under 4731.1213, subp. 1, to be a physician who:

A. Is certified by a medical specialty board whose certification process includes all of the requirements in 4731.1207, subp. 4, B, below, and whose certification has been recognized by the commissioner, NRC or an agreement state; or

B. Training and experience

(1) has completed a structured educational program in basic radionuclide handling techniques applicable to the use of annual brachytherapy sources that includes:

(a) 200 hours of classroom and laboratory training in the following areas:

((1)) radiation physics and instrumentation;

((2)) radiation protection;

((3)) mathematics pertaining to the use and measurement of radioactivity; and

((4)) radiation biology;

(b) 500 hours of work experience, under the supervision of an authorized user who meets the requirements in 4731.1207, subp. 4, or equivalent NRC or agreement state requirements at a medical institution, involving:

((1)) ordering, receiving, and unpacking radioactive materials safely and preforming the related radiation surveys;

((2)) checking survey meters for proper operation;

((3)) preparing, implanting, and removing brachytherapy sources;

((4)) maintaining running inventories of material on hand;

((5)) using administrative controls to prevent a medical event involving the use of radioactive material;

((6)) using emergency procedures to control radioactive material; and

(2) has obtained three years of supervised clinical experience in radiation oncology, under an authorized user who meets the requirements in 4731.1207, subp. 4, or equivalent NRC or agreement state requirements , as part of a formal training program approved by the Residency Review Committee for Radiation Oncology of the Accreditation Council for Graduate Medical Education or the Committee on Postdoctoral Training of the American Osteopathic Association. This experience may be obtained concurrently with the supervised work experience required by 4731.1207, subp. 4, B, (1), (b); and

(3) has obtained written certification, signed by a preceptor authorized user who meets the requirements in 4731.1207, subp. 4 or equivalent NRC or agreement state requirements, that the individual has satisfactorily completed the requirements in 4731.1207, subp. 4, B, (1) and (2), and has achieved a level of competency sufficient to function independently as an authorized user of manual brachytherapy sources for the medical uses authorized under 4731.1213, subp. 1.

Subp 5. **Training for use of sealed sources for diagnosis**. Except as provided in 4731.0152, subp. 8, the licensee shall require the authorized user of a diagnostic sealed source for use in a device authorized under in 4731.1211, subp. 1, to be a physician, dentist, or podiatrist who:

A. Is certified by a speciality board whose certification process includes all of the requirements in 4731.1207, subp. 5, B, below, whose certification has been recognized by the commissioner, NRC, or an agreement state.

B. Has had 8 hours of classroom and laboratory training in basic radionuclide handling techniques specifically applicable to the use of the device. The training must include:

(1) radiation physics and instrumentation;
(2) radiation protection;
(3) mathematics pertaining to the use and measurement of radioactivity;
(4) radiation biology; and
(5) training in the use of the device for the uses requested.

Subp 6. Reserved
Subp 7 Reserved
Subp 8 Reserved
Subp 9 Reserved
Subp 10. Reserved

Subp 11 **Training for Ophthalmic use of strontium-90.** Except as provided in 4731.0152, subp. 8, the licensee shall require the authorized user of strontium-90 for ophthalmic radiotherapy to be a physician who:

A. Is an authorized user under 4731.1207, subp. 4, or equivalent NRC or agreement state requirements; or

B. Training and experience:

(1) has completed. 24 hours of classroom and laboratory training applicable to the medical use of strontium-90 for ophthalmic radiotherapy. The training must include:

(a) radiation physics and instrumentation;
(b) radiation protection;
(d) mathematics pertaining to the use and measurement of radioactivity; and
(e) radiation biology;

(2) supervised clinical training in ophthalmic radiotherapy under the supervision of an authorized user at a medical institution that includes the use of strontium-90 for the ophthalmic treatment of five individuals. This supervised clinical training must involve:

(a) examination of each individual to be treated;
(b) calculation of the dose to be administered;
(c) administration of the dose; and
(d) follow up and review of each individual's case history; and

(3) has obtained written certification, signed by a preceptor authorized user who meets the requirements in 4731.1207, subp. 4, 4731.1207, subp.11, or equivalent NRC or agreement state requirements, that the individual has satisfactorily completed the requirements in 4731.1207, subp. 11, A and B, above, and has achieved a level of competency sufficient to function independently as an authorized user of strontium-90 for ophthalmic use.

Subp. 12. **Training for the Oral Administration of Sodium Iodide I-131 requiring a written**

directive in quantities less than or equal to 33 millicuries (1.22 MBq). Except as provided in 4731.0152, subp. 8, the licensee shall require an authorized user for the oral administration of sodium iodide I-131 requiring a written directive in quantities less than or equal to 33 millicuries(1.22 MBq), to be physician who:

A. Is certified by a medical speciality board who certification process includes all of the requirements in 4731.1207, subp. 12, C, below, and whose certification has been recognized by the commissioner, or NRC or an agreement state; or

B. Is an authorized user under 4731.1207, subp.3, A, 4731.1207, subp. 3, B, for uses listed in 4731.1207, subp. 3, B, (2), (g), ((1)) or ((2)), or 4731.1207, subp. 13, or equivalent NRC or agreement state requirements; or

C. Training

(1) has successfully completed 80 hours of classroom and laboratory training, applicable to the medical use of sodium iodide I-131 for purposes requiring a written directive. The training must include:

(a) radiation physics and instrumentation;

(b) radiation protection;

(c) mathematics pertaining to the use and measurement of radiioactivity;

(d) chemistry of radioactive materials for medical use; and

(e) radiation biology; and

(2) has work experience, under the supervision of an authorized user who meets the requirements in 4731.1207, subp. 3, A, 4731.1207, subp. 3, B, 4731.1207, subp. 12, 4731.1207, subp. 13, or equivalent NRC or agreement state requirements. A supervising authorized user who meets the requirements in 4731.1207, subp. 3, B, (2), (g), ((1)) or ((2)). The work experience must involve:

(a) ordering, receiving, and unpacking radioactive materials safely and performing the related radiation surveys;

(b) calibrating instruments used to determine the activity of dosages and performing checks for the proper operation for survey meters;

(c) calculating, measuring, and safely preparing patient or human research subject dosages;

(d) using administrative controls to prevent a medical event involving the use of radioactive materials;

(e) using procedures to contain spilled radioactive material safely and using proper decontamination procedures; and

(f) administering dosages to patients or human research subjects, that includes at least 3 cases involving the oral administration of less than or equal to 33 millicuries (1.22 MBq) of sodium iodide I-131; and

(3) has obtained written certification that the individual has satisfactorily completed the requirements in 4731.1207, subp.12, C, (1) and (2) and has achieved a level of competency sufficient to function independently as an authorized user for medical uses authorized under 4731.1212, subp. 4. The written certification must be signed by a preceptor authorized user who meets the requirements in 4731.1207, subp. 3, 4731.1207, subp. 3, B, 4731.1207, subp12, 4731.1207, subp. 13 or equivalent NRC or agreement state requirements. A preceptor authorized user, who meets the requirement in 4731.1207, subp. 3, B, must have

experience in administering dosages as specified in 4731.1207, subp. B (2), (g), ((1 or ((2)).

Subp. 13 **Training for the Oral Administration of Sodium Iodide I-131 requiring a written directive in quantities greater than 33 millicuries(1.22 MBq).** Except as provided in '4731.0152, subp. 8, the licensee shall require an authorized user for the oral administration of sodium iodide I-131 requiring a written directive in quantities greater than 33 millicuries (1.22 MBq), to be a physician who:

A. Is certified by a medical speciality board who certification process includes all of the requirements in 4731.1207, subp. 13, C, below, and whose certification has been recognized by the commissioner, NRC or an agreement state; or

B. Is an authorized user under 4731.1207, subp. 3, A, 4731.1207, subp. 3, B, for uses listed in 4731.1207, B, (2), (g), ((2)), or equivalent NRC or agreement state requirements; or

C. Training and experience:

(1) has successfully completed 80 hours of classroom and laboratory training, applicable to the medical use of sodium iodide I-131 for procedures requiring a written directive. The training must include:

(a) radiation physics and instrumentation;

(b) radiation protection;

(c) mathematics pertaining to the use and measurement of radioactivity;

(d) chemistry of radioactive materials for medical use; and

(e) radiation biology; and

(2) has work experience, under the supervision of an authorized user who meets the requirements in 4731.1207, subp. 3, A, 4731.1207, subp. 3, B, 4731.1207, subp. 13, or equivalent NRC or agreement state requirements. A supervising authorized user, who meets the requirements in 4731.1207, subp. 3, B, must have experience in administering dosages as specified in 4731.1207, subp. 3, B, (2), (g), ((2)). The work experience must involve:

(a) ordering, receiving, and unpacking radioactive materials safely and performing the related radiation surveys;

(b) calibrating instruments used to determine the activity of dosages and performing checks for proper operation for survey meters;

(c) calculating, measuring, and safely preparing patient or human research subject dosages;

(d) using administrative controls to prevent a medical event involving the use of radioactive materials;

(e) using procedures to contain spilled radioactive materials safely and using proper decontamination procedures; and

(f) administering dosages to patients or human research subjects, that includes at least 3 cases involving the oral administration of greater than 33 millicuries (1.22 MBq) of sodium iodide I-131; and

(3) has obtained written certification that the individual has satisfactorily completed the requirements in 4731.1207, subp.13, C, (1) and (2) and has achieved a level of competency sufficient to function independently as an authorized user for medical uses authorized under 4731.1212, subp. 4. The written certification must be signed by a preceptor authorized user who meets the requirements in 4731.1207, subp. 3, A, 4731.1207, subp. 3, B,

4731.1207, subp. 13, or equivalent NRC or agreement state requirements. A preceptor authorized user, who meets the requirements in 4731.1207, subp. 3, B, must have experience in administering dosages as specified in 4731.1207, subp. 3, B, (2), (g), ((2)).

Subp. 14 **Training for use of remote afterloaders units, teletherapy units, and gamma stereotactic radiosurgery units.** Except as provided in 4731.0152, subp. 8, the licensee shall require an authorized user of a sealed source for a use authorized under 4731.1211, subp. 3, to be a physician who:

A. Is certified by a medical specialty board whose certification process includes all of the requirements in 4731.1207, subp. 14, B, below, and whose certificatioin has been recognized by the commissioner, NRC, or an agreement state; or

B. Training and experience.

(1) has completed a structured educational program in basic radionuclide techniques applicable to the use of a sealed soruce in a therapeutic medical unit that includes:

(a) 200 hours of classroom and laboratory training in the following areas:

((1)) radiation physics and instrumentation;

((2)) radiation protection;

((3)) mathematics pertaining to the use and measurement of radioactivity; and

((4)) radiation biology; and

(b) 500 hours of work experience, under the supervision of an authorized user who meets the requirements in 4731.1207, subp. 14, or equivalent NRC or agreement state requirements at a medical institution, involving:

((1)) reviewing full calibration measurements and periodic spot-checks;

((2)) preparing treatment plans and calculating treatment doses and times;

((3)) using administrative controls to prevent a medical event involving the use of radioactive materials;

((4)) implementing emergency procedures to be followed in the event of the abnormal operation of the medical unit or console;

((5)) checking and using survey meters; and

((6)) selecting the proper dose and how it is to be administered; and

(2) has completed 3 years of supervised clinical experience in radiation oncology, under an authorized user who meets the requirements in 4731.1207, subp. 14, or equivalent NRC or agreement state requirements, as part of a formal training program approved by the Residency Review Committee for Radiation Oncology of the accreditation council for Graduate Medical education of the Committee on Postdoctural Training of the American Osteopathic Association. This experience may be obtained concurrently with the supervised work experience required by 4731.1207, subp. 14, B, (1), (b); and

(3) has obtained written certification that the individual has satisfactorily completed the requirements in 4731.1207, subp. 14, b, (1) and (2), and has achieved a level of competency sufficient to function independently as an authorized user of each type of therapeutic

medical unit for which the individual is requesting authorized user status. The written certification must be signed by a preceptor authorized user who meets the requirements in 4731.1207, subp. 14 or equivalent NRC or agreement state requirements for an authorized user for each type of therapeutic medical unit for which the individual is requesting authorized user status.

4731.1208 Possession and Maintenance of Instruments.

Subpart 1. **Possession, use, and calibration of instruments used to measure the activity of unsealed radioactive material.**

A. For direct measurements performed in accordance with 4731.1208,subp. 4, a licensee shall possess and use instrumentation to measure the activity of unsealed radioactive material before it is administered to each patient or human research subject.

B. A licensee shall calibrate the instrumentation required in 4731.1208, subp. 1, A, above, in accordance with the nationally recognized standards or the manufacturer's instructions.

C. A licensee must retain a record of each instrument calibration required in 4731.1208, subp.1, in accordance with 4731.1214, subp. 4, A.

Subp 2. **Calibration of survey instruments**

A. A licensee must calibrate the survey instruments used to show compliance with this part and 4731.0132, before first use, annually and following repair. A licensee must:

(1) calibrate all scales with readings up to 1000 mrem (10 mSv) per hour with a radiation source;

(2) calibrate two separate readings on each scale that will be used to show compliance with this part; and

(3) conspicuously note on the instrument the date of calibration.

B. A licensee may not use survey instruments if the difference between the indicated exposure rate and the calculated exposure rate is more than 20 percent. exposure rate differs from the calculated exposure rate by more than 10 percent.

C. A licensee must retain a record of each survey instrument calibration in accordance with 4731.1214, subp. 4, B.

Subp 3. Reserved

Subp 4, **Determination of dosages of unsealed radioactive material for medical use**

A. A licensee must determine and record the activity of each dosage before medical use.

B. For a unit dosage, this determination must be made by;

(1) direct measurement of radioactivity; or

(2) a decay correction, based on the activity or activity concentration determined by;

(a) a manufacturer or preparer licensed pursuant to 4731.0311, subp. 9, or equivalent NRC, or agreement state requirements; or

(b) a commissioner, NRC, or an agreement state licensee for use in research in accordance with the Radioactive Drug Research Committee-approved protocol or an

Investigational New Drug (IND) protocol accepted by FDA.

C. For other than unit dosages, this determination must be made by:

(1) direct measurement of radioactivity;

(2) combination of measurement of radioactivity and mathematical calculations; or

(3) combination of volumetric measurements and mathematical calculations, based on the measurement made by a manufacturer or preparer licensed under 4731.0311, subp. 9, or equivalent NRC, or agreement state requirements.

D. Unless otherwise directed by the authorized user, a licensee may not use a dosage if the dosage does not fall within the prescribed dosage range or if the dosage differs from the prescribed dosage by more than 20 percent.

E. A licensee must retain a record of the dosage determination required by 4731.1214, subp. 3, A.

Subp 5. **Authorization for calibration, transmission, and reference sources.** Any person authorized by 4731.1201, subp. 1, for medical use of radioactive material may receive, possess, and use the following radioactive material for check, calibration, transmission and reference use:

A. Sealed sources, that do not exceed 30 mCi (1.11 GBq) each, manufactured and distributed by a person licensed pursuant to 4731.0311, subp. 10, or equivalent NRC or agreement state regulations

B. Sealed sources, that do not exceed 30 mCi (1.11 GBq) each, redistributed by a licensee authorized to redistribute the sealed sources manufactured and distributed by a person licensed under 4731.0311, subp 10 providing the redistributed sealed sources are in the original packaging and shielding and are accompanied by the manufacturer's approved instructions.

C. Any radioactive material with a half-life of not longer than 120 days in individual amounts not to exceed the smaller of 200Ci (7.4 MBq) or 1000 times the quantities in 4731.3001, C.

D. Technetium-99m in amounts as needed.

Subp 6 **Requirements for possession of sealed sources and brachytherapy sources.**

A. A licensee in possession of any sealed source or brachytherapy source must follow the radiation safety and handling instructions supplied by the manufacturer.

B. A licensee in possession of a sealed source must:

(1) test the source for leakage before its first use unless the licensee has a certificate from the supplier indicating that the source was tested within 6 months before transfer to the licensee; and

(2) test the source for leakage at intervals not to exceed 6 months or at other intervals approved by the commissioner, NRC, or an agreement state in the Sealed Source and Device Registry.

C. To satisfy the leak test requirements in 4731.1208, subp, 6 B, above, the licensee must measure the sample so that the leakage test can detect the presence of 0.005 microcuries (185 Bq) of radioactive material on the sample.

D. A licensee must retain leakage test records in accordance with 4731.1214, subp. 3, B,

E. If the leakage test reveals the presence of 0.005 Microcuries (185 Bq) or more of

removable contamination, the licensee must:

(1) immediately withdraw the sealed source from use and store, dispose, or cause it to be repaired in accordance with 4731.0134, subp. 1, C; and

(2) notify the commissioner immediately and file a report within 30 days of the leakage test in accordance with 4731. 0162, subp. 1.

F. A licensee need not perform a leakage test on the following sources:

(1) sources containing only radioactive material with a half-life of less than 30 days;

(2) sources containing only radioactive material as a gas;

(3) sources containing 100 Ci (3.7 MBq) oe less of beta or gamma-emitting materuial or 10 Ci (0.37 MBq) or less of alpha-emitting material;

(4) seeds of iridium-192 encased in nylon ribbon; and

(5) sources stored and not being used. The licensee must, however, test each such source for leakage before any use or transfer unless it has been leakage-tested within 6 months before the date of use or transfer.

G. A licensee in possession of sealed sources or brachytherapy sources, except for gamma stereotactic radiosurgery sources, must conduct a semi-annual physical inventory of all such sources in the licensee's possession. The licensee must retain each inventory record in accordance with 4731.1214, subp. 3, B.

Subp 7. **Dosimetry equipment for therapeutic medical devices**

A. Except for low dose-rate remote afterloader sources where the source output or activity is determined by the manufacturer, a licensee must have a calibrated dosimetry system available for use. To satisfy this requirement, one of the following two conditions must be met.

(1) the system must have been calibrated:

(a) using a source or system traceable to the National Institute of Standards and Technology (NIST) and published protocols accepted by nationally recognized bodies or by a calibration laboratory accredited by the American Association of Physicist in Medicine (AAPM)

(b) within the previous 2 years, and

(c) after any servicing that may have affected system calibration; or

(2) the system must have been calibrated within the previous 4 years; 18-30 months after that calibration,

(a) the system must have been intercompared with another dosimetry system that was calibrated within the past 24 months by the National Institute of Standards and Technology or by a calibration laboratory accredited by the AAPM.

(b) the results of the innercomparison must have indicated that the calibration factor of the licensee's system had not changed by more than 2%.

(c) the licensee may not use the intercomparison result to change the calibration factor.

(d) when intercomparing dosimetry systems to be used for calibrating sealed sources for therapeutic devices, the licensee must use a comparable unit with beam attenuator or collimators, as applicable, and sources of the same radionuclide as the source used at the licensee's facility.

B. The licensee must have a dosimetry system available for spot-check measurements, if applicable. To satisfy this requirement, the system may be compared with a system that has been calibrated in accordance with 4731.1208, subp. 7, A, above. This comparison must have been performed within the previous year and after each servicing that may have affected system calibration. The spot-check system may be the same system used to meet the requirement in 4731.1208, subp. 7, A.

C. The licensee must retain a record of each calibration, intercomparison, and comparison in accordance with 4731. 1214, subp. 4, A.

4731.1209 Calibration of Therapeutic Medical Devices

Subpart 1. **Full calibration measurements on teletherapy units.**

A. A licensee authorized to use a teletherapy unit for medical use must perform full calibration measurements on each teletherapy unit:

(1) before the first medical use of the unit; and

(2) before medical use under the following conditions:

(a) whenever spot-check measurements indicate that the output differs by more than 5 % from the output obtained at the last full calibration corrected mathematically for radioactive decay;

(b) following replacement of the source or following reinstallation of the teletherapy unit in a new location;

(c) following any repair of the teletherapy unit that includes removal of the source or major repair of the components associated with the source exposure assembly; and

(d) at intervals not exceeding 1 year.

B. To satisfy the requirement of 4731.1209, subp. 1, A, above, full calibration measurements must include determination of:

(1) the output within +/- 3% for the range of field sizes and for the distance or range of distances used for medial use;

(2) the coincidence of the radiation field and the field indicated by the light beam localizing device;

(3) the uniformity of the radiation field and its dependence on the orientation of the useful beam;

(4) timer accuracy and linearity over the range of use;

(5) on-off error; and

(6) the accuracy of all distance measuring and localization devices in medical use.

C. A licensee must use the dosimetry system described in 4731.1208, subp. 7, A, to measure the output for one set of exposure conditions. The remaining radiation measurements required in 4731.1209, subp. 1, B, (1), may be made using a dosimetry system that indicates relative dose rates.

D. A licensee must make full calibration measurements required by 4731.1209, subp. 1, A, above, in accordance with published protocols approved by nationally recognized bodies.

E. A licenses must mathematically correct the outputs determined in 4731.1209, subp. 1, B, (1), for physical decay for intervals not exceeding 1 month for cobalt-60, 6 months for cesium-137, or at intervals consistent with 1 % decay for all other nuclides.

F. Full calibration measurements required by 4731.1209, subp. 1, A, and physical

decay corrections required by 4731.1209, subp. 1, E, must be performed by the authorized medical physicist.

G. A licensee must retain a record of each calibration in accordance with 4731.1214, subp. 4, E.

Subp 2. **Full calibration measurements on remote afterloader units.**

A. A licensee authorized to use a remote afterloader for medical use must perform full calibration measurements on each unit:

(1) before the first medical use of the unit;

(2) before medical use under the following conditions:

(a) following replacement of the source or following reinstallation of the unit in a new location outside the facility; and

(b) following any repair of the unit that includes removal of the source or major repair of the components associated with the source exposure assembly, and

(3) at intervals not exceeding 1 quarter for high dose-rate, mediumdose-rate, and pulsed dose-rate remote afterloader units with sources whose half-life exceeds 75 days; and

(4) at intervals not exceeding 1 year for low dose-rate remote afterloader units.

B. To satisfy the requirement of 4731.1209, subp. 2, A, above, full calibration measurements must include, as applicable, determination of:

(1) the output within 5%;

(2) source positioning accuracy to within 1 millimeter;

(3) source retraction with backup battery upon power failure; and

(4) length of the source transfer tubes;

(5) timer accuracy and linearity over the typical range of use;

(6) length of the applicators; and

(7) function of the source transfer tubes, applicators, and transfer tube-applicator surfaces.

C. A licensee shall use the dosimetry system described in 4731.1208, subp. 7, A to measure the output.

D. A licensee shall make full calibration measurements required by 4731.1209, subp. 2, A, above, in accordance with published protocols accepted by nationally recognized bodies.

E. In addition to the requirements for full calibrations for low dose-rate remote afterloader units in 4731.1209, subp. 2, B, above, a licensee shall perform an autoradiograph of the source(s) to verify inventory ane source(s) arrangement at intervals not exceeding 1 quarter.

F. For low dose-rate remote afterloader units, a licensee may use measurements provided by the source manufacturer that are made in accordance with 4731.1209, subp. 2, A through E, above.

G. A licenses must mathematically correct the outputs determined in 4731. 1209, subp. 2, B, (1), above, for physical decay at intervals consistent with 1 % physical decay.

H. Full calibration measurements required by 4731.1209, subp. 2, A, above, and physical decay corrections required by 4731.1209, subp. 2, G, above, must be performed by the authorized medical physicist.

I. A licensee must retain a record of each calibration in accordance with 4731.1214, subp. 4, E.

Subp 3. **Full calibration measurements of gamma stereotactic radiosurgery units.**

A. A licensee authorized to use a gamma stererotactic radiosurgery unit for medical use must perform full calibration measurements on each unit:

(1) before the first medical use of the unit;

(2) before medical use under the following conditions:

(a) whenever spot-check measurements indicate that the output differs by more than 5% from the output obtained at the last full calibration corrected mathematically for radioactive decay;

(b) following replacement of the sources or following reinstallations of the gamma stereotactic radiosurgery unit in a new location; and

(c) following any repair of the gamma stereotactic radiosurgery unit that includes removal of the sources or major repair of the components associated with the source assembly; and

(3) at intervals not exceeding 1 year with the exception that relative helmet factors need only be determined before the first medical use of a helmet and following any damage to a helmet.

B. To satisfy the requirement of 4731.1209, subp. 3, A, above, full calibration measurements must include determination of:

(1) the output within 3%;

(2) relative helmet factors;

(3) isocenter coincidence;

(4) timer accuracy and linearity over the range of use;

(5) on-off error;

(6) trunnion centricity;

(7) treatment table retraction mechanism, using backup battery power or hydraulic backups with the unit off;

(8) helmet microswitches;

(9) emergency timing circuits; and

(10) stereotactic frames and localization devices (trunnions).

C. A licensee must use the dosimetry system described in 4731.1208, subp. 7, A, to measure the output for one set of exposure conditions. The remaining radiation measurements required in 4731.1209, subp. 3, B, (1), above, may be made using a dosimetry systems that indicates relative dose rates.

D. A licensee must make full calibration measurements required by 4731.1209, subp. 3, A, in accordance with published protocols accepted by national recognized bodies.

E. A licensee must mathematically correct the outputs determined in 4731.1209, subp. 3, B, (1), at intervals not exceeding 1 month for cobalt-60 and at intervals consistent with 1% physical decay for all other radionuclides.

F. Full calibration measurements required by 4731.1209, subp. 3, A, and physical decay corrections required by 4731.1209, subp. 3, E, above, must be performed by the authorized medical physicist.

G. A licensee must retain a record of each calibration in accordance with 4731.1214, subp. 4, E.

Subp 4. **Calibration measurements of brachytherapy sources.**

A. Before the first medical use of a brachytherapy source on or after October 24,2002, a licensee must have:

(1) determined the source output or activity using a dosimetry system that meets the requirements of 4731.1208, subp. 7, A;

(2) determined source positioning accuracy within applicators; and

(3) used published protocols curently accepted by nationally recognized bodies to meet the requirements of 4731.1209, subp. 4, A, (1) and (2), above.

B. A licensee may use measurements provided by the source manufacturer or by a calibration laboratory accredited by the American Association of Physicists in Medicine that are made in accordance with 4731.1209, subp. 4, A, above.

C. A licensee must mathematically correct the outputs or activities determined in 4731.1209, subp. 4, A, above, for physical decay at intervals consistent with 1 percent physical decay.

D. A licensee must retain a record of each calibration in accordance with 4731.1214, subp. 4, D.

4731.1210 Periodic Spot-checks for Therapeutic Medical Devices

Subpart 1. **Periodic spot-checks for teletherapy units**

A. A licensee authorized to use teletherapy units for medical use must perform output spot-checks on each teletherapy unit once in each calendar month that include determination of:

(1) timer constancy, and timer linearity over the range of use;

(2) on-off error;

(3) the coincidence of the radiation field and the field indicated by the light beam localizing device;

(4) the accuracy of all distance measuring and localization devices used for medical use;

(5) the output for one typical set of operating conditions measured with the dosimetry system described in 4731.1208, subp. 7, B; and

(6) the difference between the measurement made in 4731.1210, subp. 1, A, (5), the anticipated output, expressed as a percentage of the anticipated output (i.e., the value obtained at least full calibration corrected mathematically for physical decay).

B. A licensee must perform measurements required by 4731.1210, subp. 1, A, in accordance with written procedures established by the authorized medical physicist. That individual need not actually perform the spot check measurements.

C. A licensee must have the authorized medical physicist review the results of each spot-check within 15 days. The authorized medical physicist must promptly notify the licensee in writing of the results of each spot-check.

D. A licensee authorized to use a teletherapy unit for medial use must perform safety spot-checks of each teletherapy facility once in each calendar month and after each source installation to assure proper operation of:

(1) electrical interlocks at each teletherapy room entrance;

(2) electrical or mechanical stops installed for the purpose of limiting use of the primary beam of radiation (restriction of source housing angulation or elevation, carriage or stand travel and operation of the beam on-off mechanism);

(3) source exposure indicator lights on the teletherapy unit, on the control console, and in the facility;

(4) viewing and intercom systems;

(5) treatment room doors form inside and outside the treatment room; and

(6) electrically assisted treatment room doors with the teletherapy unit electrical power turned off.

E. If the results of the checks required in 4731.1210, subp. 1, D, indicate the malfunction of any system, a licensee must lock the control console in the off position and not use the unit except as may be necessary to repair, replace, or check the malfunctioning system.

F. A licensee must retain a record of each spot-check required by 4731.1210, subp. 1, A and D, in accordance with 4731.1214, subp. 5, C.

Subp 2. **Periodic spot-checks for remote afterloader units.**

A. A licensee authorized to use remote afterloader unit for medical use must perform spot-checks on each unit:

(1) before the first use of a high dose-rate, medium dose-rate, or pulsed dose-rate remote afterloader unit on a given day ;

(2) before each patient treatment with a low dose-rate remote afterloader unit; and

(3) after each source installation.

B. A licensee shall perform the measurements required by 4731.1210, subp. 2, A, in accordance with written procedures established by the authorised medical physicist. That individual need not actually perform the spot-check measurement

C. A licensee must have the authorized medical physicist review the results of each spot-check within 15 days. The authorized medical physicist shall notify the licensee as soon as possible in writing of the results of the spot-check..

D. To satisfy the requirements of 4731.1210, subp. 2, A, spot-checks must, at a minimum, assure proper operation of:

(1) electrical interlocks at each remote afterloader unit room entrance;

(2) source exposure indicator lights on the remote afterloader unit, on the control console, and in the facility;

(3) viewing and intercom systems in each high dose-rate, medium dose-rate, and pulsed dose-rate remote afterloader facility;

(4) emergency response equipment;

(5) radiation monitors used to indicate the source position;

(6) timer accuracy; and

(7) clock time, date and time, in the unit's computer; and

(8) decayed source(s) activity in the unit's computer.

E. If the results of the checks required in 4731.1210, subp. 2, D, indicate the malfunction of any system, a licensee must lock the control console in the off position and not use the unit except as may be necessary to repair, replace, or check the malfunctioning system.

F. A licensee must retain a record of each check required by 4731.1210, subp. 2, D,

and a copy of the procedures required by 4731.1210, subp. 2, in accordance with 4731.1214, subp. 5, B.

Subp 3. Reserved

Subp 4. **Periodic spot-checks for gamma stereotactic radiosurgery units**

A. A licensee authorized to use gamma stereotactic radiosurgery units for medical use shall perform spot-checks of each gamma stereotactic radiosurgery facility and on each unit:

(1) monthly,

(2) before the first use of the unit on a given day; and

(3) after each source installation.

B. The licensee must:

(1) perform the measurements required by 4731.1210, subp. 4, A, above, in accordance with written procedures established by the authorized medical physicist. That individual need not actually perform the spot-check measurements; and

(2) have the authorized medical physicist review the results of each spot-check within 15 days. The authorized medical physicist mst notify the licensee as soon as possible in writing of the results of each spot-check .

C. To satisfy the requirements of 4731.1210, subp. 4, A, (1), spot-checks must, at a minimum:

(1) assure proper operation of:

(a) treatment table retraction mechanism, using backup battery power or hydraulic backups with the unit off;

(b) helmet microswitches;

(c) emergency timing circuits; and

(d) stereotactic frames and localizing devices (trunnions)

(2) determine:

(a) the output for one typical set of operating conditions measure with the dosimetry system described in 4731.1208, subp. 8, B;

(b) the difference between the measurement made in 4731.1210, subp. 4, C, (2), (a), and the anticipated output, expressed as a percentage of the anticipated output (i.e., the value obtained at last full calibration corrected mathematically for physical decay);

(c) source output against computer calculation;

(d) timer accuracy and linearity over the range of use;

(e) on-off error; and

(f) trunnion centricity

D. To satisfy the requirements of 4731.1210, subp. 4, A, (2) and (3), spot-checks must assure proper operation of:

(1) electrical interlocks at each gamma stereotactic radiosurgery room entrance;

(2) source exposure indicator lights on the gamma stereotactoic radiosurgery unit, on the control console, and in the facility;

(3) viewing and intercom systems;

(4) timer termination;

(5) radiation monitors used to indicate room exposures; and

(6) emergency off buttons.

E. A licensee must arrange for repair of any system identified in 4731.1210, subp. 4, C, that is not operating properly as soon as possible.

F. If the results of the checks required in 4731.1210, subp. 4, D, indicate the malfunction of any system, a licensee shall lock the control console in the off position and not use the unit except as may be necessary to repair, replace, or check the malfunctioning system.

G. A licensee must retain a record of each check required by 4731.1210, subp. 4, C and D, in accordance with 4731.1214, subp. 5, C.

Subp 5, **Additional Technical requirements for mobile remote afterloaders.**

A. A licensee providing mobile remote afterloader service must:

(1) check survey instruments before medical use at each address of use or on each day of use, which ever is more frequent; and

(2) account for all sources before departure from a client's address of use.

B. In addition to the periodic spot-checks required by 4731.1210, subp. 2, a licensee authorized to use mobile afterloaders for medical use must perform checks on each remote afterloader unit before use at each address of use. At a minimum, checks must be made to verify the operation of:

(1) electrical interlocks on treatment area access points;

(2) source exposure indicator lights on the remote afterloader unit, on the control console, and in the facility;

(3) viewing and intercom systems;

(4) applicators, source transfer tubes, and transfer-applicator interfaces;

(5) radiation monitors used to indicate room exposures;

(6) source positioning (accuracy); and

(7) radiation monitors used to indicate whether the source has returned to a safe shielded position.

C. In addition to the requirements for checks in 4731.1210, subp. 5, B, a licensee must ensure overall proper operation of the remote afterloader unit by conducting a simulated cycle of treatment before use at each address of use.

D. If the results of the checks required in 4731.1210, subp. 5, B, above, indicate the malfunction of any system, a license shall lock the control console in the off position and not use the unit except as may be necessary to repair, replace, or check the malfunctioning system.

E. A licensee must retain a record of each check required by 4731.1210, subp. 5, B, in accordance with 4731.1214, subp. 6, A.

4731.1211 Use of Sealed Sources for Medical Applications

Subpart 1. **Use of sealed sources for diagnosis.** A licensee must use only sealed sources for diagnostic medical uses as approved in the Sealed Source and Device Registry.

Subp 2. **Suppliers for sealed sources or devices for medical use.** For medical use, a licensee may use only:

A. Sealed sources or devices manufactured, labeled, packaged, and distributed in accordance with a license issued pursuant to 4731.0300- 4731.0320, and

4731.0311, subp. 10, or equivalent requirements of NRC or an agreement state;

B. Sealed sources or devices noncommercially transferred from a commissioner's medical use licensee; or

C. Teletherapy sources manufactured and distributed in accordance with a license issued under 4731.3000-4731.3020, or equivalent requirements of NRC or an agreement state.

Subp 3 **Use of a sealed source in a remote afterloader unit, teletherapy unit or gamma stereotactic radiosurgery unit.** A licensee must use sealed sources in photon emitting remote afterloader units, teletherapy units, or gamma stereotactic radiosurgery units for therapuetic medical uses:

A. As approved in the Sealed source and Device Registry; or

B. In research in accordance with an active Investigational Device Exemption(IDE) application accepted by the FDA provided the requirements of 4731.1211, subp. 2, A.

Subp. 4. **Decay of strontium-90 sources for ophthalmic treatments.**

A. Only an authorized medical physicist shall calculate the activity of each strontium-90 source that is used to determine the treatment times for ophthalmic treatments. The decay must be based on the activity determined under 4731.1209, subp. 4.

B. A licensee shall obtain a record of the activity of each strontium-90 source in accordance with 4731.1214, subp. 4, H.

4731.1212 Use of Unsealed Sources for Medical Applications

Subpart 1. **Use of unsealed radioactive material for uptake, dilution, and excretion studies for which a written directive is not required.** Except for quantities that require a written directive under 4731.1202,subp. 6, a licensee may use any unsealed radioactive material, prepared for medical use for uptake, dilution, or excretion studies that is:

A. Obtained from a manufacturer or preparer licensed pursuant to 4731.0311, subp. 9, equivalent NRC or agreement state requirements; or

B. Prepared by an authorized nuclear pharmacist, a physician who is an authorized user and who meets the requirements specified in 4731.1207, subparts 2 and 3, or an individual under the supervision of either as specified in 4731.1202, subp 4.

C. Obtained from and prepared for a commissioner's, NRC or agreement state licensee for use in research in accordance with a Radioactive Drug Research Committee-approved protocol or in Investigational New Drug(IND) protocol accepted by FDA; or

D. Prepared by the licensee for use in research in accordance with a Radioactive Drug Research Committee-approved application or an Investigational New Drug(IND) protocol accepted by FDA.

Subp 2 **Use of unsealed radioactive material for imaging and localization studies for which a written directive is not required.** Except for quantities that require a written directive under 4731.1202, subp.6, B, a licensee may use any unsealed radioactive material prepared for medical use for imaging and localization studies that is:

A. Obtained from a manufacturer or preparer licensed pursuant to 4731.0311, subp. 9, or equivalent NRC or agreement state requirements; or

B. Prepared by an authorized nuclear pharmacist, a physician who is an authorized user and who meets the requirements specified in 4731.1207, subparts 2 or 3, or an individual under the supervision of either as specified in 4731.1202, subp. 4.

C. Obtained from and prepared by a commissioner's , NRC or agreement state licensee for use in research in accordance with a Radioactive Drug Research Committee-approved protocol or an Investigational New Drug(IND) accepted by the FDA; or

D. Prepared by the licensee for use in research in accordance with a Radioactive Drug Research Committee-approved application or an Investigational New Drug (IND) protocol accepted by the FDA.

Subp 3. **Permissible molybdenum-99 concentration**

A. A licensee may not administer to humans a radiopharmaceutical containing more than 0.15 microcurie of molybdenum-99 per millicurie of technetium-99m (0.15 kilobequerel of molybdenum-99 per megabecquerel of technetium-99m).

B. A licensee that uses molybdenum-99/technetium-99m generators for preparing a technetium-99m radiopharmaceutical shall measure the molybdenum-99 concentration of the first eluate after receipt of a generator to demonstrate compliance with 4731.1212, subp. 3, A.

C. If a licensee that is required to measure the molybdenum-99 concentration, the licensee shall retain a record of each measurement in accordance with 4731.1214, subp. 3, D.

Subp 4. **Use of unsealed radioactive material for which a written directive is required.** A licensee may use any unsealed radioactive material prepared for medical use and for which a written directive is required that is:

A. Obtained from a manufacturer or preparer licensed pursuant to 4731.0311, subp. 9; or equivalent NRC or agreement state requirements; or

B. Prepared by an authorized nuclear pharmacist, a physician who is an authorized user and who meets the requirements specified in 4731.1207, subparts 2 and 3, or an individual under the supervision of either as specified in 4731.1202, subp. 4.

C. Obtained from and prepared by the commissioner's, NRC or agreement state licensee for use in research in accordance with an Investigational New Drug (IND) protocol accepted by the FDA; or

D. Prepared by the licensee for use in research in accordance with an Investigational New Drug (IND) protocol accepted by the FDA.

4731.1213 Brachytherapy

Subpart 1. **Use of sources for manual brachytherapy.** A licensee must use only brachytherapy sources for therapeutic medical uses :

A. As approved in the Sealed Source and Device Registry; or

B. In research in accordance with an active Investigational Device exemption (IDE) application accepted by the FDA provided the requirements of 4731.1211, subp. 2 are met.

Subp 2. **Surveys of patients or human research subjects after source implant and removal.**

A. Immediately after implanting sources in a patient or a human research subject, the licensee shall make a radiation survey of the patient or the human research

subject and the room of use to confirm that no sources have been misplaced.

B. Immediately after removing the last temporary implant source from a patient or a human research subject, the licensee shall make a radiation survey of the patient or the human research subject with a radiation detection survey instrument to confirm that all sources have been removed.

C. A licensee must retain a record of patient or human research subject surveys in accordance with 4731.1214, subp. 2, B

Subp 3. **Brachytherapy sources acountability**

A. A licensee must maintain accountability at all times for all brachytherapy sources in storage or use.

B. As soon as possible after removing sources from a patient or a human research subject, a licensee must return brachytherapy sources to a secure storage area.

C. A licensee must maintain a record of the brachytherapy source accountability in accordance with 4731.1214, subp. 3, C.

4731.1214 Records

Subpart 1. **Administrative records**

A. Records of mobile medical services.

(1) a licensee shall retain a copy of each letter that permits the use of radioactive material at a client's address of use, in accordance with 4731.1206, subp. 3, A, (1) . Each letter must clearly delineate the authority and responsibility of the licensee and the client and must be retained for 4 years after the last provision of service or until the commissioner's inspection.

(2) a licensee shall retain the record of each survey required by 4731.1206, subp. 3, A, (4), for four years or until the next inspection. The record must include:

(a) the date of the survey;
(b) the results of the survey
(c) the instrument used to make the survey; and
(d) the name of the individual who performed the survey.

B. Records of safety instruction. A licensee shall maintain a record of instructions and training required by 4731.1203, subparts 2, 4, and 6, for four years or until the next inspection by the commissioner. The record must include:

(1) a list of the topics covered;
(2) the date of the instruction;
(3) the names(s) of the attendee(s); and
(4) the name(s) of the individual(s) who provided the instruction.

C. Records of authority and responsibilities for radiation protection programs

(1) a licensee shall retain a record of actions taken by the licensee's management in accordance with 4731.1202, subp. 1, A, for 5 years. The record must include a summary of the actions taken and a signature of licensee management.

(2) the licensee shall retain a current copy of the authorities, duties, and responsibilities of the Radiation Safety Officer, as required in 4731.1202, subp. 1, E , and a signed copy of the radiation safety officer's willingness to be responsible for implementing the

radiation safety program, as required by 4731.1202, subp. 1, B. The records must include the signature of the radiation safety officer and licensee management.

D. Records of radiation protection program changes. A licensee shall retain a record of each radiation protection program change made in accordance with 4731.1202, subp. 2, A, for 5 years. The record must include a copy of the old and new procedures; the effective date of the change; and the signature of the licensee management that reviewed and approved the change.

E. Records of written directives. A licensee shall retain a copy of each written directive as required by 4731.1202, subp. 6, for 4 years or until the next commissioner's inspection.

F. Reserved

G. Reserved

H. Records for procedures for administrations requiring a written directive. A licensee shall retain a copy of the procedures required by 4731.1202, subp. 7, A for the duration of the license.

Subp 2 **Survey records**

A. reserved

B. Records of the release of individuals containing unsealed radioactive materials or implants containing radioactive material.

(1) a licensee shall retain a record in accordance with 4731.1204, subp. 2, that describes the bases for authorizing the release of individuals if the total effective dose equivalent is calculated by:

(a) using the retained activity rather than the activity administered;

(b) using an occupancy factor less than 0.25 at 1 meter

(c) using the biological or effective half-life; or

(d) considering the shielding by tissue.

(2) a licensee shall retain a record that the instructions required by 4731.1204, subp. 2, B, were provided to a breast-feeding woman if the radiation dose to the infant or child from continued breast-feeding could results in a total effective dose equivalent exceeding 0.5 rem (5mSv).

(3) a licensee shall retain records of the release of individuals containing pharmaceuticals or implants in accordance with 4731.1214, subp. 2, B, (1) and (2), for four years after the date of release and until the next inspection by the commissioner

C. Records of surveys after source implant and removal. A licensee must maintain a record of the surveys required by 4731.1204, subparts 2 and 3 for 4 years or until the next inspection by the commissioner. Each record must include the date and results of the survey, the survey instrument used, and the name of the individual who made the survey.

Subp 3. **Records of radioactive material**

A. Records of dosages of unsealed radioactive material for medical use

(1) a licensee shall maintain a record of dosage determinations required by 4731.1208, subp. 4, for 4 years or until the next inspection by the commissioner.

(2) the record must contain:

(a) radiopharmaceutical;

(b) patient's or human research subject's name or identification number if

one has been assigned;

(c) prescribed dosage, the determined dosage, or a notation that the total activity is less than 30 curies (1.1 MBq);

(d) date and time of the dosage determination; and

(e) name of the individual who determined the dosage.

B. Records of leaks tests and inventory of sealed sources and brachytherapy sources

(1) a licensee shall retain records of leak tests required by 4731.1208, subp. 6, B, for 4 years or until the next inspection. The records must contain the model number, and serial number if one has been assigned, of each source tested, the identity of each source radionuclide and its estimated activity, the measured activity of each test sample, a description of the method used to measure each test sample, the date of the test, and the name of the individual who performed the test.

(2) a licensee shall retain records of the semi-annual physical inventory of sealed sources and brachytherapy sources required by 4731.1208, subp. 6, G, for 4 years or until the next inspection. The inventory records must contain the model number of each source, and the serial number if one has been assigned, the identity of each source radionuclide and its nominal activity, the location of each source, and the name of the individual who performed the inventory.

C. Records of brachytherapy source accountability.

(1) a licensee shall maintain a record of brachytherapy source accountability required by 4731.1213, subp. 3, for four years or until the next inspection.

(2) for temporary implants, the record must include:

(a) the number and activity of sources removed from storage, the time and date they were removed from storage, the name of the individual who removed them from storage, and the location of use; and

(b) the number and activity of sources returned to storage, the time and date they were returned to storage, and the name of the individual who returned them from storage.

(3) for permanent implants, the record must include:

(a) the number and activity of sources removed form storage, the date they were removed from storage, and the name of the individual who removed them from storage.

(b) the number and activity of sources not implanted, the date they were returned to storage, and the name of the individual who returned them to storage; and

(c) the number and activity of sources permanently implanted in the patient or human research subject.

D. Records of molybdenum-99 concentrations. A licensee shall maintain a record of the molybdenum-99 concentration tests required by 4731.1212, subp. 3, B, for four years or until the next inspection. The record must include for each measured elution of technetium-99m:

(1) the ratio of the measures expressed as microcuries of molybdenum per millicurie of technetium (or kilobecquerel of molybdenum per megabecquerel of technitium-99;

(2) the time and date of the measurement; and

(3) the name of the individual who made the measurement.

E. Records of decay-in-storage. A licensee shall maintain records of the disposal of licensed materials made in accordance with 4731.1206, subp. 4, for 4 years or until the next

inspection. The record must include:

(1) the date of the disposal;

(2) the radionuclides disposed;

(3) the survey instrument used;

(4) the background dose rate;

(5) the dose rate measured at the surface of each waste container; and

(6) the name of the individual who performed the disposal.

Subp 4. **Calibration records**

A. Records of instrument calibrations. A licensee shall maintain a record of instrument calibrations required by 4731.1208, subp. 1, for 4 years or until the next inspection by the commissioner. The records must include the model and serial numbers of the instrument, the date of the calibration, the results of the calibration, and the name of the individual who performed the calibration.

B. Records of radiation survey instrument calibrations. A licensee shall maintain a record of radiation survey instrument calibrations required by 4731.1208, subp. 2, for 4 years, or until the next inspection. The record must include the model and serial number of the instrument, the date of the calibration, the results of the calibration, and the name of the individual who performed the calibration.

C. Records of dosimetry equipment used with remote afterloader units, teletherapy units, and gamma stereotactic radiosurgery units.

(1) a licensee shall retain a record of the calibration, intercomparison, and comparisons of its dosimetry equipment done in accordance with 4731.1208, subp. 7, for the duration of the license.

(2) for each calibration, intercomparison, or comparison, the record must include:

(a) the date;

(b) the manufacturer's name, model numbers and serial numbers of the instruments that were calibrated, intercompared, or compared as required by 4731.1208, subp. 7, A and B;

(c) the correction factor that was determined from the calibration or comparison or the apparent correction factor that was determined from an intercomparison; and

(d) the name(s) of the individual(s) who performed the calibration, intercomparison, or comparison.

D. Records of calibration measurements of brachytherapy sources.

(1) a licensee shall maintain a record of the full calibrations on brachytherapy sources required by 4731.1209, subp. 4, for four years after the last use of the source.

(2) the records must include:

(a) the date of the calibration;

(b) the manufacturer's name;

(c) model number;

(d) serial number for the source and instruments used to calibrate the source; the source output; source positioning accuracy within applicators; and

(e) the signature of the authorized medical physicist

E. Records of teletherapy, remote afterloader, and gamma stereotactic radiosurgery full

calibrations.

(1) a license shall maintain a record of the teletherapy unit, remote afterloader unit, and gamma stereotactic radiosurgery unit full calibrations required by 4731.1209, subparts 1, 2, and 3, for four years or until the next inspection by the commissioner..

(2) the record must include:

(a) the date of the calibration;

(b) the manufacturer's name, model number, and serial number for the teletherapy, remote afterloader, ane gamma stereotactic radiosurgery unit(s), the source(s), and instruments used to calibrate the unit(s);

(c) the results and an assessment of the full calibrations;

(d) the results of the autoradiograph required for low dose-rate remote afterloader units; and

(e) the signature of the authorized medical physicist who performed the full calibration.

F. Reserved

G. Records of installation, maintenance, adjustment, and repair of remote afterloader units, teletherapy units, and gamma stereotactic radiosurgery unit. A licensee shall retain a record of the installation, maintenance, adjustment, and repair of remote afterloader units, teletherapy units, and gamma stereotactic radiosurgery units as required by 4731.1206, subp. 5, for 4 years or until the next inspection by the commissioner. For each installation, maintenance, adjustment and repair, the record must include the date, description of the service, and name(s) of the individual(s) who performed the work.

H. Records of decay of strontium-90 sources for ophthmalic treatments.

(1) a licensee shall maintain a record of the activity of a strontium-90 source required by 4731.1211, subp. 4, for the life of the source.

(2) the record must include:

(a) the date and initial activity of the source as determined under 4731.1209, subp. 4; and

(b) for each decay calculation, the date and the source activity as determined under 4731.1211, subp.4.

Subp 5. **Spot check records**

A. Records of periodic spot-checks for teletherapy units.

(1) a licensee shall retain a record of each periodic spot-check for teletherapy units required by 4731.1210, subp. 1, for four years or until the next inspection.

(2) the record must include:

(a) the date of the spot-check;

(b) the manufacturer's name;

(c) model number;

(d) serial number for the teletherapy unit, source;

(e) instruments used to measure the output of the teletherapy unit;

(f) an assessment of time linearity and constancy;

(g) the calculated on-off error;

(h) a determination of the coincidence of the radiation field and the field

indicated by the light beam localizing device;

(i) the determined accuracy of each distance measuring and localization device;

(j) the difference between the anticipated output and the measured output;

(k) notations indicating the operability of each entrance door electrical interlock, each electrical or mechanical stop, each source exposure indicator light, and the viewing and intercom system and doors; and

(l) the name of the individual who performed the periodic spot-check; and

(m) the signature of the authorized medical physicist who reviewed the record of the spot-check.

(3) a licensee must retain a copy of the procedures required by 1210. Subp. 1, B, until the licensee no longer possesses the teletherapy unit.

B. Records of periodic spot-checks for remote afterloader units.

(1) a licensee shall retain a record of each spot-check for remote afterloader units required by 4731.1210, subparts 2 and 3, for four years or until the next inspection.

(2) the record must include:

(a) the date of the spot-check;

(b) the manufacturer's name;

(c) model number and serial number for the remote afterloader unit, source, and instrument used to measure the output of the remote afterloader unit;

(d) an assessment of timer accuracy;

(e) notations indicating the operability of each entrance door electrical interlock, source retraction mechanism, radiation monitors, source exposure indicator lights, viewing and intercom systems is applicable;

(f) the name of the individual who performed the periodic spot-check; and

(g) the signature of the authorized medical physicist who reviewed the record of the spot-check

C. Records of Periodic spot-checks for gamma stereotactic radiosurgery units.

(1) a licensee shall retain a record of each spot-check for gamma stereotactic radiosurgery units required by 4731.1210, subp. 4, for four years or until the next inspection.

(2). The record must include:

(a) the date of the spot-check;

(b) the manufacturer's name;

(c) model number and serial number for the gamma stereotactic radiosurgery unit and the instrument used to measure the output of the unit;

(d) an assessment of timer linearity and accuracy;

(e) the calculated on-off error;

(f) a determination of trunnion centricity;

(g) the difference between the anticipated output and the measured output;

(h) an assessment of source output against computer calculations;

(i) notations indicating the operability of radiation monitors, helmet microswitches, emergency timing circuits, emergency off buttons, electrical interlocks, source exposure indicator lights, viewing and intercom systems, timer termination, treatment table retraction mechanism, and stereotactic frames and localizing devices (trunnions); and

(j) the name of the individual who performed the periodic spot-check; and the signature of the authorized medical physicist who reviewed the record of the spot-check.

(3) a licensee must retain a copy of the procedures required by 4731.1210, subp 2, 4, until the licensee no longer possess the gamma stereotactic radiosurgey unit.

Subp 6. **Retention of inspection records for selected procedures**

A. Records of additional technical requirements for mobile remote afterloaders

(1) a licensee shall retain a record of each check for mobile remote afterloaders required by 4731.1210, subp. 5, for four years or until the next inspection by the commissioner.

(2) the record must include:

(a) the date of the check;

(b) the manufacturer's name;

(c) model number or remote afterloader;

(d) serial number of the remote afterloader;

(e) notations accounting for all sources before the licensee departs from a facility;

(f) notations indicating the operability of each entrance door electrical interlock, radiation monitors, source exposure indicator lights, viewing and intercom system, applicators, source transfer tubes, and transfer tube applicator interfaces, and source positioning accuracy; and

(g) the signature of the individual who performed the check.

B. Records of surveys of therapeutic treatment units.

(1) a licensee shall maintain a record of radiation surveys of treatment units made in accordance with 4731.1205, subp..1, for the duration of use of the unit.

(2) the record must include:

(a) the date of the measurements;

(b) the manufacturer's name;

(c) model number and serial number of the treatment unit, source, and instrument used to measure radiation levels;

(d) each dose rate measured around the source while the unit is in the off position and the average of all measurements; and

(e) the signature of the individual who performed the test.

C. Records of 5-year inspection for teletherapy and gamma stereotactic surgery units.

(1) a licensee shall maintain a record of the 5-year inspections for teletherapy and gamma stereotactic radiosurgery units required by 4731.1205, subp. 2, for the duration of use of the unit.

(2) the record must contain:

(a) the inspector's radioactive material license number

(b) the date of inspection;

(c) the manufacturer's name;

(d) model number of both the treatment unit and source;

(e) serial number of both the treatment unit and source;

(f) a list of components inspected and serviced, and the type of service; and

(g) the signature of the inspector.

D. Records of safety procedures. The licensee shall retain a copy of the procedures required by 4731.1203, subp. 6, A,(4), and D, (2), until the licensee no longer possesses the remote afterloader unit, teletherapy unit, or gamma stereotactic radiosurgery unit.

4731.1300 Registrant's Safety Requirements

Subpart 1. **Registrant responsibility**. The registrant is responsible for directing the operation of all x-ray and accelerator systems under the registrant's administrative control.

A. The registrant or the registrant's agent must ensure that the requirements specified in this part are met in the operation of all diagnostic and therapeutic x-ray systems and medical accelerators.

B. The registrant or the registrant's agent must ensure that the requirements in 4731.1300 subpart 2, 4731.0130, subparts 1 and 3, and 4731.0137 are met in the operation of all industrial x-ray systems and non-medical accelerators.

C. The registrant must supply the personnel with individual personnel monitoring dosimeters and require the personnel to wear the dosimeter in accordance with 4731.0130.

Subp. 2. **X-ray system and accelerator compliance**. An x-ray system or accelerator that does not meet the provisions of this chapter shall not be operated for diagnostic, therapeutic, or industrial purposes.

Subp. 3. **Individuals who may apply radiation**. Only those individuals who are licensed practitioners of the healing arts or individuals who have successfully passed an examination specified in parts 4731.0150 subpart 2 through subpart 5, may intentionally apply radiation to an individual.

Subp. 4. **Procedure and safety instruction**. All individuals who operate an x-ray system shall be initially instructed and annually retrained in facility-specific and system-specific safe operating procedures, emergency procedures for malfunctioning equipment, and quality assurance procedures. Written safety procedures for the facility and x-ray systems shall be provided by the registrant to the individuals specified in subpart 3 including:

A. Information on the effects of radiation exposure to the human body and the embryo-fetus;

B. Projections where holding devices cannot be used; and

C. Any restrictions of the operating technique required for the safe operation of the particular x-ray system.

D. All x-ray operators must be instructed as to the proper placement, size and type of gonad shielding to be used. Documentation of the instruction must be retained for review by the commissioner.

Subp. 5. **Radiographic technique chart**. A radiographic technique chart shall be provided in the vicinity of the x-ray system's control panel which specifies, for all examinations performed with that system, the following information:

A. The patient's anatomical size and corresponding technique factors to be used;

B. The type of the screen-film combination, or direct exposure x-ray film for dental intraoral radiography, to be used;

C. The grid focal distance and the grid ratio to be used, if any;

D. The source-to-image distance to be used; and

E. For automatic exposure control (AEC) or phototimed units, the percent differences between the AEC increments.
For computed tomography systems, a current technique chart for each routine examination, and the computed tomography conditions of operation must be provided.

Subp. 6. **Exposure of individuals other than the patient**. All radiographic procedures and therapeutic x-ray procedures must meet the requirements of this subpart.

A. Except for the patient, only the staff and ancillary personnel required for the medical, dental, and veterinary medicine procedure or training shall be in the room during the radiographic exposure.

B. All staff and ancillary personnel required for assistance with the radiographic procedures shall be positioned so no part of the body, including the hands, will be struck by the useful beam unless protected by 0.5 millimeter lead equivalent material.

C. All staff and ancillary personnel who must remain in the room to assist during radiographic, fluoroscopic, portable, or computed tomography procedures must be protected from scattered radiation by protective aprons or whole body protective barriers of not less than 0.5 millimeter lead equivalence.

D. Patients and individuals who are not involved in diagnostic radiographic procedures or demonstrations using either stationary or portable x-ray equipment, who cannot leave the room and who cannot be protected by adequate distance for the exam being performed must be protected from scattered radiation by protective lead aprons or whole body protective barriers of at least 0.25 millimeters lead equivalence.

E. During any radiographic or fluoroscopic exposure, any door which is part of the protective barrier must be closed.

F. No individual other than the patient shall be in a therapy treatment room during exposures from a therapeutic x-ray system operating above 50 kVp.

G. Thyroid and eyes must be protected if the potential exposure to the worker would exceed 10 percent of the dose limits listed in part 4731.0124 through 4731.0125.

Subp. 7. **Gonad protection**. Except for cases in which it would interfere with the diagnostic procedure, during radiographic procedures in which the gonads are in or within two inches (5cm) of the useful beam, gonad shielding of not less than 0.5 millimeter lead equivalence must be used for patients who have procreative potential.

Subp. 8. **Holding**. When a patient, film cassette, or intraoral film must be provided with auxiliary support during a radiation exposure, items A to E apply.

A. Mechanical holding devices shall be used when the technique permits.

B. Written safety procedures, as required by 4731.1300, subpart 4, must indicate the requirements for selecting the individual holding and the procedure that individual shall follow.

C. The human holder must be protected as required by 4731.1300, subpart 6.

D. No individual shall be used routinely to hold intraoral film, film cassettes, or patients.

E. In those cases where the patient must hold the film cassette, any portion of the body, other than the area of clinical interest struck by the useful beam, shall be protected by not less than 0.5

millimeter lead equivalent material.

F. If a patient must be held in position during therapeutic x-ray treatment, mechanical supporting or restraining devices shall be used.

Subp. 9. **Prevention of unauthorized use**. Therapy x-ray systems shall not be left unattended unless they are secured against unauthorized use.

Subp. 10. **Facility design requirements**. The registrant must ensure that the applicable structural shielding requirements specified in 4731.0137 through 4731.0141 are met. If an analysis of operating conditions indicates the possibility of an individual receiving a dose over the limits in 4731.0124 through 4731.0126 , the commissioner may require that structural shielding modifications be made.

4731.1301 Radiological Practice Standards.

Subpart 1. **Procedures and auxiliary equipment** designed to minimize patient and personnel exposure commensurate with ALARA to achieve the needed diagnostic information shall be used.

A. The speed of screen-film combinations, or direct exposure x-ray film in intraoral dental radiography, shall be the fastest speed consistent with the diagnostic objective of the examinations.

B. Intensifying screens shall be used in combination with the compatible film, with the exception of dental intraoral films and radiation therapy port films.

C. The radiation exposure to the patient shall be the minimum exposure required to produce images of good diagnostic quality.

D. Protective aprons and gloves shall be monitored annually for lead protection integrity. A record of the monitoring shall be maintained until the next inspection by the commissioner.

E. Viewboxes must be kept clean and be of uniform intensity. Bulbs must be of the same color. Luminance of the viewboxes located where films are checked for quality must be similar to those located where radiographs are interpreted.

F. Portable x-ray equipment shall be used only for examinations where it is impractical to transfer the patient to a stationary x-ray system.

G. Radiographic systems subject to 4731.1301, subp. 2, other than fluoroscopic, dental intraoral, and dental panoramic systems must not be used in procedures where the source-to-skin distance is less than 30 centimeters (11.8 inches), except as described in 4731.1301 .

Subp. 2. **Darkroom standards**.

A. The darkroom for film development must be free of extraneous light so fog is not added to film during handling and processing.

B. Darkroom safelight filters must be compatible with the films being processed.

C. The darkroom for film development must be tested for film fog:

(1) at least every six months;

(2) any time fog is suspected;

(3) whenever there is a change in film speed;

(4) at time of change of a safelight bulb or filters;

(5) any time the integrity of any seal around the processor, other equipment, or the darkroom may have been compromised.

D. The amount of fog (increase in optical density) for a two-minute fog test must not exceed 0.05 for facilities doing mammographic film development and 0.08 for all other radiographic film development.

E. Film processing must meet the following requirements:

(1) all film must be processed to achieve optimal sensitometric performance;

(2) the film manufacturer's published recommendations for processing time and temperature must be followed;

(3) chemicals must be mixed according to the chemical manufacturer's recommendations;

(4) the daily sensitometry must be charted, reviewed, and corrective action taken, if necessary, before patients' films are processed; and

(5) all radiographs must be free of artifacts that could cause a misinterpretation.

F. The darkroom fog test and sensitometry must, at a minimum, be performed on the film most sensitive to light and processor changes

4731.1302 Ordering of Radiographic Examinations. The registrant shall be responsible for ensuring that the following requirements on ordering radiographic or fluoroscopic examinations are met except when the radiographic examination is part of a healing arts screening program approved by the commissioner.

A. The order for a radiographic examination can be made only by a physician, dentist, veterinarian, chiropractor, podiatrist, or osteopath. A physician assistant, or registered physician assistant must show eligibility to order radiographic procedures through a written delegation agreement.

B. The radiographic provider must not carry out a radiographic procedure ordered by a physician assistant, or registered physician assistant unless a copy of a written delegation agreement is on file with the facility.

C. The order for a radiographic procedure must include clearly stated clinical indications for the examination and be available to procedure personnel at the time of the examination.

4731.1303 Required Quality Assurance Program

Subpart 1. **Applicability**. Each registrant conducting radiographic, fluoroscopic or therapeutic x-ray procedures must implement a site-specific quality assurance program which includes:

A. A quality assurance manual that contains written policies and procedures for radiation protection and describes the quality assurance program;

B. The equipment performance tests specified in 4731.1308 - 4731.1311;

(1) The quality assurance manual described in this subpart must include the required tests and the minimum performance criteria specified in 4731.1308 - 4731.1311 for the registrant's radiographic or therapeutic equipment and processing equipment. The registrant is not limited to the equipment performance tests required in 4731.1308 - 4731.1311 but may also include tests from item C. The registrant is required to meet the minimum performance criteria specified

in 4731.1308 - 4731.1311, when applicable. .

B. The manual must specify the minimum frequency of equipment performance tests. In addition, the tests must be done after any change in the facility or equipment which might cause an increase in radiation hazard or a change in equipment that results in the minimum performance criteria not being met.

C. Radiation safety surveys as specified in 4731.0132 subparts 1 and 3;

D. Calibrations as required in 4731.1304;

E. In-service education for employees as specified in 4731.0151;

F. The numeric results of equipment performance tests and the correction of any deficiencies as specified in the quality assurance manual; and

G. The calibration record of any electronic equipment used in the equipment performance tests within the preceding two years. The calibration of any electronic equipment must be in accordance with 4731.0133, subpart 1.

H. The records required in 4731.0169, subp. 5. The facility must retain records showing the correction of any deficiencies until the next inspection by the commissioner.

In addition to items A to H, each registrant with therapeutic x-ray equipment must also make spot checks as specified in 4731.1306. Accelerators used in medical settings must have separate equipment performance procedures as specified in 4731.0900 - 4731.0907.

Subp. 2. **The registrant and the registrant's employees** must be familiar with the contents and recommendations of any of the following applicable publications:

A. NCRP report 99, "Quality Assurance for Diagnostic Imaging Equipment," (December 30, 1988);

B. "Quality Assurance Program for Diagnostic Radiology Facilities," by Roger L. Burkhart, Ph.D., United States Department of Health, Education and Welfare, public health service, food and drug administration, publication number 80-8110 (February 1980);

C. "A Basic Quality Assurance Program for Small Radiology Facilities," by Roger L. Burkhart, Ph.D., United States Department of Health, Education and Welfare, public health service, food and drug administration, publication number 83-8215 (1983).

The registrant may incorporate portions of the publications specified in this subpart into the facility's quality assurance manual described in subpart 1, item A. The publications are available at the Biomedical Library of the University of Minnesota, Minneapolis, Minnesota, or through the Minitex interlibrary loan system.

4731.1304 Calibrations for Diagnostic Radiographic Systems

The registrant must ensure that calibrations are performed on a diagnostic radiographic system whenever that system does not meet the minimum performance criteria specified in 4731.1308 and when there is any change or replacement of components which could cause a change in the radiation output of that system.

4731.1305 Calibrations for Therapeutic X-ray Systems

Subpart 1. **Calibrations for therapeutic x-ray systems of less than 1.0 MeV.** Each registrant

operating a therapeutic x-ray system of less than 1.0 MeV must ensure that the calibrations specified in this subpart are performed.

A. The calibration of the radiation output of a therapeutic x-ray system must be performed:

(1) at intervals not to exceed 12 months;

(2) after any change or replacement of components which could cause a change in the radiation output; and

(3) with a calibrated dosimetry system. The calibration of the dosimeter must be traceable to its calibration standard at the National Institute of Standards and Technology (NIST). Verification of the dosimeter calibration must be performed every two years.

B. The calibration and beam characteristics of the therapeutic x-ray system must include, but not be limited to:

(1) dose rate as a function of field size, technique factors, filter, and treatment distance used;

(2) the degree of congruence between the radiation field and the field indicated by the localizing device if the device is present;

(3) an evaluation of the uniformity of the largest radiation field used;

(4) verification of the applicability of the inverse square law;

(5) verification of the accuracy of any source-to-skin distance (SSD) indicators;

(6) evaluation of timer or end effects; and

(7) verification of half value layer (HVL).

C. A copy of the current therapeutic x-ray system's dosimetry data must be available.

Subp. 2. **Calibrations for therapeutic x-ray systems greater than 1.0 MV.** Each registrant operating a therapeutic x-ray system of greater than 1.0 MV must ensure that the calibrations specified in this subpart are performed.

A. The calibration of systems subject to 4731.1310 must be performed according to protocols TG-21 and TG-25 endorsed by the American Association of Physicists in Medicine. The protocol known as TG-21 is titled "A Protocol for the Determination of Absorbed Dose from High Energy Photon and Electron Beams" and TG-25 is titled "Clinical Electron-Beam Dosimetry: Report of AAPM Radiation Therapy Committee Task Group No. 25." The protocols are published in American Association of Physicists in Medicine, Medical Physics, volume 10, number 6, pages 741 to 771 (1983) and volume 18, number 1, pages 73 to 102 (1991). The TG-21 protocol and the TG-25 protocol are incorporated by reference and are available at the Biomedical Library of the University of Minnesota, Minneapolis, Minnesota, or through the Minitex interlibrary loan system. The protocols are not subject to frequent change. The calibration protocol must be performed:

(1) before the system is first used for the irradiation of a patient;

(2) at time intervals which do not exceed 12 months; and

(3) after any change which might significantly alter the calibration, spatial distribution, or other characteristics of the therapy beam.

B. Calibration radiation measurements required by item A must be performed using a dosimetry system traceable to its calibration standard at the National Institute of Standards and Technology (NIST). The dosimetry system must:

(1) have a calibration factor for cobalt-60 gamma rays traceable to a standard maintained by the National Institute of Standards and Technology (NIST);

(2) have a calibration which has been verified every two years by an Accredited Dosimetry Calibration Laboratory (ADCL) or by intercomparison with another dosimetry system that has been calibrated by an ADCL within two years;

(3) be calibrated after any servicing that may have affected its calibration; and

(4) have constancy checks as specified in 4731.1311, subp.3.

C. The documentation of each therapy beam must include, but not be limited to, the following determinations:

(1) verification that the equipment is operating in compliance with the design specifications for the light localizer, all readouts, the optical distance indicator, laser and cross-hairs alignment with the isocenter (when applicable), radiation isocenter variation with collimator, gantry and table support rotation, beam flatness, and symmetry at a specified depth;

(2) the variation with field size of the absorbed dose rate at a reference depth in-phantom (or air) as a fraction of its value for the field size used to determine the calibration as specified in 4731.1305, subp. 2;

(3) the uniformity of the radiation field and any dependency on the direction of the useful beam;

(4) verification that existing depth-dose data and isodose charts applicable to the specific system continue to be valid or are updated to existing system conditions; and

(5) verification of transmission for all accessories such as wedges, block trays, and compensators.

D. A copy of the most recent beam data must be available.

4731.1306 Therapeutic X-ray System Spot Checks of Calibration

Subpart 1. **Spot checks of calibration for therapeutic x-ray systems of less than 1.0 MV.** The registrant must ensure that spot checks of calibration are performed on therapeutic x-ray systems. Spot checks must be performed at a minimum frequency of every six months and meet the requirements specified in this subpart.

A. Spot-check procedures must be in writing, must be maintained in the facility in accordance with 4731.1306, and must be available to the commissioner on request.

B. Parameters exceeding the tolerance specified in4731.1311 must be corrected to within the tolerance specified before the system is used for patient irradiation.

C. Whenever a spot check indicates a change in the operating level of a system which exceeds the minimum tolerance level specified in 4731.1311, the system must be recalibrated as required in 4731.1320.

D. Items to be spot checked include those calibrations and beam characteristics in 4731.1320.

Subp. 2. **Spot checks of calibration for therapeutic x-ray systems greater than 1.0 MV.** The registrant must ensure that spot checks of calibration are performed on systems subject to 4731.1306 during calibrations and at intervals not to exceed one month. Spot checks must meet the requirements specified in items A to G:

A. Spot-check procedures must be in writing.

B. The spot-check procedures must specify the frequency at which tests or measurements are to be performed and the acceptable tolerance for each parameter measured in the spot check when compared to the value for that parameter determined in the calibration.

C. At intervals not to exceed one month, spot checks must be made of absorbed dose measurements at a minimum of two depths in a phantom.

D. Where a system has built-in devices that provide a measurement of any parameter during irradiation, the measurement must not be used as a spot-check measurement.

E. A parameter exceeding a tolerance level specified in 4731.1311 must be corrected to within the tolerance level before the system is used for patient irradiation.

F. Whenever a spot check indicates a change in the tolerance level of a system which exceeds the minimum tolerance level as specified in 4731.1311, the system must be recalibrated as required in 4731.1321.

G. Where a spot check involves a radiation measurement, the measurement must be obtained using a dosimetry system satisfying the requirements of 4731.1305 subp. 2.

4731.1307 Computed Tomography (CT) Equipment Performance Measurements and Calibrations. This part applies to computed tomography facilities and must be done in addition to the requirements in 4731.1307. The registrant must ensure that the equipment performance measurements and calibration procedures specified in this part are performed and they include:
Subpart 1. **General equipment performance measurements and calibration procedures:**

A. Those measurements and calibration procedures must be in writing and are specified in 4731.1307 for CT scanners at the frequency specified and those aspects of processing at the frequency specified. In addition, the equipment performance measurements and calibration procedures must be done after any change in the facility or equipment which might cause an increase in radiation hazard or a change in equipment that results in the minimum performance criteria not being met.

B. The computed tomography dose index in the two positions in 4731.1308, subp.8, item D. The CT dosimetry phantom must be oriented so that the measurement point of 1.0 centimeter beneath the surface is in the angular location where the computed tomography dose index is maximum. For the purpose of determining the computed tomography dose index, the manufacturer's statement as to the nominal tomographic section thickness for that particular system may be used.

C. The procedures specified in 4731.1308, subp 8.

D. Radiation output measurements.

(1) measurements of radiation output from a computed tomography x-ray system must be performed as specified in 4731.1308, subp. 8 and after any change or replacement of components which could cause a change in the radiation output.

(2) the measurement of the radiation output of the computed tomography x-ray system must be performed with a calibrated dosimetry system. The dosimetry system must have been calibrated within the preceding two years. The calibration of the dosimetry system must be in accordance with 4731.0133.

(3) computed tomography dosimetry phantoms must be used in determining the

radiation output of the computed tomography x-ray system. The phantoms must comply with Code of Federal Regulations, title 21, section 1020.33.

(a) all dose measurements must be performed with the computed tomography dosimetry phantom placed on the patient couch or support device without additional attenuation materials present.

(b) computed tomography dosimetry phantoms must provide a means for the placement of a dosimeter along the axis of rotation and along a line parallel to the axis of rotation 1.0 centimeter from the outer surface and within the phantom. Means for the placement of dosimeters or alignment devices at other locations may be provided.

(c) any effects on the doses measured due to the removal of phantom material to accommodate dosimeters must be accounted for through appropriate corrections to the reported data or included in the statement of maximum deviation for the values obtained using the phantom.

(4) the dose measurements must be made for the head and body technique used at the facility. The image quality measurements must be made using a typical clinical technique in the head and body scan modes of operation.

Subp. 2 **Additional C.T. operator equipment performance measurements.** In addition to the equipment performance measurements described in subpart 1, the equipment performance measurements specified in items A and B must be performed by an operator.

A. The operator's computed tomography equipment performance procedures must be those with the monthly or daily frequencies in 4731.1308, subp. 8, and include all processing procedures noted in 4731.1308.

B. The registrant or radiation safety officer must review and initial all of the operator's equipment performance measurements at least quarterly. An operator's equipment performance measurements must include acquisition of images obtained with the CT dosimetry phantoms using the same processing mode and CT conditions of operation as are used to perform the equipment performance measurements required by subpart 1.

4731.1308 Diagnostic Equipment Performance Tests for Quality Assurance Program.
Subpart 1. **Frequency of tests**. The tests in subparts 1a to 12 are to be made at the time of installation and at the specified intervals thereafter.

Subp. 1a. Image receptors.

TEST TYPE	MINIMUM TEST INTERVAL	MINIMUM PERFORMANCE CRITERIA
A. Screen-film contact	Annually	No significant areas of poor contact as measured by 8 wires/inch copper mesh, or 7 holes/inch for regular film and 40 wires/inch copper mesh for mammography

B. Screen-film-cassette	Annually	Densities within speed match ± 0.10 O.D. for all cassettes used for each diagnostic task

Subp. 2. **Automatic processing.**

TEST TYPE	MINIMUM TEST INTERVAL	MINIMUM PERFORMANCE CRITERIA
A. Darkroom fog	Semi-annually	< 0.08 O.D. increase in density (measured at approximately 1.00 O.D.) after 2 minutes using film exposed on-site at the time of test. For mammography the O.D. increase must be < 0.05
B. Sensitometry and densitometry	Before processing first film	Density ± 0.15 O.D. using film exposed on-site at time of the day of test. As of July 1, 1993, veterinary facilities are not required to perform this test
C. Temperature check	At the time of sensitometry	Follow manufacturer's recommendations

Subp. 3. **Manual processing.**

TEST TYPE	MINIMUM TEST INTERVAL	MINIMUM PERFORMANCE CRITERIA
A. Darkroom fog	Semi-annually	< 0.08 O.D. increase in density (measured at approximately 1.00 O.D.) after 2 minutes using film exposed on-site at time of test
B. Sensitometry and	Before	Density ± 0.15 O.D.

densitometry	processing first film of the day	using film exposed on-site at time of test. As of July 1, 1993, veterinary facilities are not required to perform this test
C. Temperature check	Before processing each batch of film	Follow manufacturer's time and temperature chart

Subp. 4. **All diagnostic radiographic tubes; required when applicable.**

TEST TYPE	MINIMUM TEST INTERVAL	MINIMUM PERFORMANCE CRITERIA
A. SID accuracy	Biennially	± 2% of measured value
B. X-ray and light field alignment	Biennially	± 2% of SID any one direction, ±3% of SID, both directions (total)
C. X-ray and image receptor alignment	Biennially	± 2% of SID
D. Collimator dial accuracy	Biennially	± 2% of SID
E. Reproducibility	Biennially	Coefficient of variation < 5%
F. mR/mAs	Biennially	±10% of baseline
G. Linearity	Biennially	± 10% over clinical range
H. Linearity-for mAs only units manufactured after May 3, 1994	Biennially	Average ratios of exposure to the indicated mAs obtained in any two consecutive mAs settings shall not differ by more than 0.10 times their sum, or at two settings differing by no more than a factor

		of two where the mAs selector provides continuous selection.
I. Timer accuracy	Biennially	Single Phase: use Table 4730.1692 or ± 10% of setting. Three phase, high frequency, and constant potential: use ± 5% of selected time when measured > than 100 milliseconds. At times shorter than 100 milliseconds, use manufacturers' specifications.
J. Half-value layer	Biennially	Use part 4731.1313, subp 6, item A
K. kVp accuracy	Biennially	± 5% of indicated kVp for noncertified equipment. For certified equipment follow manufacturer's specified limits
L. Phototimer reproducibility, if present	Biennially	± 5% of average exposure
M. AEC (phototimer) increments	Biennially	± 10% of manufacturer's stated increments
N. Illuminance of certified collimator	Biennially	> 15 footcandles
O. Film density vs. thickness change on AEC	Biennially	± 0.30 O.D. of the averaged exposures over the range specified by the manufacturer
P. Film density vs.	Biennially	± 0.30 O.D. of the

kVp change on AEC		averaged exposures when measured at > 1.2 O.D. and over the range as specified by the manufacturer
Q. Spot film reproducibility (fluoro units with manual mode)	Annually	± 5% of average exposure
R. Phototimer back-up timer cut off	At time of installation	terminates exposure at < 600 mAs
S. AEC density at normal or "0"	Biennially	> 1.0 O.D.

Subp. 5. **For facilities with fluoroscopes and C-arm fluoroscopes, except radiation therapy simulators, manufactured before May 19, 1995.**

TEST TYPE	MINIMUM TEST INTERVAL	MINIMUM PERFORMANCE CRITERIA
A. Maximum output at tabletop or equivalent minimum SSD	Annually and every tube change	< 5 R (1.3 mC kg-1) per minute for manual; < 10 R (2.6 mC kg-1) per minute for Automatic Exposure Rate Control systems
B. High level control maximum output at tabletop or equivalent minimum SSD	Annually and every tube change	< 20 R (5.0 mC kg-1) per minute
C. Fluoroscopic image size	Annually and every tube change	Error between fluorographic beam size and observed image size must be no more than ±3% of SID for all modes and at

		any tower height
D. Actual spot-film size vs indicated	Annually	Error between actual fluorographic beam size at image receptor and indicated image size must be no more than ± 3% of SID for all modes and at any tower height
E. Spot-film reproducibility	Annually	±5% of average exposure
F. Phototimer reproducibility, if present	Annually	±5% of average exposure
G. Fluoroscopic high contrast resolution and distortion	Annually	15 centimeter (six inch) intensifier: center 30 and edge 24 (wires per inch) copper mesh; 23 centimeter (nine inch) intensifier: center 24 and edge 20 (wires per inch) copper mesh
H. Half-value layer	Annually and after every tube change	Use part 4731.1313, subp. 6, item A
I. kVp accuracy	Annually and after every tube change	± 5% for noncertified equipment. For certified equipment follow manufacturer's specified limits.

Subp. 5a **For facilities with fluoroscopes and C-arm fluoroscopes, except radiation therapy simulators, manufactured on or after May 19, 1995.**

TEST TYPE	MINIMUM TEST INTERVAL	MINIMUM PERFORMANCE CRITERIA
A. Maximum output	Annually	> 5 R/min must have

at tabletop or equivalent minimum SSD	and at every tube change	Automatic Exposure Rate Control; > 10 R/min must have high level control; if no high level control maximum is < 10 R/min.
B. High level control maximum output at tabletop or equivalent minimum SSD	Annually and at every tube change	< 20 R/min
C. All other tests as indicated in subpart 5		

Subp. 6. **For facilities with mammography systems. All tests on mammographic units must follow the Mammography Quality Standards Act of 1992, United States Code, title 42, section 263b, and regulations adopted thereunder.**

Subp. 7. **For facilities with tomography systems other than computed tomography.**

TEST TYPE	MINIMUM TEST INTERVAL	MINIMUM PERFORMANCE CRITERIA
A. Section level	Annually	± 5 mm
B. Level incrementation	Annually	± 2 mm
C. Section thickness	Annually	Follow manufacturer's specifications
D. All tests in part 4730.1691, subpart 4, if applicable		
E. Spatial plane resolution	Annually	40 mesh screen or better

Subp. 8. **For facilities with computed tomography scanners.**

	MINIMUM

TEST TYPE	TEST INTERVAL	MINIMUM PERFORMANCE CRITERIA
A. Accuracy of scout localization view	Annually	± 1 mm
B. Accuracy of distance measurements	Annually	± 1 mm
C. CT dose index	Annually	± 20% from manufacturer's recommendations
D. CT number dependence on slice thickness	Annually	Mean ±3 CT numbers averaged over 100 pixels
E. CT number calibration and noise	Daily	Water: 0 ± 5 CT numbers; Noise: ± 3 standard deviations of the mean of the baseline noise variance measurements
F. CT number uniformity and artifacts	Monthly for mobile units. Annually for fixed base units	Variation ±5 CT numbers between the mean values of measurements made at center and edge of phantom that is at least 20 cm. in diameter among a mean of 100 pixels. Artifacts: no noticeable artifacts
G. Hard copy output and visual display	Daily	Luminance and contrast not significantly different.

Subp. 9. **For facilities with cinefluorographic and special procedure systems.**

TEST TYPE	MINIMUM TEST INTERVAL	MINIMUM PERFORMANCE CRITERIA
A. Cinefluorographic exposure rates	Annually	Approximately 10 to 20 μR (2.6 to 5.0 nC/kg)

		per frame at intensifier for nine inch (23 cm) mode; approximately 20 to 30μR (5 to 8 nC/kg) per frame at intensifier for six inch (15 cm) mode
B. All tests in subparts 4, 5, and 5a, if applicable		
C. Film changer screen-film contact	Annually	No significant areas of poor contact as measured by 8 wires/inch copper mesh or 7 holes/ inch
D. High contrast resolution for cinefluorographic and digital systems	Annually	No significant difference between static and dynamic conditions
E. Optical density of films over duration of filming run	Annually	<± 0.2 O.D. difference

Subp. 10. **For facilities with dental intraoral systems.**

TEST TYPE	MINIMUM TEST INTERVAL	MINIMUM PERFORMANCE CRITERIA
A. Film processing	Before the first film of the day	Between 0.75 and 1.05 O.D. on the test tool or follow test tool manufacturer's recommendations
B. Filtration (HVL)	Biennially	Use part 4731.1313, subp 6, item A
C. Radiation exposure at end of cone	Biennially	Use part 4731.1315, subp4, item C

D. Timer reproducibility and accuracy	Biennially	± 10% of indicated timer setting
E. kVp accuracy	Biennially	± 5% of indicated kVp for noncertified equipment. For certified equipment follow manufacturer's specified limits
F. Reproducibility	Biennially	Coefficient of variation < 5%
G. Fog test	Semi-annually	Use criteria in subp2, item A for automatic processing; subp 3, item A for manual processing
H. Dental mA linearity	Biennially	± 10% over the clinical range

Subp. 11. **For facilities with dental extraoral systems including panoramic systems.**

TEST TYPE	MINIMUM TEST INTERVAL	MINIMUM PERFORMANCE CRITERIA
A. Film processing		Use automatic and manual processing as specified in subparts 2 and 3. A step wedge may be used in place of the sensitometry and densitometry test in subparts 2, item B, and 3, item B
B. Same test types and minimum performance		

criteria as Diagnostic Radiographic Tubes in subpart 4		
C. Fog test	Semi-annually	Use criteria in subp 2, item A for automatic processing; subp 3, item A for manual processing

4731.1309 Exposure Time Control Limits for Single Phase Full-wave Rectified Generators.

Exposure time (seconds)	Acceptance limits
1/5	24±1 dot
1/10	12±1 dot
1/20	6±0 dots
1/30	4±0 dots

Note: when using a spinning top, the x-ray pulses are imaged as dots on the film as the small hole in the top is moved rapidly (rotated) over the film. Source: National Council on Radiation Protection, Report No. 99, Table 7.3, December 30, 1988.

4731.1310 Therapy Equipment Performance Tests and Limits for Measurement Equipment.

Subpart 1. **Local standard (Loc. Std.).**

TEST	MINIMUM TEST INTERVAL	TOLERANCE
A. AAPM - accredited Dosimetry calibration Laboratory calibration	Every two years	D
B. Linearity	Every four years	0.5 percent
C. Venting	Every four years	D
D. Extracameral signal	Initial use	0.5 percent
E. Leakage	Each use	0.1 percent
F. Recombination	Initial use	Documented
G. Collecting potential	Each use	D

Subp. 2. **Other field instruments.**

TEST TYPE	MINIMUM TEST INTERVAL	TOLERANCE
A. Local standard comparison	Every 2 years	one percent
B. Linearity	Every two years	D
C. Venting	Every two years	D
D. Extracameral signal	Every two years	D
E. Leakage	Each use	0.1 percent
F. Recombination	Initial use	Documented
G. Collecting potential	Each use	D

Subp. 3. **Relative dosimetric equipment.**

TEST TYPE	MINIMUM TEST INTERVAL	TOLERANCE
A. Thermoluminescent Dosimeter		
(1) Calibration	Each batch or box	D
(2) Linearity	Initial use	D
B. Film		
(1) Dose and response	Each batch or box	D
(2) Densitometer linearity	Every year	D
C. Air Ionization Chamber system		
(1) Linearity	Every year	D
(2) Extracameral signal	Initial use	1 percent
D. Diode System		
(1) Energy dependence	Initial use	D
(2) Extracameral signal	Initial use	D
(3) Linearity	Initial use	D

Subp. 4. **Survey instruments.**

TEST TYPE	MINIMUM TEST INTERVAL	TOLERANCE
A. Calibration	Every year	D
B. Linearity	Every year	D
C. Constancy	Each use	5 percent
D. Battery voltage	Each use	D

Subp. 5. **Positioning equipment.**

TEST TYPE	MINIMUM TEST INTERVAL	TOLERANCE
A. Accuracy	Each use	2 mm
B. Hysteresis	Each use	2 mm

Subp. 6. **Phantoms and attenuators.**

TEST TYPE	MINIMUM TEST INTERVAL	TOLERANCE
A. Thickness	Initial use	D
B. Density	Initial use	D
C. Phantom stacked density	Initial use	D
D. Detector fit	Initial use	D

Subp. 7. **Accessory equipment.**

TEST TYPE	MINIMUM TEST INTERVAL	TOLERANCE
A. Thermometer		
(1) Calibration	Initial use	0.1 degree/C
B. Barometer (mercury)		
(1) Calibration Hg	Initial use	1 mm Hg
C. Barometer (aneroid)		
(1) Calibration Hg	Initial use	1 mm Hg
(2) Intercomparison	Annually	1 mm Hg

D = Documented and correction applied or noted in report of measurement, when appropriate.

Source: Derived from American Association of Physicists in Medicine, Report No. 13, Table I, pp. 21-22, 1984 and TG-40, Medical Physics, volume 21, number 4, Tables I, II, and IV, pages 581 to 618 (1994).

4731. 1311 Equipment Performance Tests For External Beam Teletherapy and Simulation Systems.

Subpart 1. **Dosimetry**.

TEST TYPE	MINIMUM TEST INTERVAL	TOLERANCE
A. General axis dose calibration	Annually	2 percent
B. Constancy checks-photons		
(1) Dose per monitor unit along central axis	Weekly	3 percent
(2) Depth dose	Monthly	2 percent
(3) Beam uniformity	Monthly	3 percent
(4) Monitor chamber linearity	Annually	1 percent
(5) Timer linearity and error	Annually	1 percent

Subp. 2. **Geometry.**

TEST TYPE	MINIMUM TEST INTERVAL	TOLERANCE
A. Field positioning aids		
(1) Light field and radiation field agreement	Monthly	2 mm
(2) Mechanical distance pins, lasers, and SSD lights	Monthly	2 mm
(3) Scale readouts		2 mm/1 degree angle
B. Machine alignment		
(1) Jaw symmetry	Annually	2 mm
(2) Coincidence of collimator (jaw) and gantry axes with isocenter	Annually	2 mm
(3) Stability of gantry	Annually	2 mm

arm and bearing under rotation		
(4) Couch motion and tabletop sag	Annually	2 mm

Subp. 3. **Constancy checks-electrons.**

TEST TYPE	MINIMUM TEST INTERVAL	TOLERANCE
A. Beam uniformity	Monthly	5 percent
B. Depth dose	Monthly	2 mm at therapeutic depth
C. Dose per monitor unit constancy check	Weekly	3 percent

Subp. 4. **Treatment accessories.** *

TEST TYPE	MINIMUM TEST INTERVAL	TOLERANCE
A. Wedge transmission factor	Annually	2 percent
B. Transmission factor constancy for all treatment accessories	Annually	2 percent

Subp. 5. **Simulators.**

TEST TYPE	FREQUENCY	TOLERANCE
A. Localizing lasers	Daily	2 mm
B. Distance indicator	Daily	2 mm
C. Field size indicator	Monthly	2 mm
D. Gantry/collimator angle indicators	Monthly	1 degree
E. Cross-hair centering	Monthly	2 mm diameter
F. Focal spot-axis indicator	Monthly	2 mm

G. Fluoroscopic image quality	Monthly	Established baseline
H. Collision avoidance	Monthly	Functional
I. Light/radiation field coincidence	Monthly	2 mm or 1 percent
J. Collimator rotation isocenter	Annual	2 mm diameter
K. Gantry rotation isocenter	Annual	2 mm diameter
L. Couch rotation isocenter	Annual	2 mm diameter
M. Coincidence of collimator, gantry, couch axes, and isocenter	Annual	2 mm diameter
N. Table top sag	Annual	2 mm
O. Vertical travel of couch	Annual	2 mm
P. Exposure rate	Annual	Established baseline
Q. Table top exposure with fluoroscopy	Annual	Established baseline
R. Kvp and mAs calibration	Annual	Established baseline
S. High and low contrast resolution	Annual	Established baseline

* Attenuation in blocks, wedge factors, and compensator data must be checked annually. A visual inspection of the mechanical integrity of these accessories must be done monthly.

Source: Derived from American Association of Physicists in Medicine, Report No. 13, Table II, page 29 (1984) and TG-40, Medical Physics, volume 21, number 4, Tables I, II, III, and IV, pages 581 to 618 (1994).

4731.1312 Healing Arts Screening

Subpart 1. **General Requirements.** Any person who desires to perform diagnostic x-ray screening in Minnesota must seek commissioner approval before x-ray screening may proceed. All applicants must meet the requirements specified in 4731.0100 - 4731.1315 and 4731.1318 - 4731.1319. In addition:

A. All applicants must be registered with the commissioner before application for screening is initiated; and

B. The registrant must submit an application to the commissioner requesting permission to perform diagnostic x-ray screening.

Subp. 2. **Content of application.** In the application for screening the registrant must:

A. Provide his or her business name and address. If the registrant is a corporation or other business or nonbusiness association, the name of the person and phone number representing the association must be given.

B. Give the location of the proposed screening and the name and telephone number of a contact person at each location.

C. State the purpose of the proposed screening program planned. The purpose must include a detailed statement specifying the compelling health reasons, health benefits, and health emergency, if any, that justifies the radiation exposure to which any individual will be subjected by the proposed screening.

D. Explain why alternate screening methods that do not require the use of radiation are not being used.

E. Name all practitioners of the healing arts who will interpret the radiographic images.

F. Name all individuals responsible for making the exposures of the patients during the screening process.

G. State the proposed interval for which permission to perform screening is requested.

H. List the radiographic projections or views being proposed in the screening program.

I. Specify the x-ray equipment to be used in connection with the proposed x-ray screening.

J. Describe the retention or disposition of the images and other records pertaining to the screening x-ray examinations after the screening project is completed.

K. Describe the population to be examined in the screening program, including age, sex, physical condition and any criteria to determine correct patient population.

L. Provide exposure measurements of the exposure at skin entrance (ESE) and specific organ doses, for the type of screening proposed. These exposures must be consistent with those produced with state-of-the-art techniques. If no guidelines are available for exposure measurements, the commissioner may request peer review to establish such guidelines.

M. Provide a written evaluation of the radiation safety survey and the quality assurance program as required by 4731.0132; 4731.0169, subp.6; 4731.1300; 4731.1304; and 4731.1308. This must have been performed within three months prior to the application.

N. Any individual screened must be personally informed by the registrant of the results, interpretation, or findings. The screening application must:

(1) describe how this information will be communicated to the individual who has been screened;

(2) describe where the results, interpretation, or findings will be sent; and

(3) describe what arrangements will be made to ensure that the individual who has been screened will be informed as to the need for further medical and health care evaluation or treatment.

Subp. 3. **Additional information.** The commissioner may request the submission of additional information and data subsequent to the submission of the original or renewal application.

Subp. 4. **Notification of commissioner's decision.** The registrant shall be notified in writing of the commissioner's decision. If an application is granted, the notification shall specify the time,

not to exceed one year, for which the application will be effective.

Subp. 5. **Changes in screening program**. The registrant is responsible for informing the commissioner of any changes in the screening program from that which was described in the content of the application in subpart 2. The registrant must obtain commissioner approval of the changes before the commencement of the requested changes in the screening program.

Subp. 6. **Denial of approval**. The commissioner may deny or revoke approval of any healing arts screening program if the registrant fails to or refuses to comply with this chapter.

Subp. 7. **Appeal procedure**. The registrant may appeal the denial, revocation, or refusal to approve an application or renewal application by requesting a contested case hearing under the provisions of the Administration Procedure Act, Minnesota Statutes, chapter 14. The registrant shall submit, within 15 days of the receipt of the department's decision, a written request for a hearing. The request for a hearing shall set forth in detail the reasons why the registrant contends the decision of the department should be reversed or modified.

Subp. 8. **Renewal of screening application**. Any request for the renewal of a screening program application shall be submitted in writing before its expiration date. Renewal requests shall contain the information specified in subpart 2.

Subp. 9. **Commissioner-approved healing arts screening**. The commissioner may inspect the healing arts screening program while in progress to ensure that it is carried out as described in the registrant's application and in compliance with this chapter.

Subp. 10. **Withdrawal of approval for conditions allowing overexposure**. Approval may be withdrawn immediately if, after an inspection, the commissioner finds the existence of conditions that would result in serious overexposure. All screening procedures shall be terminated immediately upon receipt of the written notice of existence of such overexposure. The applicant may request a contested case hearing within five days after receipt of the notice. The request for hearing does not stay the commissioner's order of immediate cessation of the screening program. The hearing shall be scheduled within ten days of receipt of the request for the hearing.

Subp. 11. **Withdrawal of approval for noncompliance with application**. Approval for healing arts screening may be withdrawn if, after an inspection, the commissioner finds discrepancies between the screening program as implemented and as described in the application in this part or for violation of this chapter. A hearing shall be held if requested by the applicant within three days after the receipt of the notice of withdrawal of approval. The hearing may be held upon granting the applicant three days' notice. If a hearing is requested, withdrawal of approval shall not take effect until a final order is issued by the commissioner.

4731.1313 General Equipment Requirements for All Diagnostic Radiographic Systems.

Subpart 1. **Applicability.** All diagnostic radiographic systems must meet the requirements in this part.

Subp. 2. **Warning label.** The control panel containing the main power switch must bear the warning statement which is legible and accessible to view: "WARNING: This x-ray unit may be dangerous to patient and operator unless safe exposure factors and operating instructions are observed."

Subp. 3. **Battery charge indicator**. On battery-powered x-ray generators, visual means must be provided on the control panel to indicate whether the battery is adequately charged for proper operation.

Subp. 4. **Leakage radiation from the diagnostic source assembly**. The leakage radiation from the diagnostic source assembly measured at a distance of one meter (39.4 inches) in any direction from the source must not exceed 100 milliroentgens (25.8 uC/kg) in one hour when the x-ray tube is operated at its leakage technique factors. Compliance must be determined by measurements averaged over an area of 100 square centimeters (15.5 square inches) with no linear dimension greater than 20 centimeters (7.9 inches).

Subp. 5. **Radiation from components other than the diagnostic source assembly**. The radiation emitted by a component other than the diagnostic source assembly must not exceed two milliroentgens (0.516 uC/kg) in one hour at five centimeters (1.97 inches) from any accessible surface of the component when it is operated in an assembled x-ray system under any conditions for which it was designed. Compliance must be determined by measurements averaged over an area of 100 square centimeters (15.5 square inches) with no linear dimension greater than 20 centimeters (7.9 inches).

Subp. 6. **Beam quality, half-value layer**. The half-value layer of the useful beam for a given kVp must not be less than the values shown in item A. If it is necessary to determine a half-value layer at a kVp which is not listed in item A, linear interpolation or extrapolation may be made.

A. Values for half-value layer of useful beam for x-ray tube:

Design operating range (kVp)	Measured kVp	Half-value layer (millimeter of aluminum) Other x-ray Systems	Specified Dental Systems
Below 50	30	0.3	1.5
	40	0.4	1.5
	50	0.5	1.5

51-70	51	1.2	1.5
	60	1.3	1.5
	70	1.5	1.5
Above 70	71	2.1	2.1
	80	2.3	2.3
	90	2.5	2.5
	100	2.7	2.7
	110	3.0	3.0
	120	3.2	3.2
	130	3.5	3.5
	140	3.8	3.8
	150	4.1	4.1

B. All intraoral dental radiographic systems installed on and after December 1, 1980, must have a minimum half-value layer not less than 1.5 millimeters aluminum.

C. For capacitor energy storage equipment, compliance with the requirements of this subpart must be determined with the capacitors fully charged and with a technique which discharges at least half of the energy stored in the capacitors (half of the maximum milliampere-second).

D. The half-value layer of the useful beam must be measured with all the materials in the beam which are always present between the source and the patient.

Subp. 7. **Beam quality, filtration controls**. For x-ray systems which have variable kVp and variable filtration for the useful beam, means must be provided to prevent an exposure unless the filtration required to obtain the half-value layer specified in subpart 6, item A, is in the useful beam for the given kVp which has been selected.

Subp. 8. **Multiple tubes**. Where two or more x-ray tubes are controlled by one exposure switch, the tube or tubes which have been selected must be clearly indicated before initiation of the exposure. The indication must be both on the x-ray control panel and at or near the tube housing assembly which has been selected.

Subp. 9. **Mechanical support of tube head.** The tube housing assembly supports must be adjusted so it remains stable during an exposure unless tube housing movement is a designed function of the x-ray system.

Subp. 10. **Technique factors.** The technique factors in items A to C apply to all diagnostic radiographic systems.

A. The technique factors to be used during an exposure must be indicated before an exposure begins. If automatic exposure controls are used, the technique factors which are set before exposure must be indicated.

B. If automatic exposure controls are used in a system installed after September 10, 1991, in

addition to the requirements of item A:

(1) the exposure time or milliampere-second must be displayed for x-ray generators with a constant milliamperage; and

(2) the milliampere-second must be displayed for falling load generators.

C. The requirement of item A may be met by permanent markings on systems having fixed technique factors. Indication of technique factors must be visible from the operator's position except in the case of spot films made by the fluoroscopist.

Subp. 11. **Timers.** The requirements in this subpart for timers apply to all general radiographic, intraoral dental, and veterinary medicine radiographic systems.

A. A means must be provided to terminate the exposure at a preset time interval, a preset product of milliamperage and time, a preset number of pulses, or a preset radiation exposure to the image receptor.

B. An exposure must not be possible when the timer is set to a zero or off position, if either position is provided.

C. Except for dental panoramic systems, termination of the exposure must cause automatic resetting of the timer to its initial setting or to zero.

Subp. 12. **Reproducibility.** With a timer setting of 0.5 seconds or less, the difference between the maximum exposure time (Tmax) and the minimum exposure time (Tmin) must be less than or equal to 20 percent of the average exposure time (T) when four timer tests are performed:

$$(Tmax - Tmin) < 0.2\ T.$$

Subp. 13. **X-ray control.** The x-ray control must meet the requirements in this subpart.

A. The exposure control switch must be a dead-man type which requires continuous pressure to complete the exposure.

B. Each x-ray control console other than dental intraoral systems must be located in such a way as to meet the requirements in this item.

(1) stationary x-ray systems must have the x-ray control permanently mounted behind the protective barrier so the operator remains behind that barrier during the entire exposure.

(2) portable x-ray systems that produce more than 25 milliamperes-minutes per week at the same location must meet the requirement of subitem (1).

(3) portable x-ray systems that produce less than 25 milliamperes-minutes per week at the same location, must meet the requirement of subitem (1), or be provided with a 6.5 foot (2.0 m) high protective barrier which is placed at least six feet (1.8 m) from the tube housing assembly and at least six feet (1.8 m) from the patient.

C. The x-ray control console must provide visual indication observable at or from the operator's protected position whenever x-rays are produced.

D. All x-ray control console panel indicator lights must be operational.

Subp. 14. **Exposure Reproducibility.** The coefficient of variation must not exceed 0.05 when all technique factors are held constant.

Subp. 15. **Additional requirements for general purpose x-ray system**. A facility with a general purpose x-ray system must also comply with items A to C.

A. Means must be provided to limit the x-ray field in the plane of the image receptor so the field does not exceed each dimension of the image receptor by more than two percent of the SID when the axis of the x-ray beam is perpendicular to the plane of the image receptor.

B. Means must be provided to align the center of the x-ray field with the center of the image receptor to within two percent of the SID, or means must be provided to both size and align the x-ray field so the x-ray field at the plane of the image receptor does not extend beyond any edge of the image receptor.

C. The requirements of items A and B may be met with a system that meets the requirements for a general purpose x-ray system as specified in 4731.1314, subp. 4. When alignment means are also provided, the requirements of items A and B may be met with either:

(1) an assortment of removable, fixed-aperture, beam-limiting devices sufficient to meet the requirement for each combination of image receptor size and SID for which the system is designed with each device having clear and permanent markings to indicate the image receptor size and SID for which it is designed; or

(2) a beam-limiting device having multiple fixed apertures sufficient to meet the requirement for each combination of image receptor size and SID for which the system is designed. Permanent, clearly legible markings must indicate the image receptor size and SID for which each aperture is designed and must indicate which aperture is in position for use.

4731.1314 General Requirements for Certified Diagnostic Radiographic Systems Other Than Fluoroscopic, Dental intraoral, Veterinary Medicine, or Computed Tomography Systems.

Subpart 1. **Applicability**. This part applies to all diagnostic x-ray systems certified according to standards provided by United States Code, title 42, section 263f. The requirements in this part are in addition to the requirement in parts 4731.0100 to 4731.1313, subparts 1 through 15. This part does not apply to fluoroscopic, dental intraoral, veterinary medicine, or computed tomography x-ray systems.

Subp. 2. **Diagnostic Radiographic Systems.** Only diagnostic radiographic systems incorporating one or more certified components must comply with the requirement in this subpart which relate to those certified components.

A. The radiographic system must be operated on an adequate power supply as specified by the manufacturer. The coefficient of variation of radiation exposures must be no greater than 0.05 for any specific combination of selected technique factors.

B. When the radiographic system allows a choice of x-ray milliamperage settings and is operated on a power supply as specified by the manufacturer according to the requirements of applicable federal performance standards for any fixed kVp within tthe range of 40 to 100 percent of the maximum rating, the average ratios of exposure to the milliampere-seconds product obtained at any two consecutive milliamperage settings must not differ by more than 0.10 times their sum:

$$(X\ 1 - X2)\ \ 0.10\ (X1 + X2)$$

(Graphic to go here currently not available.)

C. Deviation of technique factors for kVp must be those the manufacturer has specified for that system. For other technique factors, the deviation must have a coefficient of variation of no more than five percent.

D. The x-ray control console must provide a signal audible to the operator that the exposure has terminated.

E. A certified diagnostic radiographic system and its associated certified components used on humans must be maintained in compliance with applicable requirements of the Federal X-ray Equipment Performance Standard, Code of Federal Regulations, title 21, chapter 1, subchapter J, in effect at the time of manufacture.

Subp. 3. **Beam limitation**. The useful beam must be limited to the patient's area of clinical interest.

Subp. 4. **General purpose stationary x-ray systems**. General purpose stationary x-ray systems must meet the standards in items A to E.

A. A means for stepless adjustment of the size of the x-ray field must be provided.

B. A method must be provided for visually defining the perimeter of the x-ray field. The total misalignment of the edges of the visually defined field with the respective edges of the x-ray field along either the length or width of the visually defined field must not exceed two percent of the distance from the source to the center of the visually defined field when the surface upon which it appears is perpendicular to the axis of the x-ray beam.

C. Except when spot-film devices or special attachments for mammography are in service, a method must be provided to:

(1) indicate when the axis of the x-ray beam is perpendicular to the plane of the image receptor;

(2) align the center of the x-ray field with respect to the center of the image receptor to within two percent of the SID; and

(3) indicate the SID to within two percent.

D. The beam-limiting device must numerically indicate the field size at the plane of the image receptor to which it is adjusted.

E. The indication of field size dimensions and SIDs must be:

(1) specified in inches or centimeters; and

(2) such that aperture adjustments result in x-ray field dimensions at the plane of the image receptor which correspond to those indicated by the beam-limiting device to within two percent or less of the SID when the beam axis is perpendicular to the plane of the image receptor

Subp. 5. **Diagnostic radiographic systems designed for one image receptor size**. Diagnostic radiographic systems designed for only one image receptor size at a fixed SID must be provided with means to limit the field at the plane of the image receptor to dimensions no greater than those of the image receptor, and must align the center of the x-ray field with the center of the image receptor to within two percent of the SID. Alternatively, such systems must be provided with means to both size and align the x-ray field so the x-ray field at the plane of the image

receptor does not extend beyond any edge of the image receptor.

Subp. 6. **Stationary and portable general purpose x-ray systems.** Stationary and portable general purpose x-ray systems must have means to limit the useful beam.

A. There must be provided a means of stepless adjustment of the size of the x-ray filed. The minimum field size at a SID of 100 centimeters (39.4 inches) must be equal to or less than five by five centimeters(1.97 inches).

B. When a light localizer is used to define the x-ray field, it must provide an average illumination of not less than 160 lux (15.0 foot candles) above ambient at 100 centimeters (39.4 inches) or at the maximum SID, whichever is less. The average illumination must be based upon measurements made in the approximate center of each quadrant of the light field. Radiation therapy simulation systems installed on and after may 27, 1980, are exempt from this requirement.

C. The edge of the light field at 100 centimeters (39.4 inches) or at the maximum SID, whichever is less, must have a contrast ratio, corrected for ambient lighting, of not less than four in the case of beam-limiting devices designed for use on stationary x-ray systems, and a contrast ratio of not less than three in the case of beam-limiting devices designed for use on portable x-ray systms. The contrast ratio is defined as I1/I2 where I1 is the illumination three millimeters (0.12 inches) from the edge of the light field toward the center of the field; and I2 is the illumination three millimeters (0.12 inches) from the edge of the light field away from the center of the field. Compliance must be determined with a measuring instrument aperture of one millimeter (0.04 inches) in diameter.

Subp. 7. **For general purpose x-ray systems which contain a tube housing assembly, an x-ray control, and table (if so equipped).** The system must be certified according to Code of Federal Regulations, title 21, section 1020.30(c). The system must meet the standards in items A through F.

A. When positive beam limitation is provided, it must meet the criteria in units (1) to (6).

(1) the image receptor must be inserted into a permanently mounted cassette holder.

(2) the image receptor length and width must each be less than 50 centimeters (19.7 inches).

(3) the x-ray beam axis must be within plus or minus three degrees of vertical and the SID must be 90 centimeters to 130 centimeters (35.4 inches to 51.2 inches) inclusive; or the x-ray beam axis must be within plus or minus three degrees of horizontal and the SID must be 90 centimeters to 205 centimeters (35.4 inches to 80.7 inches) inclusive.

(4) the x-ray beam axis must be perpendicular to the plane of the image receptor to within plus or minus three degrees.

(5) neither tomographic nor stereoscopic radiography is being performed.

(6) the positive beam limitation system must not be intentionally overridden. This override provision is subject to the provisions of item C.

B. Positive beam limitation must prevent the production of x-rays when:

(1) the length or width of the x-ray field in the plane of the image receptor differs from the corresponding image receptor dimensions by more than three percent of the SID except as

permitted by item D; or

(2) the sum of the length and width differences as stated in unit (a) without regard to sign exceeds four percent of the SID.

C. If a method of overriding the positive beam limitation system exists, that method must be designed for use only in the event of positive beam limitation system failure or if the system is being serviced. If the positive beam limitation system is in a position that the operator considers part of the operational controls or if it is referenced in the operator's manual or in other materials intended for the operator:

(1) a key must be used to override the positive beam limitation;

(2) the key must remain in place during the entire time the positive beam limitation system is overridden; and

(3) that the key or key switch must be clearly and durably labeled as follows: "FOR X-RAY FIELD LIMITATION SYSTEM FAILURE."

D. Compliance with item B, must be determined when the equipment indicates the beam axis is perpendicular to the plane of the image receptor and the provisions of item A, are met. Compliance must be determined no sooner than five seconds after insertion of the image receptor.

E. The positive beam limitation system must be capable of operation, at the discretion of the operator, so that the size of the field may be made smaller than the size of the image receptor through stepless adjustment of the field size. The minimum field size at an SID of 100 centimeters (39.4 inches) must be equal to or less than five centimeters by five centimeters (1.97 inches by 1.97 inches).

F. The positive beam limitation system must be designed so that if a change in image receptor does not cause an automatic return to positive beam limitation function as described in item B, then any change of image receptor size of SID must cause the automatic return.

Subp. 8. **For mammography x-ray systems installed after September 5, 1978.** For x-ray systems installed after September 5, 1978, designed only for mammography, the transmission of the primary beam through any image receptor support provided with the system must be limited so the exposure five centimeters (1.97 inches) from any accessible surface beyond the plane of the image receptor supporting device does not exceed 0.1 milliroentgen (25.8 nC/kg) for each activation of the tube. Exposure must be measured with the system operated at the minimum SID for which it is designed. Compliance must be determined at the maximum kVp for the system and at the maximum rated product of milliamperage and exposure time (milliampere-seconds) for that kVp. Compliance must be determined by measurements averaged over an area of 100 square centimeters (15.5 square inches) with no linear dimension greater than 20 centimeters (7.9 inches).

Supb. 9. **Automatic or semiautomatic collimators (PBL).** If the facility chooses, automatic or semiautomatic collimators (PBL) may be permanently changed to a manual mode. This requires the automatic system to be permanently disabled. The collimator must be relabeled with a durable material "manual operation required" so that it is clearly observable to the operator.

Subp. 10. **Radiation exposure, x-ray controls**. An x-ray control must be incorporated into each x-ray system so an exposure can be terminated by the operator at any time during exposures of greater than one-half second. During serial radiography means must be provided to permit completion of any single exposure of the series in process before terminating the series.

Subp. 11. **Radiation exposure, automatic exposure controls**. When an automatic exposure control is provided:

A. Indication must be made on the control panel when this mode of operation is selected;

B. The minimum exposure time for all radiographic systems, other than that specified in item E, must be equal to or less than 1/60 second or a time interval required to deliver five milliampere-seconds, whichever is greater

C. Either the product of the kVp, milliamperage, and exposure time must be limited to not more than 60 kWs per exposure, or the product of x-ray milliamperage and exposure time must be limited to not more than 600 mAs per exposure;

D. A visible signal must indicate when an exposure has been terminated at the limits required by item C, and manual resetting must be required before further automatically timed exposures can be made; and

E. If the kVp is equal to or greater than 50 kVp, the minimum exposure time for field emission equipment rated for pulsed operation must be equal to or less than a time interval equivalent to two pulses.

Subp.12. **Source-to-skin distance**. All portable x-ray systems must be provided with means to maintain a minimum source-to-skin distance equal to or greater than 30 centimeters (11.8 inches).

Subp. 13. **Radiation from capacitor energy storage equipment in standby status**. Radiation emitted from the x-ray tube when the exposure switch or timer is not activated must not exceed a rate of two milliroentgens (0.5 uC/kg) per hour at five centimeters (1.97 inches) from any accessible surface of the diagnostic source assembly, with the beam-limiting device fully open.

Subp. 14. **Additional requirements applicable only to certified x-ray components.** Only diagnostic radiographic systems incorporating one or more certified components must comply with the requirements in this subpart which relate to those certified components.

A. The radiographic system must be operated on an adequate power supply as specified by the manufacturer. The coefficient of variation of radiation exposures must be no greater than 0.05 for any specific combination of selected technique factors.

B. When the radiographic system allows a choice of x-ray milliamperage settings and is operated on a power supply as specified by the manufacturer according to the requirements of applicable federal performance standards for any fixed kVp within the range of 40 to 100 percent of the maximum rating, the average ratios of exposure to the milliampere-seconds product obtained at any two consecutive milliamperage settings must not differ by more than 0.10 times their sum:

Graphic to go here currently not available

C. Deviation of technique factors for kVp must be those the manufacturer has specified for that system. For other technique factors, the deviation must have a coefficient of variation of no more than five percent.

D. The x-ray control console must provide a signal audible to the operator that the exposure has terminated.

E. A certified diagnostic radiographic system and its associated certified components used on humans must be maintained in compliance with applicable requirements of the Federal X-ray Equipment Performance Standard, Code of Federal Regulations, title 21, chapter 1, subchapter J, in effect at the time of manufacture.

4731.1315 Intraoral Dental Radiographic Systems

Subpart 1. **Applicability.** This part applies to x-ray systems used for intraoral dental radiography. Requirements for extraoral dental radiographic systems are covered in part 4731.1313 and 4731.1314. This part applies in addition to the requirements in 4731.0100 to 4731.1314.

Subp. 2. **Source-to-skin distance**. X-ray systems designed for use with an intraoral image receptor must be provided with a position-indicating-device to limit source-to-skin distance to not less than 18 centimeters (7.1 inches).

Subp. 3. **Field limitation**. Radiographic systems designed for use with an intraoral image receptor must be provided with and used with collimation to limit the x-ray field such that:

A. If the minimum source-to-skin distance is 18 centimeters (7.1 inches) or more, the x-ray field, at the minimum, must be containable in a circle having a diameter of no more than seven centimeters (2.76 inches); or

B. With rectangular position-indicating-devices, the longer side must not exceed 5.1 centimeters (two inches); and

C. The x-ray system must be operated so the useful beam at the patient's skin does not exceed the requirements of this subpart.

Subp. 4. **Safety controls**. The registrant must ensure that the safety controls in this subpart are followed.

A. Intraoral film holders and bite blocks must be used except when endodontic procedures do not permit. Film must not be routinely held by hand.

B. The tube housing and the position-indicating-device must not be hand-held during an exposure and must be stable before the exposure is initiated and during the exposure.

C. The exposure at the end of the cone for a bitewing technique must not exceed the values listed in Table 4731.1316:

TABLE 4731.1316

kVp	"D" Speed Film	"E" Speed Film	"D/E or E+" Speed Film

	ESE (milliroentgens)	ESE (milliroentgens)	ESE (milliroentgens)
50	425 - 575	220 - 320	220 - 320
55	350 - 500	190 - 270	190 - 270
60	310 - 440	165 - 230	165 - 230
65	270 - 400	140 - 200	140 - 200
70	240 - 350	120 - 170	120 - 170
75	170 - 260	100 - 140	100 - 140
80	150 - 230	90 - 120	90 - 120
85	130 - 200	80 - 105	80 - 105
90	120 - 180	70 - 90	70 - 90
95	110 - 160	60 - 80	60 - 80
100	100 - 140	50 - 70	50 - 70

Notes:

(1) Exposures are specified as free-in-air exposures without backscatter.

(2) The indicated kVp is often significantly different from the actual kVp. The kVp must be tested at the time the output per film is measured to determine the correct exposure range to be applied.

4731.1316 Veterinary Medicine Radiographic Installations

Subpart 1. **Applicability**. This part applies to x-ray systems used for diagnostic veterinary medicine radiography and applies in addition to the requirements in 4731.0100 to 4731.1314.

A. Requirements for fluoroscopic veterinary medicine systems are covered in 4731.1317.

B. Requirements for therapeutic veterinary medicine shall be the same as those in 4731.1319 and 4731.1320.

C. Requirements for dental intraoral veterinary medicine shall be the same as those in 4731.1315.

Subp. 2. **Beam limitation**. Collimators must be provided to restrict the useful beam to the area of clinical interest and must provide the same degree of protection as is required of the tube housing.

A. If a variable-aperture beam limiting collimator is used, the projected light and x-ray field must not exceed the smallest dimension of the x-ray film cassette by greater than two percent of the distance of the x-ray tube to the film (SID) in any direction.

B. A method must be provided to:

(1) indicate when the axis of the x-ray beam is perpendicular to the plane of the image receptor;

(2) align the center of the x-ray field with respect to the center of the image receptor to within two percent of the SID; and

(3) indicate the SID to within two percent.

C. If a fixed dimension beam limiting collimator is used, it must meet the additional requirements in this item.

(1) The collimator must be labeled to indicate the field size and the SID for which it is designed.

(2) The collimator must be used only for the field size and the SID for which it is designed.

(3) The x-ray field must not exceed the x-ray film cassette by greater than two percent of the distance of the x-ray tube to the film SID in the x-ray film cassette's smallest dimension.

(4) The requirements in 4731.1315, subpart 4, items D and E.

D. In the case of horizontal beam x-rays, a mechanical cassette holding device must be used to ensure that no part of the body of the individual steadying the cassette is exposed to primary beam x-rays.

E. If necessary, and any involved individual is properly attired in protective apron and gloves of at least 0.5 mm lead equivalency, this does not preclude the operation of the radiographic system by one of the individuals holding the animal patient using a foot switch.

Subp. 3. **Operating procedures**. The registrant must ensure that the operating procedures in this subpart are applied.

A. The operator must not stand in the path of the useful beam during radiographic exposures.

B. No individual other than the operator must be in the radiographic room while exposures are being made unless the individual's assistance is required.

C. When an animal must be held in position by an individual during radiography, that individual must wear protective gloves and apron of at least 0.5 mm lead equivalency, and the individual must be positioned so no part of the body, protected or unprotected, will be struck by the useful beam.

4731.1316. Fluoroscopic X-ray Systems Except Radiation Therapy Simulators

Subpart 1. **Applicability**. This part applies to all fluoroscopic x-ray systems in addition to the requirements in 4731.0100 to 4731.1314.

Subp. 2. **Limitation of useful beam, primary barrier**. For all fluoroscopes, the requirements in items A and B must be met.

A. The fluoroscopic imaging assembly must be provided with a primary protective barrier which intercepts the entire cross section of the useful beam at any SID.

B. The x-ray tube used for fluoroscopy must not produce x-rays unless the barrier is in position to intercept the entire useful beam.

Subp. 3. **Limitation of useful beam, x-ray field**. All fluoroscopes must be provided with image intensification equipment to view the fluoroscopic images.

A. For image-intensified fluoroscopic equipment, neither the length nor the width of the x-ray field in the plane of the image intensifier may exceed that of the visible area of the image intensifier by more than three percent of the SID during fluoroscopy or digital imaging. The sum of the excess length and the excess width must be no greater than four percent of the SID. In addition, means must be provided to permit further limitations of the field:

(1) beam-limiting devices installed after May 22, 1979, and incorporated in equipment with either a variable SID or a visible area of greater than 300 square centimeters (46.5 square inches), must be provided with means for the stepless adjustment of the x-ray field.

(2) all equipment with a fixed SID and a visible area of 300 square centimeters (46.5 square inches) or less must be provided with either stepless adjustment of the x-ray field or with means to further limit the x-ray field size at the plane of the image receptor to 125 square centimeters (19.4 square inches) or less. Stepless adjustment must, at the greatest SID, provide continuous field sizes from the maximum obtainable to a field size of five by five centimeters (1.97 by 1.97 inches) or less.

(3) for fluoroscopic x-ray systems manufactured after February 25, 1978, when the angle between the image receptor and beam axis is variable, means must be provided to indicate when the axis of the x-ray beam is perpendicular to the plane of the image receptor.

(4) compliance must be determined with the beam axis indicated to be perpendicular to the plane of the image receptor. For rectangular x-ray fields used with circular image reception, the error in alignment must be determined along the length and width dimensions of the x-ray field which pass through the center of the visible area of the image receptor.

B. Spot-film devices which are certified components must meet the additional requirements in subitems (1) to (4):

(1) means must be provided between the source and the patient for adjustment of the x-ray field size in the plane of the film to the size of that portion of the film which has been selected on the spot-film selector. Such adjustment must be automatically accomplished, except when the x-ray field size in the plane of the film is smaller than that of the selected portion of the film. For spot-film devices installed after June 21, 1979, if the x-ray field size is less than the size of the selected portion of the film, the means for adjustment of the field size must be only at the operator's option.

(2) it must be possible to adjust the x-ray field size in the plane of the film to a size smaller than the selected portion of the film. The minimum field size at the greatest SID must be equal to, or less than, five by five centimeters (1.97 by 1.97 inches).

(3) the center of the x-ray field in the plane of the film must be aligned with the center of the selected portion of the film to within two percent of the SID.

(4) on spot-film devices installed after February 25, 1978, if the angle between the plane of the image receptor and beam axis is variable, means must be provided to indicate when the axis of the x-ray beam is perpendicular to the plane of the image receptor. Compliance must be determined with the beam axis indicated to be perpendicular to the plane of the image receptor.

C. If a means exists to override any of the automatic x-ray field size adjustments required in this subpart, that means must:

(1) be designed for use only in the event of system failure;

(2) incorporate a signal visible at the fluoroscopist's position which indicates whenever the automatic field size adjustment is overridden; and

(3) be clearly and durably labeled as follows: "FOR X-RAY FIELD LIMITATION SYSTEM FAILURE."

Subp. 4. **Activation of the fluoroscopic tube**. X-ray production in the fluoroscopic mode must be controlled by a device which requires continuous pressure by the fluoroscopist for the entire time of any exposure. When recording serial fluoroscopic images, the fluoroscopist must be able to terminate the x-ray exposure at any time, but means may be provided to permit completion of any single exposure of the series in process.

Subp. 4a. **Entrance exposure rate allowable limits on fluoroscopic systems manufactured before May 19, 1995.** The registrant must ensure that the entrance exposure rate allowable limits in this subpart are met.

A. Equipment with automatic exposure rate control (AERC). Fluoroscopic equipment that is provided with AERC shall not be operable at any combination of tube potential and current that results in an exposure rate in excess of ten roentgens per minute (10 R/min) or 2.58 x 10-3 coulomb per kilogram (C/kg) per minute at the point where the center of the useful beam enters the patient, except:

(1) during recording of fluoroscopic images when using photographic film; or

(2) when an optional high-level control is provided. When so provided, the equipment shall not be operable at any combination of tube potential and current that results in an exposure rate in excess of 5 R/min (1.29 x 10-3 C/kg per minute) at the point where the center of the useful beam enters the patient, unless the high-level control is activated. Special means of activation of high-level controls is required. The high-level control shall be operable only when continuous manual activation is provided by the operator. A continuous signal audible to the fluoroscopist shall indicate that the high-level control is being employed.

B. Equipment without AERC (manual mode). Fluoroscopic equipment that is not provided with AERC shall not be operable at any combination of tube potential and current that results in an exposure rate in excess of 5 R/min (1.29 x 10-3 C/kg per minute) at the point where the center of the useful beam enters the patient, except:

(1) during the recording of fluoroscopic images; or

(2) when an optional high-level control is activated. Special means of activation of high-level controls is required. The high-level control shall be operable only when continuous manual activation is provided by the operator. A continuous signal audible to the fluoroscopist shall indicate that the high-level control is being employed.

C. Equipment with both an AERC mode and a manual mode. Fluoroscopic equipment that is provided with both an AERC mode and a manual mode shall not be operable at any combination of tube potential and current that results in an exposure rate in excess of 10 R/minute (2.58 x 10-3 C/kg per minute) in either mode at the point where the center of the useful beam enters the patient, except:

(1) during the recording of fluoroscopic images when using photographic film; or

(2) when the mode or modes have an optional high-level control, in which case that mode or modes shall not be operable at any combination of tube potential and current that results in an exposure rate in excess of 5 R/minute (1.29 x 10-3 C/kg per minute) at the point where the center of the useful beam enters the patient, unless the high-level control is activated. Special means of activation of high-level controls is required. The high-level control shall be operable only when continuous manual activation is provided by the operator. A continuous signal audible to the

fluoroscopist shall indicate that the high-level is being employed.

D. Compliance with this subpart shall be determined as follows:

(1) movable grids and compression devices shall be removed from the useful beam during the measurement;

(2) if the source is below the x-ray table, the exposure rate shall be measured at one centimeter above the tabletop or cradle;

(3) if the source is above the x-ray table, the exposure rate shall be measured at 30 centimeters above the tabletop with the end of the beam-limiting device or spacer positioned as closely as possible to the point of measurement;

(4) in a C-arm type of fluoroscope, the exposure rate shall be measured at 30 centimeters from the input surface of the fluoroscopic imaging assembly, with the source positioned at any available SID, provided that the end of the beam-limiting device or spacer is no closer than 30 centimeters from the input surface of the fluoroscopic imaging assembly; and

(5) in a lateral type of fluoroscope, the exposure rate shall be measured at a point 15 centimeters from the center line of the x-ray table and in the direction of the x-ray source with the end of the beam-limiting device or spacer positioned as closely as possible to the point of measurement. If the tabletop is movable, it shall be positioned as closely as possible to the lateral x-ray source, with the end of the beam-limiting device or spacer no closer than 15 centimeters to the center line of the x-ray table.

Subp. 5. **Entrance exposure rate allowable limits on fluoroscopic systems manufactured after May 19, 1995.** The registrant must ensure that the entrance exposure rate allowable limits in this subpart are met.

A. Fluoroscopic equipment operable at any combination of tube potential and current that results in an exposure rate greater than 5 R/minute (1.29 x 10-3 C/kg per minute) at the point where the center of the useful beam enters the patient shall be equipped with automatic exposure rate control (AERC). Provision for manual selection of technique factors may be provided.

B. Fluoroscopic equipment shall not be operable at any combination of tube potential and current that results in an exposure rate in excess of 10 R/minute (2.58 x 10-3 C/kg per minute) at the point where the center of the useful beam enters the patient, except:

(1) during the recording of images from an x-ray image-intensifier tube using photographic film; or

(2) when an optional high-level control is activated. When the high-level control is activated, the equipment shall not be operable at any combination of tube potential and current that results in an exposure rate in excess of 20 R/minute (5.16 x 10-3 C/kg per minute) at the point where the center of the useful beam enters the patient. Special means of activation of high-level control is required. The high-level control shall only be operable when continuous manual activation is provided by the operator. A continuous signal audible to the fluoroscopist shall indicate that the high-level control is being employed.

C. Compliance with item B, subitem (2), shall be determined as follows:

(1) movable grids and compression devices shall be removed from the useful beam during the measurement;

(2) if the source is below the x-ray table, the exposure rate shall be measured at one centimeter above the tabletop or cradle;

(3) if the source is above the x-ray table, the exposure rate shall be measured at 30 centimeters above the tabletop with the end of the beam-limiting device or spacer positioned as closely as possible to the point of measurement;

(4) in a C-arm type of fluoroscope, the exposure rate shall be measured at 30 centimeters from the input surface of the fluoroscopic imaging assembly, with the source positioned at any available SID, provided that the end of the beam-limiting device or spacer is no closer than 30 centimeters from the input surface of the fluoroscopic imaging assembly; and

(5) in a lateral type of fluoroscope, the exposure rate shall be measured at a point 15 centimeters from the center line of the x-ray table and in the direction of the x-ray source with the end of the beam-limiting device or spacer positioned as closely as possible to the point of measurement. If the tabletop is movable, it shall be positioned as closely as possible to the lateral x-ray source, with the end of the beam-limiting device or spacer no closer than 15 centimeters to the center line of the x-ray table. Variable SID units shall not exceed 10 R/minute at any SID.

D. During fluoroscopy and cinefluorography, x-ray tube potential and current must be continuously indicated. Deviation of x-ray tube potential and current from the indicated values must not exceed the maximum deviation as stated by the manufacturer according to Code of Federal Regulations, title 21, section 1020.30, paragraph (h), item (3).

E. Periodic measurement of the maximum exposure rate must be performed in the manual mode, automatic exposure rate control, and high-level control mode, if applicable.

(1) the measurements must be made annually and after any maintenance of the system which might affect the exposure rate.

(2) the results of these measurements must be in the record required in 4731.0168 and 4731.0169. The measurement results must be stated in Roentgens per minute or mC/kg per minute and must include the technique factors used in determining such results. The name of the individual performing the measurements and the date the measurements were performed must be included in the results.

(3) materials must be placed in the useful beam when conducting these periodic measurements to protect the imaging system.

(4) the periodic measurement of the maximum entrance exposure rate must be made under the conditions that satisfy the requirements of item D. For x-ray systems that do not incorporate an automatic exposure rate control, the kilovoltage and milliamperage must be manually adjusted to produce the maximum entrance exposure rate.

Subp. 6. **Barrier transmitted radiation rate limits**. The exposure rate due to transmission through the primary protective barrier with the attenuation block in the useful beam, combined with radiation from the image intensifier, must not exceed 3.34 x 10-3 percent of the entrance exposure rate at ten centimeters (3.9 inches) from any accessible surface of the fluoroscopic imaging assembly beyond the plane of the image receptor for each roentgen per minute (0.25 mC/kg) of entrance exposure rate.

Subp. 7. **Measuring compliance of barrier transmission**. Compliance with subpart 6 shall be determined according to this subpart.

A. The exposure rate due to transmission through the primary protective barrier combined with radiation from the image intensifier must be determined by measurements averaged over an area of 100 square centimeters (15.5 square inches) with no linear dimension greater than 20 centimeters (7.9 inches).

B. If the source is below the tabletop or cradle, the measurement must be made with the input surface of the fluoroscopic imaging assembly positioned 30 centimeters (11.8 inches) above the tabletop or cradle.

C. If the source is above the tabletop or cradle and the SID is variable, the measurement must be made with the end of the beam-limiting device or spacer as close to the tabletop as it can be placed, provided that it must not be closer than 30 centimeters (11.8 inches).

D. The attenuation block must be positioned in the useful beam ten centimeters (3.9 inches) from the point of measurement of entrance exposure rate and between this point and the input surface of the fluoroscopic imaging assembly.

Subp. 8. **Indication of kilovoltage and milliamperage**. For fluoroscopic x-ray systems manufactured and installed after February 25, 1978, during fluoroscopy and cinefluorography, the kilovoltage and the milliamperage must be continuously indicated.

Subp. 9. **Source-to-skin distance**. The source-to-skin distance must not be less than:

A. 38 centimeters (15 inches) on stationary fluoroscopes;

B. 35.5 centimeters (14 inches) on stationary fluoroscopes manufactured prior to August 1, 1974;

C. 30 centimeters (11.8 inches) on all portable fluoroscopes; and

D. 20 centimeters (7.9 inches) for image intensified fluoroscopes used for specific surgical applications. The written safety procedures must provide precautionary measures to be adhered to when image intensified fluoroscopes are used for specific surgical applications. The 20 centimeter (7.9 inch) spacer cone must be replaced with the 30 centimeter (11.8 inch) spacer cone immediately after the end of the fluoroscopic surgical procedure.

Subp. 10. **Fluoroscopic timer**. Means must be provided to preset the cumulative on-time of the fluoroscopic x-ray tube. The maximum cumulative time of the timing device must not exceed five minutes without resetting. A signal audible to the fluoroscopist must indicate the completion of any preset cumulative on-time. The signal must continue to sound while x-rays are produced, until the timing device is reset.

Subp. 11. **Control of scattered radiation**. The procedures in this subpart must be used to control scattered radiation from all fluoroscopes.

A. When a fluoroscopic table with an undertable x-ray tube is used, the bucky opening must be shielded to attenuate the scattered radiation by at least 70 percent. Lead drapes must be attached to the intensifier tower to attenuate scattered radiation by at least 70 percent.

B. For other undertable configurations, provisions must be made through equipment design or

radiation protection measures to ensure that individuals do not receive a dose in excess of the allowable dose limits listed in 4731.0124.

(1) any individual who must be in the room during a fluoroscopic procedure must wear a protective apron of not less than 0.5 millimeter lead equivalence.

(2) all fluoroscopic x-ray equipment must be provided with a bucky-slot cover panel, if applicable, and either lead drapes attached to the intensifying tower or self-supporting shields of not less than 0.5 millimeter lead equivalent material.

C. For single-tube above table combination radiographic and fluoroscopic x-ray systems used in the fluoroscopic mode, protective aprons of not less than 0.5 millimeter lead equivalence must be used to ensure that any individual who must be in the room during a fluoroscopic procedure does not receive a dose greater than the allowable dose limits listed in 4731.0124. In addition, portable lead shields, barriers, or aprons of not less than 0.5 millimeter lead equivalence must be used.

D. For portable C-arm fluoroscopes, provision must be made through the use of protective aprons of not less than 0.5 millimeter lead equivalence to ensure that any individual other than the patient who may be exposed during a fluoroscopic procedure does not receive a dose in excess of the allowable dose limits listed in 4731.0124.

Subp. 12. **Radiation therapy simulation systems.** A radiation therapy simulation system is exempt from the requirements of subpart 5, provided:

A. The system is designed and used so no individual other than the patient is in the simulation room when the system is producing x-rays; and

B. A system which does not meet the requirements of subpart 10 has a means to indicate the cumulative time that an individual patient has been exposed to x-rays. Procedures must require in such cases that the timer be reset between examinations.

4731.1318 Computed Tomography Systems

Subpart 1. **Applicability.** This part applies to all computed tomography systems in addition to the requirements in 4731.0100 to 4731.1314.

Subp. 2. **Termination of exposure.** A visible signal must indicate when the x-ray exposure has been terminated. The operator must be able to terminate the x-ray exposure at any time during a scan, or series of scans under CT x-ray system control, of greater than one-half second duration.

Subp. 3. **Tomographic plane indication and alignment.** The provisions in items A to C apply.

A. For any single slice tomogram system, means must be provided to permit visual determination of the tomographic plane or a reference plane offset from the tomographic plane.

B. For any multiple slice tomogram system, means must be provided to permit visual determination of the location of a reference plane. This reference plane can be offset from the location of the tomographic planes.

C. If a device using a light source is used to satisfy either item A or B, the light source must provide illumination levels of not less than 160 lux (15.0 foot candles) above the room ambient illumination level.

Subp. 4. **Beam-on and shutter status indicators**. The x-ray control and gantry must visually indicate whenever x-rays are produced and, if applicable, whether the shutter is open or closed. All emergency buttons or switches must be clearly labeled as to their functions.

Subp. 5. **Indication of computed tomography conditions of operation**. The computed tomography x-ray system must be designed so the computed tomography conditions of operation to be used during a scan or a scan sequence are indicated prior to the initiation of the scan or a scan sequence. On equipment having all or some of these conditions of operation at fixed values, this requirement may be met by permanent markings. Indication of computed tomography conditions of operation must be visible from any position from which scan initiation is possible.

Subp. 6. **Extraneous radiation**. When data is not being collected for image production, the radiation adjacent to the tube port must not exceed the leakage radiation from the diagnostic source assembly that is measured at a distance of one meter (39.4 inches) in any direction from the source. That leakage must not exceed 100 milliroentgens (26 uC/kg) in one hour when the x-ray tube is operated at its leakage technique factors. Compliance must be determined by a measurement averaged over an area of 100 square centimeters (15.5 square inches) with no linear dimension greater than 20 centimeters (7.9 inches).

Subp. 7. **Maximum surface computed tomography dose index identification**. The angular position where the maximum surface computed tomography dose index occurs must be identified to allow for reproducible placement of a computed tomography dosimetry chamber.

Subp. 8. **Additional requirements for computed tomography x-ray systems containing a gantry manufactured after September 3, 1985.**

A. The total error in the indicated location of the tomographic plane or reference plane must not exceed five millimeters (0.2 inches).

B. If the x-ray production period is less than one-half second, the indication of x-ray production must be actuated for at least one-half second. Indicators at or near the patient side of the gantry must be discernible to the operator.

C. The deviation of indicated scan increment versus actual increment must not exceed plus or minus one millimeter (0.04 inches) with a mass of 100 kilograms (220 pounds) resting on the support device. The patient support device must be incremented from a typical starting position to the maximum incremented distance or 30 centimeters (11.8 inches), whichever is less, and then returned to the starting position. Measurement of actual versus indicated scan increment may be taken anywhere along this incremented distance.

D. Premature termination of the x-ray exposure by the operator must necessitate resetting of the computed tomography conditions of operation before the initiation of another scan.

Subp. 9. **Audio communication**. Within the computed tomography area, provision must be made for two-way audio communication between the patient and operator at the control panel.

Subp. 10. **Patient observation.** Within the computed tomography area, provision must be made for a shielded window containing the same lead equivalence as the adjoining walls so the operator at the control panel may directly observe the patient, any other individual in the room, and any doorways into the room. A closed circuit television system may be used as a secondary means of observing the patient.

Subp. 11. **Location of control panel and x-ray control.** The control panel and x-ray control must be mounted in a permanently protected area outside the computed tomography room. The operator is required to remain in that protected area during the entire exposure.

Subp. 12. **Operating procedure information.** Information about the operation, radiation safety surveys, and equipment performance measurements of the system must be available at the control console. This information must contain:

A. The dates of the last radiation safety survey and equipment performance measurements;

B. Written results of the most recent radiation safety survey and equipment performance measurements including:

(1) those specified in part 4731.1307.

(2) photographic images obtained from the photographic image recording device; and

(3) images stored in digital form.

C. Instructions on the use of the computed tomography phantoms, including a schedule of equipment performance checks appropriate for the system, allowable variations for the indicated measurements, and the results of the last two years' equipment performance measurements in addition to the original equipment performance and acceptance test measurements, images, and digital data; and

D. The distance in millimeters between the tomographic plane and the reference plane if a reference plane is used.

Subp. 13. **Corrective action.** If the equipment performance measurements required by 4731.1307, of the computed tomography systems identify that a measurement has exceeded a tolerance specified in 4731.1308, subp.8, the registrant must correct the measurement to within the tolerances specified in 4731.1308. Correction of the problem must take place within five working days and must be verified by performing the equipment performance measurements specified in 4731.1307.

4731.1319 Therapeutic X-ray Systems of Less Than 1.0 MV

Subpart 1. **Applicability.** In addition to the requirements in 4731.0100 to 4731.1318, this part applies to all therapeutic x-ray systems of less than 1.0 MV.

Subp. 2. **Leakage radiation.** When the tube is operated at its leakage technique factors, the instantaneous exposure rate leakage radiation must not exceed the value specified at the distance specified in this subpart for the classification of that x-ray system.

A. Leakage radiation for contact therapeutic x-ray systems must not exceed 100

milliroentgens (25.8 uC/kg) per hour at five centimeters (1.97 inches) from the surface of the tube housing assembly.

B. Zero to 150 kVp systems installed prior to September 10, 1991, must have a leakage radiation which does not exceed 1.0 roentgen (0.258 mC/kg) in one hour at one meter (39.4 inches) from the source.

C. Zero to 150 kVp systems installed on or after September 10, 1991, must have a leakage radiation which does not exceed 100 milliroentgens (25.8 uC/kg) in one hour at one meter (39.4 inches) from the source.

D. 151 to 999 kVp systems must have leakage radiation which does not exceed one roentgen (0.258 mC/kg) in one hour at one meter (39.4 inches) from the source. However, systems that operate in excess of 500 kVp may have a leakage radiation rate at one meter (39.4 inches) from the source not to exceed 0.1 percent of the useful beam one meter (39.4 inches) from the source.

Subp. 3. **Leakage from permanent beam limiting devices**. Permanent fixed diaphragms or cones used for limiting the useful beam must provide the same or a higher degree of protection as required for the tube housing assembly in subpart 2.

Subp. 4. **Removable beam limiting devices**. Removable beam limiting devices must, for the portion of the useful beam to be blocked by these devices, transmit not more than five percent of the useful beam at the maximum kilovoltage and maximum treatment filter. This requirement does not apply to auxiliary blocks or materials placed in the useful beam to shape the useful beam to the individual patient.

Subp. 5. **Adjustable beam limiting devices**. Adjustable beam limiting devices installed after September 10, 1991, must meet the requirements of subpart 4. Adjustable beam limiting devices installed before September 10, 1991, must, for the portion of the x-ray beam to be blocked by these devices, not transmit more than five percent of the useful beam at the maximum kilovoltage and maximum treatment filter.

Subp. 6. **Filter system**. The filter system must be designed so:

A. the filters cannot be accidentally displaced at any possible tube orientation;

B. the radiation at five centimeters (1.97 inches) from the filter insertion slot opening does not exceed 30 roentgens (7.74 mC/kg) per hour under any operating condition; and

C. each filter is marked as to its material of construction and its thickness. For wedge filters, the wedge angle must appear on the wedge or wedge tray.

Subp. 7. **Tube immobilization**. The tube housing assembly must be capable of being immobilized for stationary treatments.

Subp. 8. **Focal spot marking**. The tube housing assembly must be marked so it is possible to determine the location of the focal spot to within five millimeters (0.2 inches), and such marking must be readily accessible for use during calibration procedures.

Subp. 9. **Beam block**. If the x-ray tube of a contact therapeutic x-ray system is hand-held during irradiation, the operator must wear protective gloves and apron. When practical, a cap of at least 0.5 millimeters lead equivalence must cover the aperture window of the tube housing of such apparatus when the apparatus is not being used.

Subp. 10. **Timer**. A timer which has a display must be provided at the treatment control panel. The timer must:

A. Have a preset time selector and an elapsed time indicator;

B. Be a cumulative timer which activates with the production of radiation and retains its reading after the irradiation is interrupted or terminated;

C. Terminate irradiation when a preselected time has elapsed if any dose monitoring system present has not previously terminated irradiation;

D. Permit accurate presetting and determination of exposure times within an accuracy of one second;

E. Not permit an exposure if set at zero; and

F. Not activate until the shutter is opened when irradiation is controlled by a shutter mechanism.

Subp. 11. **Control panel functions**. The control panel must have:

A. An indication of whether electrical power is available at the control panel and if activation of the x-ray tube is possible;

B. An indication of whether x-rays are being produced;

C. Meters that indicate kVp and mA;

D. Means for terminating an exposure at any time;

E. A locking device which will prevent unauthorized use of the x-ray system; and

F. For x-ray systems installed after September 10, 1991, a positive display of all specific filters in the beam.

Subp. 12. **Multiple tubes**. A control panel may energize more than one x-ray tube if the x-ray tubes are located in the same room. In this situation, the following must apply:

A. It must be possible to activate only one x-ray tube at any time;

B. There must be an indication at the control panel identifying which x-ray tube is energized; and

C. There must be an indication at the tube housing assembly when that tube is energized.

Subp. 13. **Source-to-skin distance**. There must be means of determining the source-to-skin distance to within two millimeters (0.08 inches).

Subp. 14. **Shutters.** Unless it is possible to bring the x-ray output to the prescribed exposure parameters within five seconds, the beam must be automatically attenuated by a shutter having a lead equivalence of not less than that of the tube housing assembly. In addition:

A. After the system is at operating parameters, the shutter must be controlled electrically by

the operator from the control panel; and

B. An indication of the shutter position must appear at the control panel.

Subp. 15. **Low-filtration x-ray tubes.** Each x-ray system equipped with a beryllium or other low-filtration window must be clearly labeled as "beryllium window" or "low-filtration window" on the tube housing assembly and at the control panel.

Subp. 16. **Entrance interlocks.** For therapeutic x-ray systems capable of operation above 150 kVp, interlocks or safety devices must be provided so all access to the radiation therapy rooms are blocked before treatment can be initiated or continued. If the radiation beam is interrupted by any door opening or tripping of a safety device, it must not be possible to restore the system to operation without reactivating the safety device and reinitiating irradiation by manual action at the control panel. When any entrance door is opened while the x-ray tube is activated, the exposure at a distance of one meter (39.4 inches) from the source must be reduced to less than 100 milliroentgens (0.001 sieverts or one millisievert) per hour.

Subp. 17. **Operating procedures.** The tube housing assembly of contact therapeutic equipment must not be held by hand during operation unless the system is designed to require such holding and the kVp of the system does not exceed 50 kVp. In such cases, the holder must wear protective gloves and apron of not less than 0.5 millimeter lead equivalence at 100 kVp.

Subp. 18. **Additional requirements.** The x-ray system must not be used in the administration of radiation therapy unless the requirements of 4731.1305 and 4731.1306, have been met.

4731.1320 X-ray And Electron Therapy Systems With Energies Of 1.0 MV/1.0 MEV And Above.

Subpart 1. **Applicability.** In addition to the requirements in 4731.0100 to 4731.1318, the requirements in this part shall apply to the use of therapeutic x-ray systems with energies of 1.0 MV and above.

Subp. 2. **System requirements; leakage radiation to the patient area.** All x-ray and electron therapy systems or any part of a system must meet the requirements in this subpart.

A. Systems or any part of a system installed after September 10, 1991, must meet the following requirements:

(1) for operating conditions producing maximum leakage radiation, the absorbed dose in rads (cGy) due to any leakage radiation component, including x-rays, electrons, and neutrons, at any point in a circular plane of two meters (78.7 inches) radius centered on or perpendicular to the central axis of the beam at the isocenter (patient plane), or nominal treatment distance and outside the maximum useful beam size must not exceed 0.1 percent of the maximum absorbed dose in rads (grays) of the unattenuated useful beam measured at the point of intersection of the central axis of the beam and the circular plane surface.

(2) measurements, excluding those for neutrons, must be averaged over an area up to but not exceeding 100 square centimeters (15.5 square inches) at the positions specified in

this item. Measurements of the portion of the leakage radiation dose contributed by neutrons must be averaged over an area up to but not exceeding 200 square centimeters (31 square inches).
(2) For each system, the registrant must determine or obtain from the manufacturer the leakage radiation existing at the positions specified in subitem (1) for the operating conditions specified in that subitem.

B. Systems installed before September 10, 1991, must meet the following requirements:

(1) For operating conditions producing maximum leakage radiation, the absorbed dose in rads (cGy) due to leakage radiation, excluding neutrons, at any point in a circular plane of a two meter (78.7 inch) radius centered on a plane perpendicular to the central axis of the beam two meters (78.7 inches) from the virtual source, and outside the maximum size useful beam, must not exceed 0.1 percent of the maximum absorbed dose in rads (grays) of the unattenuated useful beam measured at the point of intersection of the central axis of the beam and the surface of the circular plane. Measurements must be averaged over an area up to but not exceeding 100 square centimeters (15.5 square inches) at the positions specified in this item.

(2) For each system, the registrant must determine or obtain from the manufacturer the leakage radiation existing at the positions specified in subitem (1) for the operating conditions specified in that subitem.

Subp. 3. **Leakage of radiation outside the patient area for systems or any part thereof installed after September 10, 1991.** For systems or any part of a system installed after September 10, 1991, the system must meet the requirements in this subpart.

A. The absorbed dose in rads (cGy) due to leakage radiation, except in the area specified in subpart 2, item A, subitem (1), when measured at any point one meter (39.4 inches) from the path of the charged particle, before the charged particle strikes the target or window, must not exceed 0.1 percent of the maximum absorbed dose in rads (cGy) of the neutrons and must not exceed 0.1 percent of the maximum absorbed dose in rads (cGy) of the photons of the unattenuated useful beam measured at the point of intersection of the central axis of the beam and the circular plane specified in subpart 2, item A, subitem (1).

B. The registrant must determine or obtain from the manufacturer, the actual leakage radiation existing at the positions specified in item A for specified operating conditions. Radiation measurements, excluding neutrons, must be averaged over an area up to but not exceeding 100 square centimeters (15.5 square inches). Neutron measurements must be averaged over an area up to but not exceeding 200 square centimeters (31 square inches).

Subp. 4. **Beam limiting devices.** Adjustable or interchangeable beam limiting devices must be provided, and the devices must transmit no more than five percent of the useful beam at the nominal treatment distance for the portion of the useful beam which is to be attenuated by the beam limiting device. This requirement does not apply to auxiliary blocks or materials placed in the useful beam to shape the useful beam to the individual patient. The neutron component of the useful beam must be excluded from the calculation of the five percent limitation.

Subp. 5. **Filters.** All x-ray and electron therapy systems must have filters that meet the requirements in this subpart.

A. All compensating removable filters must be clearly identified. Documentation available at the control panel must contain a description of the filter. For wedge filters, the wedge angle must appear on the wedge or wedge tray.

B. If the absorbed dose rate data required by subpart 17 relates exclusively to operation with a field flattening or beam scattering filter in place, the filter must be removable only with the use of tools.

C. For systems or any part of a system installed after September 10, 1991, which uses a system of wedge filters, interchangeable field flattening filters, or interchangeable beam scattering filters:

(1) irradiation must not be possible until a selection of a filter has been made at the treatment control panel;

(2) an interlock system must be provided to prevent irradiation if the filter selected is not in the correct position;

(3) a display must be provided at the treatment control panel showing the filters in use; and

(4) an interlock must be provided to prevent irradiation if any filter selection operation carried out in the treatment room does not agree with the filter selection operation carried out at the treatment control panel.

Subp. 6. **Electron beam quality**. The registrant must determine, or obtain from the manufacturer, the maximum percentage absorbed dose in the useful beam due to neutrons, excluding stray neutron radiation, when electrons and photons are being generated.

Subp. 7. **Radiation monitors**. All therapeutic x-ray systems must be provided with radiation monitors in the radiation head.

A. Systems or any part of a system installed after September 10, 1991, must measure all therapeutic radiation beams with at least two radiation monitors. The radiation monitors must be incorporated into two separate dose monitoring systems.

B. Systems installed prior to September 10, 1991, must be provided with at least one radiation monitor. This radiation monitor must be incorporated into a primary dose monitoring system.

C. The radiation monitor and the dose monitoring system into which that radiation monitor is incorporated must meet the following requirements:

(1) each radiation monitor must be removable only with tools and must be interlocked to prevent incorrect positioning.

(2) each radiation monitor must form part of a dose monitoring system from whose readings in dose monitor units the absorbed dose at a reference point in the treatment volume can be calculated.

(3) each dose monitoring system must be capable of independently monitoring, interrupting, and terminating irradiation.

(4) for dose monitoring systems installed after September 10, 1991, the design of the dose monitoring system must assure that:

(a) the malfunctioning of one dose monitoring system does not affect the correct functioning of the second dose monitoring system; and

(b) the failure of any element common to both dose monitoring systems which could affect the correct function of both dose monitoring systems terminates irradiation.

(5) Each dose monitoring system must have a legible display at the treatment control panel. For dose monitoring systems installed after September 10, 1991, each display must:

(a) maintain a reading until intentionally reset to zero;

(b) have only one scale and no scale multiplying factors;

(c) use a design so that any increased dose is displayed by increasing numbers and must be so designed that, in the event of an overdosage of radiation, the absorbed dose may be accurately determined; and

(d) display the dose monitoring information required by this subitem at the control panel and be retrievable in at least one dose monitoring system for a five-minute period of time in the event of a power failure.

(6) The internal dose monitoring system must be capable of delivering a dose that varies by less than two percent over a 12-hour period.

Subp. 8. **Beam symmetry**. For any system installed after September 10, 1991, that has the capacity to produce useful beams with asymmetry exceeding five percent, the asymmetry of the radiation beam in two orthogonal directions must be monitored before the beam passes through the beam limiting device. The asymmetry must be measured for a 30 square centimeter (4.65 square inch) field at a depth of ten centimeters (3.9 inches) at the points that correspond to 80 percent of the full width half maximum (FWHM) of central axis value.

Capabilities must be provided so that, if the difference in dose rate between one region and another region symmetrically displaced from the central axis of the beam in the same plane exceeds five percent of the central axis dose rate, indication of the dose rate difference is made at the control panel; and if the dose rate difference exceeds five percent, the irradiation is terminated.

Subp. 9. **Selection and display of dose monitor units**. All x-ray and electron therapy systems must provide for the selection and display of dose monitor units according to this subpart.

A. Irradiation must not be possible until a selection of a number of dose monitor units has been made at the treatment control panel.

B. The preselected number of dose monitor units must be displayed at the treatment control panel until reset manually for the next irradiation.

C. On systems installed after September 10, 1991, following an irradiation terminated by the dose monitoring system, it must be necessary to manually reset the preselected dose monitor units after irradiation is terminated and before irradiation can be reinitiated.

Subp. 10. **Termination of irradiation by the dose monitoring system or systems during stationary beam therapy.** All x-ray and electron therapy systems must meet the requirements in this subpart regarding termination of irradiation by dose monitoring systems during stationary beam therapy.

A. Each primary system must terminate irradiation when the preselected number of dose

monitor units has been detected by the system.

B. If original design of the system included a second dose monitoring system, that system must be capable of terminating irradiation when not more than 15 percent or 40 dose monitor units, whichever is smaller, above the preselected number of dose monitor units set at the treatment control panel has been detected by the second dose monitoring system.

C. Systems installed after September 10, 1991, must have a second dose monitoring system which terminates irradiation when not more than ten percent or 25 dose monitor units, whichever is smaller, above the preselected number of dose monitor units set at the treatment control panel has been detected by the second dose monitoring system.

D. Systems installed after September 10, 1991, must have an indicator on the control panel that shows which dose monitoring system has terminated irradiation.

Subp. 11. **Interruption switches.** All x-ray and electron therapy systems must have switches that allow the interruption of irradiation and meet the requirements in this subpart.

A. It must be possible to interrupt irradiation and equipment movement at any time from the operator's position at the treatment control panel.

B. Emergency off switches must be placed on or near the treatment console. Inside the treatment room, emergency off switches must be placed on or near both sides of the treatment couch, and on or near both sides of the gantry stand.

Subp. 12. **Termination switches.** All x-ray and electron therapy systems must have termination switches that make it possible to terminate irradiation and equipment movements, or go from an interruption condition to termination conditions, at any time from the operator's position at the treatment control panel.

Subp. 13. **Timer.** All x-ray and electron therapy systems must have a timer that meets the requirements in this subpart.

A. A timer which has a visual display must be provided at the treatment control panel. The timer must have a preset time selector and an elapsed time indicator.

B. The timer must be a cumulative timer which activates with the production of radiation and returns its reading after irradiation is interrupted or terminated. After irradiation is terminated and before irradiation can be reinitiated, it must be necessary to reset the elapsed time indicator to zero.

C. For systems installed after September 10, 1991, after termination of irradiation and before irradiation can be reinitiated, it must be necessary to manually reset the preset time selector.

D. The timer must terminate irradiation when a preselected time has elapsed if the dose monitoring systems have not previously terminated irradiation.

E. For systems installed after September 10, 1991, if the backup timer is automatically set by control circuitry, the additional time must not be more than ten percent above the time determined by dividing the number of monitor units (MU) by the monitor unit irradiation rate.

Subp. 14. **Selection of radiation type.** Therapy systems capable of emitting both x-rays and electrons must allow for the selection of the radiation type according to the requirements in

this subpart.

A. Irradiation must not be possible until a selection of radiation type has been made at the treatment control panel.

B. An interlock system must be provided to ensure that the equipment can emit only the radiation type which has been selected.

C. An interlock system must be provided to prevent irradiation if any selected operations carried out in the treatment room do not agree with the selected operations carried out at the treatment control panel.

D. An interlock system must be provided to prevent irradiation with x-rays except to obtain a port film when electron applicators are fitted.

E. An interlock system must be provided to ensure electron beam irradiations do not take place with inappropriate beam modifiers such as wedges in the beam.

F. The radiation type selected must be displayed at the treatment control panel before and during irradiation.

Subp. 15. **Selection of energy.** Systems capable of generating radiation beams of different energies must allow for the selection of the energy value according to the requirements in this subpart.

A. Irradiation must not be possible until a selection of energy has been made at the treatment control panel.

B. An interlock system must be provided to prevent irradiation if any selected operations carried out in the treatment room do not agree with the selected operations carried out at the treatment control panel.

C. The nominal energy value and photon or electron modality selected must be displayed at the treatment control panel before and during irradiation.

Subp. 16. **Selection of stationary beam therapy or rotational beam therapy**. Systems capable of both stationary beam therapy and rotational beam therapy must allow for the selection of stationary beam therapy or rotational beam therapy according to the requirements in this subpart.

A. Irradiation must not be possible until a selection of stationary beam therapy or rotational beam therapy has been made at the treatment control panel.

B. An interlock system must be provided to ensure that the equipment can operate only in the mode which has been selected.

C. An interlock system must be provided to prevent irradiation if any selected operations carried out in the treatment room do not agree with the selected operations carried out at the treatment control panel.

D. The mode of operation must be displayed at the treatment control panel.

E. For systems installed after September 10, 1991, an interlock system must be provided to terminate irradiation if:

(1) movement of the gantry occurs during stationary beam therapy; or

(2) movement of the gantry stops during rotational beam therapy unless such stoppage is a preplanned function.

F. Rotational beam therapy must be controlled to provide accurate total dose and arc angle.

(1) for systems installed after September 10, 1991, where the angle of rotation terminates the radiation, the maximum difference between the delivered and expected monitor units (MU) must not exceed three percent or one monitor unit, whichever is greater. The expected MU is calculated by multiplying the set value of MU/degree by the set value of total gantry rotation angle. The observed terminal gantry angle must be within plus or minus three degrees of expected. This requirement applies for all arcs of 45 degrees or more at all MU/degree values indicated as "clinically usable" by the manufacturer.

(2) for systems installed after September 10, 1991, where the dose monitoring system terminates the irradiation, the maximum difference between the observed and expected angle of rotation of the gantry shall not exceed plus or minus three degrees. The expected angle of rotation is calculated by dividing the set value of monitor units by the set value of MU/degree. The agreement of elapsed MU to MU set must be three percent, or 1.0 MU, whichever is greater. This requirement applies for all arcs of 45 degrees or more at all MU/degree values indicated as "clinically usable" by the manufacturer.

Subp. 17. **Absorbed dose rate**. Systems installed after September 10, 1991, must have a component from which readings of the absorbed dose rate at a reference point in the treatment volume can be calculated. The radiation detectors in subpart 7 may form a portion of this system. The requirements in items A and B also apply.

A. The dose monitor unit rate must be displayed at the treatment control panel.

B. If the system can deliver under any conditions an absorbed dose rate at the nominal treatment distance of more than ten percent above the value specified by the manufacturer for any equipment parameters used, a device must be provided which terminates irradiation when the absorbed dose rate exceeds a value twice the specified maximum. The value at which the irradiation will be terminated must be in a record maintained by the registrant.

Subp. 18. **System checking facilities**. Capabilities shall be provided so all radiation safety interlocks can be checked for correct operation. When preselection of any of the operating conditions requires action in the treatment room and at the treatment control panel, selection at one location shall not give a display at the other location until the requisite selected operations in both locations have been completed.

Subp. 19. **Operating procedures**. Any therapy system with energies greater than one MV shall not be used in the administration of radiation therapy unless the requirements of 4731.0131; 4731.1305, subp.2; and 4731.1306, subp 2, have been met.

4731.1500 Transportation of Radioactive Materials

Subpart 1. **Packaging and transportation subject to state and federal rule**. The packaging and transportation of radioactive material are subject to the provisions of Chapter 4731 and are also subject to the requirements of other agencies such as the U.S. Nuclear Regulatory Commission, U.S. Department of Transportation (U.S. DOT), the and the U.S. Postal Service. The requirements of part 4731.1500-4731.1518 are in addition to, and not in substitution for, other requirements.

Subp 2. **Modification of requirements**. The licensee shall conform to the standards and requirements of the U.S. DOT specified in part 4731.1501, subp. 2 to the same extent as if the shipment or transportation were subject to U.S. DOT regulations. A request for any modification, waiver, or exemption referred to in those requirements, must be filed with, or made to the commissioner.

Subp 3. **A_1 and A_2 values**. Determinations of A_1 and A_2 values are found in parts 4731.3001, I, and 4731.3002, 1.

4731.1501 General Requirements

Subpart 1. **Deliver to carrier**. No person shall deliver radioactive material to a carrier for transport or transport radioactive material except as authorized in a general license or specific license issued by the commissioner or as exempted in part 4731.1513.

Subp. 2. **Comply with U. S. DOT regulations**. Each licensee who transports radioactive material outside of the site of usage, as specified in the license from the commissioner, or where transport is on public highways, or who delivers licensed material to a carrier for transport, shall comply with the applicable requirements, of the U.S. DOT regulations in 49 CFR parts 170 through 189 appropriate to the mode of transport.

A. The licensee shall comply with the U.S. DOT in the following areas:

(1) packaging - 49CFR Part 173 : subparts A, and B and I.

(2) marking and labeling - 49CFR Part 172: Subpart D, §§ 172.400 through 172.407, §§ 172.436 through 172.440, and subpart E.

(3) placarding - 49CFR Part 172: subpart F, especially §§ 172.500 through 172.519, 172.556, and Appendices B and C.

(4) accident reporting - 49CFR Part 171: §§ 171.15 and 171.16.

(5) shipping papers and emergency information - 49CFR Part 172: subparts C and G.

(6) hazardous material employee training - 49CFR Part 172: subp H.

(7) hazardous material shipper /carrier registration - 49CFR Part 107: subp G.

B. The licensee shall comply with U.S. DOT regulations pertaining to the following modes of transportation:

(1) rail - 49CFR Part 174: subparts A through D and K.

(2) air - 49CFR Part 175.

(3) vessel - 49CFR Part 176: subparts A through F and M.

(4) public highways - 49CFR Part 177 and Parts 390 through 397.

Subp 3. **Instructions to open package** . Before delivery of a package to a carrier for transport, the licensee shall ensure that any special instructions needed to safely open the package have been sent to, or otherwise made available to, the consignee for the consignee's use in accordance with part 4731.0123, subp 5, E.

4731.1502 Quality Assurance Requirements

Subpart 1. **Quality assurance program**. Each licensee shall establish, maintain, and execute a quality assurance program to verify by procedures such as checking, auditing, and inspection that deficiencies, deviations, and defective equipment or other ancillary materials relating to the shipment of packages containing radioactive material are promptly identified and corrected.

Subp 2. **Scope of quality assurance program**. The licensee shall identify the scope of the equipment, ancillary material and other components to be covered by the quality assurance program.

Subp 3. **Document and implement quality assurance program.** Each licensee shall document the quality assurance program by written procedures or instructions and shall carry out the program in accordance with those procedures throughout the period during which packaging is used.

Subp 4. **Commissioner approval**. Prior to the use of any package for the shipment of radioactive material, each licensee shall obtain approval by the commissioner of its quality assurance program.

Subp 5. **Records**. The licensee shall maintain sufficient written records to demonstrate compliance with the quality assurance program. Records of quality assurance pertaining to the use of a package for shipment of radioactive material shall be maintained for a period of 4 years after shipment.

4731.1503 Preliminary Determinations. Before the first use of any packaging for the shipment of radioactive material:

A. The licensee shall ascertain that there are no cracks, pinholes, uncontrolled voids, or other defects which could significantly reduce the effectiveness of the package;

B. Where the maximum normal operating pressure will exceed 35 kilopascal (5 pounds per square inch) gauge, the licensee shall test the containment system at an internal pressure of at least 50 percent higher than the maximum normal operating pressure to verify that capability of that system to maintain its structural integrity at that pressure; and

C. The licensee shall conspicuously and durably mark the packaging with its model number, serial number, gross weight, and a package identification number assigned by the U.S. NRC. Before applying the model number, the licensee shall determine that the packaging has been fabricated in accordance with the design approved by the U.S. NRC.

4731.1504 Routine Determinations. Before each shipment of radioactive material, the licensee shall ensure that the package with its contents satisfies the applicable requirements of this part and of the license. The licensee shall determine that:

A. The package is proper for the contents to be shipped;

B. The package is in an unimpaired physical condition except for superficial defects such as marks or dents;

C. Each closure device of the packaging, including any required gasket , is properly installed and secured and free of defects;

D. Any system for containing liquid is adequately sealed and has adequate space or other specified provision for expansion of the liquid;

E. Any pressure relief device is operable and set in accordance with written procedures;

F. The package has been loaded and closed in accordance with written procedures;

G. For fissile material, any moderator or neutron absorber, if required, is present and in proper condition;

H. Any structural part of the package which could be used to lift or tie down the package during transport is rendered inoperable for that purpose unless it satisfies design requirements of 10 CFR 71.45;

I. The level of nonfixed (removable) radioactive contamination on the external surfaces of each package offered for shipment is as low as reasonably achievable, and within the limits specified in U.S. DOT regulations in 49CFR173.443;

J. External radiation levels around the package and around the vehicle, if applicable, will not exceed the limits specified in 10CFR71.47 at any time during transportation; and

K. Accessible package surface temperatures will not exceed the limits specified in 10CFR71.43(g) at any time during transportation.

4731.1505 General License for Use of Nuclear Regulatory Commission Approved Packages

Subpart 1. **License to transport or deliver**. Any person who has a license from the commissioner is issued a general license to transport, or to deliver to a carrier for transport, licensed material in a package for which a license, certificate of compliance or other approval has been issued by the U.S. NRC.

Subp 2. **Approved quality assurance program.** This general license applies only to a licensee who has a quality assurance program approved by the U.S. NRC. as satisfying the provisions of 10CFR71.101-10CFR71.137

Subp 3. **Compliance with conditions.** This general license applies only to a licensee who:

A. Has a copy of the certificate of compliance, or other approval of the package, and has the drawings and other documents referenced in the approval relating to the use and maintenance of the packaging and to the actions to be taken before shipment;

B. Complies with the terms and conditions of the license, certificate, or other approval, as applicable, and the applicable requirements of 10CFR71.5 and 10CFR71.12-

C. Submits in writing to U.S. NRC, before the licensee's first use of the package, the licensee's name and license number and the package identification number specified in the package approval.

D. The general license in part 4731.1505, subp 1 only when the package approval authorizes use of the package.

E. For a Type B or fissile material package, the design of which was approved by the U.S. NRC before April 1, 1996, the general license is subject to the additional restrictions of 4731.1506.

4731.1506 General License for the Use of Previously Approved Type B Packages

Subpart 1. **Conditions for Type B package**. A Type B package previously approved by the U.S. NRC., but not designated as B(U) or B(M) in the identification number of the U.S.NRC. Certificate of Compliance, may be used under the general license of part 4731.1505 above, with the following additional conditions:

A. Fabrication of the packaging was satisfactorily completed before August 31, 1986, and its model number marked as required in part 4731.1509;

B. The package used for a shipment to a location outside the United states is subject to multilateral approval, as defined in U.S. DOT regulations at 49CFR173.403; and

C. A serial number that uniquely identifies each packaging which conforms to the approved design is assigned to, and legibly and durably marked on, the outside of each packaging.

Subp 2. **Package previously approved by NRC**.A Type B(U) package, a Type B(M) package, a low specific activity (LSA) material package or a fissile material package, previously approved by the U.S. NRC but without the designation "–85"" in the identification number of the Certificate of Compliance may be used under the general license of part 4731.1505 with the following additional conditions:

A. Fabrication of the package is satisfactorily completed by April 1, 1999, and it's model number marked as requested in part 4731.1503, C .

B. A package for a shipment to a location outside the United States is subject to multilateral approval as defined in U.S. DOT regulations at 49CFR173.403.

C. A serial number which uniquely identifies each packaging which conforms to the approved design is assigned to and legibly and durably marked on the outside of each packaging.

4731.1507 General License for the Use of U.S. Department of Transportation Specification Container

Subpart 1. **Use U.S. DOT specification containers**. Any person who has a license from the commissioner is issued a general license to transport, or to deliver to a carrier for transport, licensed material in a specification container for fissile material or for a Type B quantity of radioactive material as specified in 49CFR Parts 173 and 178 is issued a general license to use U.S. DOT specification containers.

Subp 2. **Requires approved quality assurance program.** This general license applies only to a licensee who has a quality assurance program approved by the commissioner as satisfying the provisions of part 4731.1502.

Subp 3. **Comply with specification conditions.** This general license applies only to a licensee who:

A. Has a copy of the specification;

B. Complies with the terms and conditions of the specification and the applicable requirements of parts 4731.0162, C, 4731.0185, 4731.500, 4731.1501, 4731.1503, 4731.1504, 4731.1511, 4731.1512, 4731.1514; and

Subp 4. **Specification container use within United States**. The general license in part 4731.1506, subp 1, is subject to the limitation that the specification container may not be used for a shipment to a location outside the United States except by multilateral approval as defined in 49 CFR 1173.403.

4731.1508 General License Use of Foreign Approved Package

Subpart 1. **Use of foreign approved packages** . Any person who has a license from the commissioner is issued a general license to transport, or deliver to a carrier for transport, licensed material in a package the design of which has been approved in a foreign national competent authority certificate that has been revalidated by the U.S. DOT as meeting the applicable requirements of 49 CFR 171.12 is issued a general license to use foreign approved packages.

Subp 2. **Requires approved quality assurance program**. Except as otherwise provided in parts 4731.1500-4731.1518, the general license applies only to a licensee who has a quality assurance program approved by the commissioner as satisfying the applicable provisions of part 4731.1502.

Subp 3. **Use to ship to or from outside United States**. This general license applies only to shipments made to or from locations outside the United States.

Subp 4. **Comply with certificate conditions.** This general license applies only to a licensee who:

A. Has a copy of the applicable certificate, the revalidation, and the drawings and other documents referenced in the certificate, relating to the use and maintenance of the packaging and to the actions to be taken before shipment; and

B. Complies with the terms and conditions of the certificate and revalidation, and with the applicable requirements of parts 4731.1500, 4731.1501, 4731.1503, 4731.1504, 4731.1511, 4731.1512, 4731.1514. With respect to the quality assurance provisions of part 4731.15102, the licensee is exempt from design, construction, and fabrication considerations.

4731.1509 Applicability of Operating Controls and Procedures for Fissile Material. A

license subject to part 4731.1503, who, under a general or specific license, transports licensed material or delivers licensed material to a carrier for transport, shall comply with the requirements of parts 4731.0500, 4731.1501, 4731.1503, 4731.1504, 4731.1511, 4731.1512, 4731.1514 and parts 4731.0100-4731.0102, and 4731.0105-4731.0109.

4731.1510 General License for Use of Fissile Material, Limited Quantity Package
Subpart 1. **Transport or deliver fissile material.** Any person who has a license from the commissioner is issued a general license to transport fissile material, or to deliver fissile material to a carrier for transport, without demonstrating compliance with 10CFR71.31-10CFR71.77, if the material is shipped in accordance with part 4731.1511 is issued a general license use of fissile material, limited quantity package.

Subp 2. **Requires approved quality assurance program.** The general license applies only to a licensee who has a quality assurance program approved by the commissioner as satisfying the provisions of 10CFR71.101- 10CFR71.137.

Subp 3. **Package limited to Type A package.** This general license applies only when a package contains no more than a Type A quantity of radioactive material, including only one of the following:

A. Up to 40 grams of uranium-235; or

B. Up to 30 grams of uranium-233; or

C. Up to 25 grams of the fissile radionuclides of plutonium, except that for encapsulated plutonium-beryllium neutron sources in special form, an A_1 quantity of plutonium may be present; or

D. A combination of fissile radionuclides in which the sum of the ratios of the amount of each radionuclide to the corresponding maximum amounts in part 4731.1510, subp. 3, A, B, and C, above, does not exceed unity.

Subp 4. **Package limited to Type A quantity.** For packages where fissile material is mixed with substances having an average hydrogen density grater than water, this general license applies only when a package contains no more than a Type A quantity of radioactive material, including only one of the following:

A. Up to 20 g of uranium-235

B. Up to 18 g of uranium-233

C. Up to 18 g of fissile radionuclides of plutonium, or

D. A combination of fissile radionuclides in which the sum of the ratios of the amount of each radionuclide to the corresponding maximum amounts in part 4731.1510, subp. 4, A, B. and C, above , does not exceed unity.

Subp 5. **Contains no beryllium, graphite, or enriched hydrogenous material** . Except for the beryllium contained within the special form plutonium-beryllium sources authorized in part 4731.1510, subp. 3, this general license applies only when beryllium, graphite, or hydrogenous material enriched in deuterium is not present in quantities exceeding 0.1 percent of the fissile

material mass.

Subp 6. **Special conditions**

A. Except as specified in part 4731.1510, subp. 6, B, below, for plutonium-beryllium sources authorized in part 4731.1510, subparts 3 and 4, this general license applies only when a packages labeled with a transport index not less that the number given by the following equation, where the package contains x grams of uranium-235, y grams of uranium-233, and z grams of the fissile radionuclides of plutonium.

Minimum Transportation Index = (0.25x + 0.33y + 0.4z). (where the package contains x grams of uranium-235, y grams of uranium-233, and z grams of the fissile radionuclides of plutonium.)

B. For a package in which the only fissile material is in the form of encapsulated plutonium-beryllium neutron sources in special form, the transport index based on criticality considerations may be taken as 0.025 times the number of grams of the fissile radionuclides of plutonium.

C. Packages which have a transport index greater than 10 are not authorized under the general license provisions in 4731.1505 - 4731.1511, and 4731.3001, D.

4731.1511 General License for use of packages for Fissile Material, Limited Moderator per Package, and Fissile Material, Limited Quantity, Controlled Shipment

Subpart 1. **Limited fissile material, limited moderator per package** . Any person who has a license from the commissioner is issued a general license to transport fissile material, or to deliver fissile material to a carrier for transport, without complying to 10CFR71.41-10CFR71.77 if the material is shipped in accordance with 4731.1510 is issued a general license for use of packages for fissile material, limited moderator per package and fissile material, limited quantity, controlled shipment.

Subp. 2. **Approved quality assurance program.** The general license in subpart 1, above, applies only to a licensee who has a quality assurance program approved by the commissioner as satisfying the provisions of 4731.1502.

Subp. 3. **Limited quantity conditions**. This general license applies only when the licensee complies with 4731.1502 and all of the following requirements are met:

A. The package contains no more than a Type A quantity of radioactive material.

B. Neither beryllium nor hydrogenous material enriched in deuterium is present.

C. The total mass of graphite present does not exceed 150 times the total mass of uranium-235 plus plutonium.

D. Substances having a higher hydrogen density than water are not present, except that polyethylene may be used for packing or wrapping.

E. Uranium-233 is not present, and the amount of plutonium does not exceed 1 percent of the amount of uranium-235.

F. The amount of uranium-235 is limited as follows:

(1) if the fissile radionuclides are not uniformly distributed, the maximum

amount of uranium-235 per package may not exceed the value given in the following table:

Table 1

Uranium enrichment in weight percent of uranium-235 not exceeding	Permissible maximum grams of uranium-235 per package
24	40
20	42
15	45
11	48
10	51
9.5	52
9	54
8.5	55
8	57
7.5	59
7	60
6.5	62
6	65
5.5	68
5	72
4.5	76
4	80
3.5	88
3	100
2.5	120
2	164
1.5	272
1.35	320
1	680
0.92	1200

(2) if the fissile radionuclides are distributed uniformly, the maximum amount of uranium-235 per package may not exceed the value given in the following table:

Table 2

Uranium enrichment in weight percent of uranium-235 not exceeding	Permissible maximum grams of uranium-235 per package

4	84
3.5	92
3	112
2.5	148
2	240
1.5	560
1.35	800

G. The transport index of each package based on criticality considerations is taken as ten times the number of grams of uranium-235 in the package divided by the maximum allowable number of grams per package in accordance with Table 1 or Table 2 above as applicable.

Subp. 4. **Comply with 10 CFR 71.22.** A general licensee who transports fissile material, limited quantity, controlled shipment shall comply with 10 CFR 71.22

4731.1512 Air Transport of Plutonium

Subpart. 1. **Limitations for plutonium transport.** Notwithstanding the provisions of any general licenses and notwithstanding any exemptions stated directly in this part or included indirectly by citation of 49CFR chapter I, as may be applicable, the licensee shall assure that plutonium in any form, whether for import, export, or domestic shipment, is not transported by air, or delivered to a carrier for air transport, unless:

A. The plutonium is contained in a medical device designed for individual human application; or

B. The plutonium is contained in a material in which the specific activity is not greater than 0.002 microcuries per gram (70 Bq/g) of material and in which the radioactivity is essentially uniformly distributed; or

C. The plutonium is shipped in a single package containing no more than an A_2 quantity of plutonium in any isotope or form, and is shipped in accordance with part 4731.1501; or

D. The plutonium is shipped in a package specifically authorized for shipment of plutonium by air in the Certificate of Compliance for that package issued by the Nuclear Regulatory Commission.

Subp. 2. **Comply with 10 CFR 73.24.** Nothing in part 4731.1504, A, is to be interpreted as removing or diminishing the requirements of 10CFR73.24.

Subp. 3. **Comply with 49 CFR 175.704.** For a shipment of plutonium by air which is subject to part 4731.1512, subp.1, D, the licensee shall, through special arrangement with the carrier, require compliance with 49 CFR 175.704, the U.S. DOT regulations applicable to the air transport of plutonium.

4731.1513 Exemptions For Low Level Radioactive Materials

Subpart 1. **Package with less than 0.002 microcurie per gram.** A licensee is exempt from the requirements of parts 4731.1500- 4731.1518 with respect to shipment or carriage of a package containing radioactive material having a specific activity not greater than 0.002 microcurie per gram (70 Bq/gm).

Subp 2. **Only exempt fissile material**. A licensee is exempt from all requirements of parts 4731.1500- 4731.1518, other than parts 4731.1501 and 4731.1512 with respect to shipments or carriage of the following packages, provided the packages contain no fissile material, or the U.S. NRC fissile material exemption standards 10CFR71.53 are satisfied:

A. A package containing no more than a Type A quantity of radioactive material; or

B. A package in which the only radioactive material is low specific activity (LSA) material or surface contaminated objects (SCO), provided the external radiation level at 3 m from the unshielded material or objects does not exceed 1 rem/h (10 mSv/h); or

C. A package which contains only americium or plutonium in special form with an aggregate radioactivity not to exceed 20 curies (740 Gbq), when it is transported between locations within the United States.

Subp. 3. **Low-specific activity or surface contaminated objects**. A license is exempt from all requirements of parts 4731.1500- 4731.1518, other than part 4731.1501, subp. 2, and1512, with respect to shipment or carriage of low-specific-activity (LSA) material in group LSA-I, or surface contaminated objects (SCOs) in group SCO-I as defined in part 4731.0100.

4731.1514 Advance Notification of Shipment of Radioactive Waste (1514)

Subpart 1. **Notice to governor**. As specified in part 4731.1514, subparts B, C, and D, each licensee shall provide advance notification to the governor of a state, or the governor's designee, of the shipment of licensed material, through, or across the boundary of the state, before the transport, or delivery to a carrier, form transport, of licensed material outside the confines of the license's plant or other place of use or storage.

Subp 2. **Irradiated fuel and special conditions**. Advance notification is required under part 4731.1514 for shipments of irradiated fuel in quantities less than that subject to advance notification requirements of 10CFR73.37(f). Advance notification is also required under this section for shipments of licensed material, other than irradiated fuel, meeting the following three conditions:

A. The licensed material is required by part 4731.1514 to be in Type B packaging for transportation;

B. The licensed material is being transported to or across a state boundary enroute to a disposal facility or to a collection point for transport to a disposal facility; and

C. The quantity of licensed material in a single package exceeds the least of the following:

(1) 3000 times the A_1 value of the radionuclides as specified in part 4731.3002, 1, for special form radioactive material;

(2) 3000 times the A_2 value of the radionuclides as specified in part

4731.3002, 1, for normal form radioactive material, or

(3) 27.000 curies (1000 TBq) .

Subp 3. **Procedures for submitting advance notification.** The notification must:

A. Be made in writing to the office of each affected state governor or governor's designee and to the commissioner.

B. Be delivered by mail and must be postmarked at least 7 days before the beginning of the 7-day period during which departure of the shipment is estimated to occur.

C. Be delivered by messenger must reach the office of the governor or of the governor's designee at least 4 days before the beginning of the 7-day period during which departure of the shipment is estimated to occur.

(1) a list of the names and mailing addresses of the governor's designees receiving advance notification of transportation of nuclear waste was published in the Federal Register on June 30,1995 (60 FR34306).

(2) the list will be published annually in the Federal Register on or about June 30 to reflect changes in information.

(3) the list of the names and mailing addresses of the governor's designees is available on request from the Director, Office of State Programs, U.S. NRC, Washington, DC 2055-0001.

D. The licensee shall retain a copy of the notification as a record for 4 years or until the next inspection.

Subp 4. **Information to be furnished in advance notification of shipment** . Each advance notification of shipment of irradiated reactor fuel or nuclear waste must contain the following information:

A. The name, address, and telephone number of the shipper, carrier and receiver of the irradiated reactor fuel or nuclear waste shipment;

B. A description of the irradiated reactor fuel or nuclear waste contained in the shipment as specified by the regulations of the U.S. DOT in 49 CFR 172.202 and 172.203(d);

C. The point of origin of the shipment and the 7-day period during which departure of the shipment is estimated to occur;

D. The 7-day period during which arrival of the shipment at state boundaries is estimated to occur;

E. The destination of the shipment, and the 7-day period during which arrival of the shipment is estimated to occur; and

F. A point of contact, with a telephone number, for current shipment information.

Subp 5. **Revision notice.** A licensee who finds that schedule information previously furnished to a governor or a governor's designee, in accordance with this section, will not be met, shall telephone a responsible individual in the office of the governor of the state or of the governor's designee and inform that individual of the extent of the delay beyond the schedule originally reported. The licensee shall maintain a record of the name of the individual contacted for 4

years or until next inspection.

Subp 6. **Cancellation notice**.

A. Each licensee who cancels an irradiated reactor fuel or nuclear waste shipment, for which advance notification has been sent, shall send a cancellation notice to the governor of each state, or to the governor's designee previously notified, and to the commissioner.

B. The licensee shall state in the notice that it is a cancellation and identify the advance notification that is being cancelled. The licensee shall retain a copy of the notice as a record for 4 years

CHARTS
10CFR ORDER

10 CFR 19 Chart

10 CFR	Minnesota Rule	CFR Title
19.1		Purpose
19.2		Scope
19.3	4731.0100	Definitions
19.4		Interpretations
19.5		Communications
19.8		Information collection requirements: OMB approval
19.11	4731.0122, subpart 3	Posting of notices to workers
19.12	4731.0151, subpart 1	Instruction to workers
19.13	4731.0130, subpart 2	Notifications and reports to individuals
19.14	4731.0106	Presence of representatives of licensees and workers during inspections
19.15	4731.0106, subpart 1 4731.0106, subpart 3	Consultation with workers during inspections
19.16	4731.0106, subpart 3	Requests by workers for inspections
19.17	4731.0106, subpart 3	Inspections not warranted; informal review
19.18		Sequestration of witnesses and exclusion of counsel in interviews conducted under subpoena
19.20	4731.0109, subpart 2	Employee protection
19.30	4731.0108	Violations
19.31	4731.0107	Application for exemptions
19.32	4731.0109, subpart 2	Discrimination prohibited
19.40	4731.0108	Criminal penalties

10 CFR 20 Chart

10 CFR	Minnesota Rule	CFR Title
20.1001	4731.0101	Purpose
20.1002	4731.0101	Scope
20.1003	4731.0100	Definitions
20.1004	4731.0100	Units of radiation exposure and dose
20.1005	4731.0100 4731.3001, subpart 5 and 6	Unites of radioactivity
20.1006		Interpretations
20.1007	4731.1001, subpart 3	Communications
20.1008	4731.0121	Implementation
20.1009	N/A	Information collection requirements: OMB approval
20.1101	4731.0131, subpart 1	Radiation protection programs
20.1201	4731.0124, subpart 1	Occupational dose limits for adults
20.1202	4731.0125, subpart 3	Compliance with requirements for summation of external and internal dose
20.1203	4731.0125, subpart 5	Determination of external dose from airborne radioactive material
20.1204	4731.0125, subpart 4	Determination of internal exposure
20.1206	4731.0124, subpart 4	Planned special exposure
20.1207	4731.0124, subpart 2	Occupational dose limits for minors
20.1208	4731.0124, subpart 3	Dose equivalent to an embryo fetus
20.1301	4731.0126, subpart 1	Dose limits for individual members of the public
20.1302	4731.0126, subpart 2	Compliance with dose limits for individual members of the public
20.1401	4731.0301, subpart 1	General provisions and scope
20.1402	4731.0301, subpart 2	Radiological criteria for unrestricted use
20.1403	4731.0301, subpart 3	Criteria for license termination under restricted conditions

20.1404	4731.0301, subpart 4	Alternate criteria for license termination
20.1405	4731.0301, subpart 5	Public notification and public participation
20.1406	4731.0301, subpart 5, item C	Minimization of contamination
20.1501	4731.0132, subpart 2 4731.0130, subpart 1, item E	General
20.1502	4731.0125, subpart 2	Conditions requiring individual monitoring of external and internal occupational dose
20.1601	4731.0131, subpart 2	Control of access to high radiation areas
20.1602	4731.0131, subpart 3	Control of access to very high radiation areas
20.1701	4731.0123, subpart 2, item A	Use of process or other engineering controls
20.1702	4731.0123, subpart 2, item B and item C	Use of other controls
20.1703	4731.0123, subpart 1	Use of individual respiratory protection equipment
20.1704	4731.0123, subpart 1, item E	Further restrictions on the use of respiratory equipment
20.1705	4731.0123, subpart 1, item F	Application for use of higher assigned protection factors
20.1801	4731.0135, subpart 1	Security of stored material
20.1802	4731.0135, subpart 2	Control of material not in storage
20.1901	4731.0122, subpart 1	Caution signs (sign not in yet)
20.1902	4731.0122, subpart 2	Posting requirements
20.1903	4731.0122, subpart 4	Exceptions to posting requirements
20.1904	4731.0123, subpart 3	Labeling containers
20.1905	4731.0123, subpart 4	Exemptions to labeling requirements
20.1906	4731.0123, subpart 5	Procedures for receiving and opening packages
20.2001	4731.0136, subpart 1	General requirements
20.2002	4731.0136, subpart 2	Method for obtaining approval of proposed disposal procedures
20.2003	4731.0136, subpart 3, item A and item B	Disposal by release into sanitary sewerage
20.2004	4731.0136, subpart 3, item C	Treatment or disposal by incineration
20.2005	4731.0136, subpart 4	Disposal of specific wastes

20.2006	4731.0136, subpart 5	Transfer for disposal and manifests
20.2007	4731.0112	Compliance with environmental and health protection regulations
20.2101	4731.0168, subpart 2	General provisions
20.2102	4731.0169, subpart 1	Records of radiation protection programs
20.2103	4731.0169, subpart 2	Records of surveys
20.2104	4731.0125, subpart 1	Determination of prior occupational dose
20.2105	4731.0172	Records of planned special exposures
20.2106	4731.0171	Records of individual monitoring results
20.2107	4731.0171, item D	Records of dose to individual members of the public
20.2108	4731.0183, subpart 1	Records of waste disposal
20.2110	4731.0168, subpart 2	Form of records
20.2201	4731.0161	Reports of theft or loss of licensed material
20.2202	4731.0162	Notification of incidents
20.2203	4731.0163	Reports of exposures, radiation levels and concentrations of radioactive material exceeding the constraints or limits
20.2204	4731.0164	Reports of planned special exposures
20.2205	4731.0130, subpart 2, item E	Reports of individuals of exceeding dose limits
20.2206	4731.0165	Reports of individual monitoring
20.2301	4731.0107	Application of exemptions
20.2302	4731.0300, subpart 5, item D	Additional requirements
20.2401	4731.0108	Violations
20.2402	4731.0108	Criminal penalties
Appendix A	4731.3001, item A	Assigned protection factors respirators
Appendix B	4731.3001, item B	Annual limits on intake ALIs and derived.....
Appendix C	4731.3001, item C	Quantities of licensed material requiring labeling
Appendix D	Not included	U.S. Nuclear Regulatory Commission regional offices

Appendix G	4731.3001, item G	Requirements for transfers of low-level radioactive waste intended for disposal at licensed land disposal facilities and manifests

10 CFR 30 Chart

10 CFR	Minnesota Rule	CFR Title
30.1	4731.0101	Scope
30.2		Resolution of conflict
30.3	4731.0300	Activities requiring license
30.4	4731.0100	Definition
30.5		Interpretations
30.6	4731.0101, subpart 3	Communications
30.7	4731.0109	Employee protection
30.8	N/A	Information collection requirements: OMB approval
30.9	4731.0101, subpart 3	Completeness and accuracy of information
30.10	4731.0109	Deliberate misconduct
30.11	4731.0300, subpart 7	Specific exemptions
30.12	4731.3001, item D and subpart 1, item A	Persons using byproduct material under certain Department of Energy and Nuclear Regulatory Commission contracts
30.13	4731.3001, item D and subpart 1, item B	Carriers
30.14	4731.3001, item D and subpart 2, item A	Exempt concentrations
30.15	4731.3001, item D and subpart 2, item C (1)	Certain items containing byproduct material
30.16	4731.3001, item D and subpart 2, item D (4)	Resins containing scandium-146 and designed for sand-consolidation in oil wells
30.18	4731.3001, item D and subpart 2, item B	Exempt quantities
30.19	4731.3001, item D and subpart 2, item C (2)	Self luminous products containing tritium, krypton 85 or proemthium-147
30.20	4731.3001, item D and subpart 2, item C (3)	Gas and aerosol detectors containing byproduct materials

30.21	4731.3001, item D and subpart 2, item D	Radioactive drug: capsules containing carbon-14 urea for "in vivo" diagnosis use in humans
30.31	4731.0102	Types of license
30.32	4731.0308	Application for specific licenses
30.32(i)	4731.0317	Emergency plan requirements
30.33	4731.0309	General requirements for issuance of specific licenses
30.34	4731.0300, subpart 5	Terms and conditions of licenses
30.35	4731.0309, subpart 2, 3 and 4	Financial assurance and recordkeeping for decommissioning
30.36	4731.0314	Expiration and termination of licenses and decommissioning of sites and separate buildings or outdoor areas
30.37	4731.0308, subpart 3	Application of renewal of licenses
30.38	4731.0308, subpart 4	Application of amendment of licenses
30.39	4731.0308, subpart 5	Commission action on application to renew or amend
30.41	4731.0315	Transfer of byproduct of material
30.50	4731.0162	Reporting requirements
30.51	4731.0168, subpart 2 and 4731.0180	Records
30.52	4731.0106	Inspections
30.53	4731.0106	Tests
30.61	4731.0300, subpart 4	Modification and revocation of licenses
30.62	4731.0300, subpart 6	Right to cause the withholding or recall of byproduct material
30.63	4731.0108	Violations
30.64	4731.0108	Criminal penalties
30.70	4731.3003, item A	Schedule A - exempt concentrations
30.71	4731.3003, item B	Schedule B
30.72	4731.3003, item D	Schedule D - quantities of radioactive materials requiring consideration of the need for an emergency plan for responding to a release

Appendix A	4731.3001, item J	Criteria relating to the use of financial tests and parent company.....
Appendix B	4731.3001, item C	Quantities of licensed material requiring labeling
Appendix C	4731.3001, item K	Criteria relating to the use of financial tests and self guarantees for providing reasonable assurance funds for decommissioning
Appendix D	4731.3001, item L	Criteria relating to the use of financial tests and self guarantees for providing reasonable assurance of funds for outstanding rated bonds
Appendix E	4731.3001, item M	Criteria relating to the use of financial tests and self guarantees for providing reasonable assurance funds for decommissioning by nonprofit colleges, universities and hospitals

10 CFR 31 Chart

10 CFR	Minnesota Rule	CFR Title
31.1	4731.0300, subpart 1 and subpart 2	Purpose and scope
31.2	4731.0300, subpart 1	Terms and conditions
31.3	4731.0304, subpart 1	Certain devices and equipment
31.4	N/A	Information collection requirements: OMB approval
31.5	4731.0304, subpart 2	Certain measuring, gauging or controlling devices
31.6	4731.0304, subpart 2, item E	General license to install devices generally licensed in 31.5
31.7	4731.0304, subpart 3	Luminous safety devices for use in aircraft
31.8	4731.0304, subpart 5	Americium-241 in the form of calibration or reference sources
31.9	4731.0304, subpart 4	General license to own byproduct material
31.10	4731.0304, subpart 7	General license for strontium-90 in ice detection
31.11	4731.0304, subpart 6	General license for use of byproduct material for certain in vitro clinical or laboratory testing
31.12	4731.0168	Maintenance of records
31.13	4731.0108	Violations
31.14	4731.0108	Criminal penalties

10 CFR 32 Chart

10 CFR	Minnesota Rule	CFR Title
32.1	4731.0300	Purpose and scope
32.2	4731.0100	Definitions
32.3	4731.0168	Maintenance of records
32.8	N/A	Information collection requirements: OMB approval
32.11	4731.0311, item A	Introduction of byproduct material in exempt concentrations into products or materials.....
32.12	4731.0311, subpart 1, item B	Same: records and material transfer reports
32.13	4731.0311, subpart 1, item C	Same: Prohibition of introduction
32.17	4731.0311, subpart 1, item D	Resins containing scandium-46 and designing for sand-consolidation in oil wells.....
32.24	4731.3002, subpart 4	Same: table of organ doses
32.51	4731.0311, subpart 4, item A, B and C	Byproduct material contained in devices for use under 31.5; requirements for license to manufacturer...
32.51a	4731.0311, subpart 4, item D	Same: conditions of licenses
32.52	4731.0311, subpart 4, item F	Same: material transfer reports and records
32.53	4731.0311, subpart 5, item A	Luminous safety devices for use in aircraft: requirements for license to manufacture, assemble....
32.54	4731.0311, subpart 5, item B	Same: labeling of devices
32.55	4731.0311, subpart 5, item C	Same: quality assurance; prohibition of transfer
32.56	4731.0311, subpart 5, item D	Same: material transfer reports
32.57	4731.0311, subpart 6, item A	Calibration of reference sources containing americium-241: requirements for license for license to.....
32.58	4731.0311, subpart 6, item B	Same: labeling of devices
32.59	4731.0311, subpart 6, item C	Same: leak testing of each source
32.61	4731.0311, subpart 8, item A	Ice detection devices containing strontium-90; requirements for license to manufacture or initially transfer
32.62	4731.0311, subpart 8, item B	Same: quality assurance; prohibition of transfer

32.71	4731.0311, subpart 7	Manufacture and distribution of byproduct material for certain in vitro clinical; or laboratory testing under general license
32.72	4731.0311, subpart 9	Manufacture, preparation, or transfer for commercial distribution of radioactive drugs containing byproduct material for medical use under part 35
32.74	4731.0311, subpart 10	Manufacture and distribution of sources or devices containing byproduct material for medical use
32.101	4731.0311, subpart 5, item A (4) (d)-ref	Use in aircraft
32.102	4731.0311, subpart 6, item A (4) (b)-ref	Schedule C prototype tests for calibrations or reference sources containing americium-241
32.103	4731.0311, subpart 8, item A (5)(d)-ref	Schedule D-prototype tests for ice detection devices containing strontium-90
32.110	4731.0311, subpart 5, item C (4)(b)-ref	Acceptance sampling procedures under certain licenses
32.210	4731.0308, subpart 2, item A (2) not dosing SSD evaluations	Registration of product information
32.301	4731.0108	Violations
32.303	4731.0108	Criminal penalties

10 CFR 33 Chart

10 CFR	Minnesota Rule	CFR Title
33.1	4731.0310, intro	Purpose and scope
33.8	N/A	Information collection
33.11	4731.0310, subpart 1	Types of specific license of broad scope
33.12	4731.0308, subpart 1	Applications for specific licenses of broad scope
33.13	4731.0310, subpart 2	Requirements for the issuance of Type A specific license of broad scope
33.14	4731.0310, subpart 3	Requirements for the issuance of a Type B specific license of broad scope
33.15	4731.0310, subpart 4	Requirements for the issuance of a Type C specific license of broad scope
33.16	4731.0308	Application for other specific licenses
33.17	4731.0310, subpart 5	Conditions of specific licenses of broad scope
33.21	4731.0108	Violations
33.23	4731.0108	Criminal penalties
Schedule A	4731.3003, item C	Limits for broad scope license

10 CFR 34 Chart

10 CFR	Minnesota Rule	CFR Title
34.1	4731.0500, subpart 1	Purpose and scope
34.3	4731.0100	Definitions
34.5		Interpretations
34.8		Information collection requirements: OMB approval
34.11		Application for a specific license
34.13	4731.0500, subpart 2	Specific license for industrial radiography
34.13 h	4731.0504, subpart 3	Specific license for industrial radiography
34.13 g	4731.0127	Specific license for industrial radiography
34.20	4731.0501	Performance requirements for industrial radiography equipment
34.21	4731.0510, subpart 1, item D	Limits on external radiation levels from storage containers and source changers
34.23	4731.0513, item D 4731.0513, item E 4731.0513, item F	Locking of radiographic exposure devices, storage containers and source changers
34.25	4731.0133, subpart 2	Radiation survey instruments
34.27	4731.0134	Leak testing and replacement of sealed sources
34.27 a	4731.0504, subpart 1, item F	Leak testing and replacement of sealed sources
34.27 b	4731.0509	Leak testing and replacement of sealed sources
34.29 a	4731.0511	Quarterly inventory
34.29 b	4731.0500, subpart 3	Quarterly inventory
34.31	4731.0507	Inspection and maintenance of radiographic exposure devices, transport and storage containers, associated equipment, source changers and survey instruments
34.33 a	4731.0503	Permanent radiographic installations
34.33 b	4731.0507, subpart 2, item B 4731.0507, subpart 2, item C 4731.0507, subpart 2, item D 4731.0507, subpart 2, item E	Permanent radiographic installations

34.35	4731.0512, item A 4731.0512, item B 4731.0513, item A 4731.0513, item B	Labeling, storage and transportation
34.41	4731.0506, subpart 2	Conducting industrial radiographic operations
34.41 c	4731.0514	Conducting industrial radiographic operations
34.42 a&b	4731.0128, subpart 1 4731.0128, subpart 2	Radiation safety officer for industrial radiography
34.42 c	4731.0129, subpart 1 4731.0129, subpart 2	Radiation safety officer for industrial radiography
34.43	4731.0150, subpart 1 4731.0151, subpart 2 4731.0152, subpart 2	Training
34.45	4731.0504 4731.0505	Operating and emergency procedures
34.46	4731.0506	Supervision of radiographers assistants
34.47 a	4731.0502 4731.0130, subpart 3	Personnel monitoring
34.49	4731.0510	Radiation surveys
34.51	4731.0513, item D	Surveillance
34.53	4731.0512, item C	Posting
34.61		Records of the specific license for industrial radiography
34.63	4731.0504, subpart 2, item C	Records of the receipt and transfer of sealed sources
34.65	4731.0169, subpart 3	Records of radiation survey instruments
34.67	4731.0134, subpart 1, item B	Records of leak testing of sealed sources and devices containing depleted uranium
34.69	4731.0186, subpart 3	Records of quarterly inventory
34.71	4731.0504, subpart 3, item A	Utilization logs
34.73	4731.0186, subpart 5	Records of inspection and maintenance of radiographic exposure devices, transport and storage containers, associated equipment, source changers and survey instruments

34.75	4731.0507, subpart 2	Records of alarm system and entrance control checks at permanent radiographic installations
34.79	4731.0186, subpart 6	Records of training and certification
34.81	4731.0505	Copies of operating and emergency procedures
34.83	4731.0169, subpart 7	Records of personnel monitoring procedures
34.85	4731.0510, subpart 1	Records of radiation surveys
34.87	4731.0168	Form of records
34.89	4731.0186, subpart 1	Location of documents and records
34.101	4731.0162, subpart 3	Notifications
34.111	4731.0107	Applications for exemptions
34.121	4731.0108	Violations
34.123	4731.0108	Criminal penalties
34 Appendix	4731.3001, item E	Radiographer certification

10 CFR 35 Chart

10 CFR	Minnesota Rule	CFR Title
35.1	4731.1200	Purpose and scope
35.2	4731.0100	Definitions
35.5	4731.0168	Maintenance of records
35.6	4731.1203, subpart 1	Provisions for the protection of human research subjects
35.7	4731.1200	FDA, other Federal and State requirements
35.8	Not included	Information collection requirements : OMB
35.10	4731.0121, subpart 1 and 5	Implementation
35.11	4731.0121, subpart 1	License required
35.12	4731.1201, subpart 2	Application for license, amendment, or renewal
35.13	4731.1201, subpart 3	License amendments
35.14	4731.1201, subpart 4	Notifications
35.15	4731.1201, subpart 5	Exemptions regarding Type a specific licenses of broad scope
35.18	4731.1201, subpart 6	License issuance
35.19	4731.0300, subpart 7	Specific exemptions
35.24	4731.1202, subpart 1	Authority and responsibilities for the radiation protection program
35.26	4731.1202, subpart 2	Radiation protection program changes
35.27	4731.1202, subpart 4	Supervision
35.40	4731.1202, subpart 6	Written directives
35.41	4731.1202, subpart 7	Procedures for administrations requiring a written directive
35.49	4731.1211, subpart 2	Suppliers for sealed sources or devices for medical use
35.50	4731.0128, subpart 7	Training for Radiation Safety Officer
35.51	4731.0152, subpart 7, item A	Training for an authorized medical physicist
35.55	4731.0152, subpart 7, item B	Training for an authorized nuclear phyisicist

35.57	4731.0152, subpart 8	Training for experienced Radiation Safety Officer, teletherapy or medical physicist, authorized user, and nuclear pharmacist
35.59	4731.0152, subpart 1, item D	Recentness of training
35.60	4731.1208, subpart 1	Possession, use and calibration of instruments used to measure the activity of unsealed byproduct material
35.61	4731.1208, subpart 2	Calibration of survey instruments
35.63	4731.1208, subpart 4	Determination of dosages of unsealed byproduct material for medical use
35.65	4731.1208, subpart 5	Authorization for calibration, transmission and reference sources
35.67	4731.1208, subpart 6	Requirements for possession of sealed sources and brachytherapy sources
35.69	4731.1206, subpart 1	Labeling of vials and syringes
35.70	4731.1206, subpart 2	Surveys of ambient radiation exposure rate
35.75	4731.1204, subpart 2	Release of individuals containing unsealed byproduct material or implants containing byproduct material
35.80	4731.1206, subpart 3	Provision of mobile medical service
35.92	4731.1206, subpart 4	Decay-in-storage
35.100	4731.1212, subpart 1	Use of unsealed byproduct material for uptake, dilution and excretion studies for which a written directive is not required
35.190	4731.1207, subpart 1	Training for uptake, dilution and excretion studies
35.200	4731.1212, subpart 2	Use of unsealed byproduct material for imaging and localization studies for which a written directive is not required
35.204	4731.1212, subpart 3	Permissible molybdenum-99 concentration
35.290	4731.1207, subpart 2	Training for imaging and localization studies
35.300	4731.1212, subpart 4	Use of unsealed byproduct material for which a written directive is required
35.310	4731.1203, subpart 2	Safety instructions
35.315	4731.1203, subpart 3	Safety precautions

35.390	4731.1207	Training for use if unsealed byproduct material for which a written directive is required
35.392	4731.1207, subpart 12	Training for the oral administration of sodium iodide I-131 requiring a written directive in quantities less than or equal to 1.22 gigabecquerels (33 millicuries)
35.394	4731.1207, subpart 13	Training for the oral administration of sodium iodide I-131 requiring a written directive in quantities greater than 1.22 gigabecquerels (33 millicuries)
35.400	4731.1213, subpart 1	Use of sources for manual brachtherapy
35.404	4731.1213, subpart 2	Surveys after source implant and removal
35.406	4731.1213, subpart 3	Brachtherapy sources accountability
35.410	4731.1203, subpart 4	Safety instructions
35.415	4731.1203, subpart 5	Safety precautions
35.432	4731.1209, subpart 4	Calibrations measurements of brachtherapy sources
35.433	4731.1211, subpart 4	Decay of strontium-90 sources for ophthalmic treatments
35.457	4731.1205, subpart 3	Therapy-related computer systems
35.490	4731.1207, subpart 4	Training for use of manual brachtherapy sources
35.491	4731.1207, subpart 11	Training for ophthalmic use of strontium-90
35.500	4731.1211, subpart 1	Use of sealed sources of diagnosis
35.590	4731.1207, subpart 5	Training for use of sealed sources of diagnosis
35.600	4731.1211, subpart 3	Use of sealed source in a remote afterloader unit, teletherapy unit or gamma stereotatic radiosurgery unit
35.604	4731.1204, subpart 1	Surveys of patients and human research subjects treated with a remote afterloader unit
35.605	4731.1206, subpart 5, subpart 3, item A and B	Installation, maintenance, adjustment and repair
35.610	4731.1206, subpart 6	Safety procedures and instructions for remote afterloader units, teletherapy units and gamma stereotactic radiosurgery unit
35.615	4731.1203, subpart 7	Safety precautions for remote afterloader units, teletherapy units and gamma stereotactic radiosurgery unit

35.630	4731.1208, subpart 7	Dosimetry equipment
35.632	4731.1209, subpart 1	Full calibration measurements on teletherapy units
35.633	4731.1209, subpart 2	Full calibration measurements on remote afterloader units
35.635	4731.1209, subpart 3	Full calibration measurements on gamma stereotactic radiosurgery units
35.642	4731.1210, subpart 1	Periodic spot-checks for teletherapy units
35.643	4731.1210, subpart 2	Periodic spot-checks for remote afterloader units
35.645	4731.1210, subpart 4	Periodic spot-checks for gamma stereotactic radiosurgery units
35.647	4731.1210, subpart 5	Additional technical requirements for mobile remote afterloader units
35.652	4731.1205, subpart 1	Radiation surveys
35.655	4731.1205, subpart 2	Five-year inspection for teletherapy and gamma stereotactic radiosurgery units
35.657	4731.1205, subpart 3	Therapy-related computer systems
35.690	4731.1207, subpart 14	Training for use of remote afterloader units, teletherapy units and gamma stereotactic radiosurgery units
35.900	not included	Radiation Safety Officer
35.910	not included	Training for uptake, dilution, and excretion studies
35.920	not included	Training for imaging and localization studies
35.930	not included	Training for therapuetic use of unsealed byproduct material
35.932	not included	Training for treatment of hyperthyroidsim
35.934	not included	Training for treatment of thyroid carcinoma
35.940	not included	Training for use of brachytherapy
35.941	not included	Training for ophthalmic use of strontium-90
35.950	not included	Training for use of sealed sources for diagnosis
35.960	not included	Training for use of therapeutic medical devices
35.961	not included	Training for authorized medical physicist

35.980	not included	Training for an authorized nuclear physicist
35.981	not included	Training for experienced nuclear pharmacists
35.1000	4731.1201, subpart 7	Other medical uses of byproduct material or radiation from byproduct material
35.2024	4731.1214, subpart 1, item C	Records of authority and responsibilities for radiation protection programs
35.2026	4731.1214, subpart 1, item D	Records of radiation protection program changes
35.2040	4731.1214, subpart 1, item E	Records of written directives
35.2041	4731.1214, subpart 1, item H	Records for procedures for administrations requiring a written directive
35.2060	4731.1214, subpart 4, item A	Records of calibrations of instruments used to measure the activity of unsealed byproduct material
35.2061	4731.1214, subpart 4, item B	Records of radiation survey instrument calibrations
35.2063	4731.1214, subpart 3, item A	Records of dosage of unsealed byproduct material for medical use
35.2067	4731.1214, subpart 3, item B	Records of leak tests and inventory of sealed sources and brachytherapy sources
35.2070	4731.0169, subpart 4	Records of surveys for ambient radiation exposure rate
35.2075	4731.1214, subpart 2, item B	Records of the release of individuals containing unsealed byproduct material or implants containing byproduct material
35.2080	4731.1214, subpart 1, item A	Records of mobile medical services
35.2092	4731.1214, subpart 3, item E 4731.1214, subpart 4, item B	Records of decay-in-storage
35.2204	4731.1214, subpart 3, item D	Records of molybdenum-99 concentrations
35.2310	4731.1214, subpart 1, item B	Records of safety inspections
35.2404	4731.1214, subpart 2, item C	Records of surveys after source implant and removal
35.2406	4731.1214, subpart 3, item C	Records of brachytherapy source accountability
35.2432	4731.1214, subpart 4, item D	Records of calibration measurements of brachytherapy sources
35.2433	4731.1214, subpart 4, item H	Records of decay of strontium-90 sources for ophthalmic treatments

35.2605	4731.1214, subpart 4, item G	Records of installation, maintenance, adjustment, and repair of remote afterloader units, teletherapy units and gamma stereotactic radiosurgery units
35.2610	4731.1214, subpart 6, item D	Records of safety protection
35.2630	4731.1214, subpart 4, item C	Records of dosimetry equipment used with remote afterloader units, teletherapy units and gamma stereotactic radiosurgery units
35.2632	4731.1214, subpart 4, item E	Records of teletherapy, remote afterloader and gamma stereotactic radiosurgery full calibrations
35.2642	4731.1214, subpart 5, item A	Records of periodic spot-checks for teletherapy units
35.2643	4731.1214, subpart 5, item B	Records of periodic spot-checks for remote afterloader units
35.2645	4731.1214, subpart 5, item C	Records of periodic spot-checks for gamma stereotactic radiosurgery units
35.2647	4731.1214, subpart 6, item A	Records of additional technical requirements for mobile remote afterloader units
35.2652	4731.1214, subpart 6, item B	Records of surveys of therapeutic treatment units
35.2655	4731.1214, subpart 6, item C	Records of 5-year inspection for teletherapy and gamma stereotactic radiosurgery units
35.3045	4731.0162, subpart 4	Report and notification of medical event
35.3047	4731.0162, subpart 5	Report and notification of a dose to an embryo/fetus or a nursing child
35.3067	4731.0162, subpart 1, item A (3), subpart 2, item B	Report of a leaking source
35.4001	4731.0108	Violations
35.4002	4731.0108	Criminal penalties
Appendix A	4731.3001, item F	Examining organization or entity

10CFR	Minnesota Rule	CFR Title
36.1 a	4731.0700, subpart 1.	Purpose and scope
36.1 b	4731.0700, subpart 1, item A	Purpose and scope
36.1 c	4731.0700, subpart 1, item B	Purpose and scope
36.2	4731.0100	Definitions
36.5		Interpretations
36.8		Information collection requirements; OMB approval
36.11		Application for a specific license
36.13	4731.0700, subpart 2.	Specific licenses for irradiators
36.15	4731.0702, subpart 1	Start of construction
36.17	4731.0700, subpart 3.	Applications for exemptions
36.19		Request for written statements
36.21	4731.0701	Performance criteria for sealed sources
36.23 a-h	4731.0707, subpart 2	Access control
36.23 i	4731.0706, subpart 3	Access control
36.25	4731.0703	Shielding
36.27	4731.0702, subpart 2, item A, subitem 3; and 4731.0702, subpart 3, item B, subitem 3	Fire protection
36.29	4731.0705	Radiation monitors
36.31	4731.0707, subpart 1	Control of source movement
36.33	4731.0706	Irradiator pools
36.35	4731.0702, subpart 2, item A, subitem 5	Source rack protection
36.37	4731.0708, subpart 4, item A	Power failures
36.39	4731.0702, subpart 2	Design requirements
36.41	4731.0702, subpart 3	Construction monitoring and acceptance testing.
36.51	4731.0151, subpart 3 4731.0152, subpart 3	Training

36.53	4731.0708, subpart 1 4731.0708, subpart 3 4731.0708, subpart 5	Operating and emergency procedures
36.55	4731.0704	Personnel monitoring
36.57	4731.0710	Radiation surveys
36.59 a	4731.0134	Detection of leaking sources
36.59 b&c	4731.0708, subpart 4, item B	Detection of leaking sources
36.61	4731.0709	Inspection and maintenance
36.63	4731.0706, subpart 2	Pool water purity
36.65	4731.0708, subpart 2	Attendance during operation
36.67 a&b	4731.0707, subpart 2, item B, subitems 2&3	Entering and leaving the radiation room
36.67 c	4731.0708, subpart 4, item A, subitem 3	Entering and leaving the radiation room
36.69	4731.0711	Irradiation of explosive or flammable materials
36.81		Records and retention periods
36.83	4731.0708, subpart 3	Reports
36.91	4731.0108	Violations
36.93	4731.0108	Criminal penalties

10CFR	Minnesota Rule	CFR Title
39.1	4731.0800, subpart 1	Purpose and scope
39.2	4731.0100	Definitions
39.5		Interpretations
39.8		Information collection requirements; OMB approval
39.11		Application for a specific license
39.13	4731.0800, subpart 2	Specific license for well logging
39.15	4731.0810	Agreement with well owner or operator
39.17		Request for written statements
39.31	4731.0809	Labels, security, and transportation precautions
39.33 a&b	4730.0807, subpart 2	Radiation detection instruments
39.33 c	4731.0133	Radiation detection instruments
39.33 d	4731.0169	Radiation detection instruments
39.35	4731.0134, subpart 1	Leak testing of sealed sources
39.37	4731.0808	Physical inventory
39.39	4731.0808	Records of material use
39.41	4731.0801	Design and performance criteria for sealed sources
39.43	4731.0805 and 4731.0806	Inspection, maintenance and opening of a source or source holder
39.45	4731.0813	Subsurface tracer studies
39.47	4731.0812, subpart 1	Radioactive markers
39.49	4731.0812, subpart 2	Uranium sinker bars
39.51	4731.0811	Use of a sealed source in a well without surface casing
39.53	4731.0812, subpart 3	Energy compensation source
39.55	4731.0812, subpart 4	Tritium neutron generator target source
39.61	4731.0151, subpart 4 4731.0152, subpart 4	Training
39.63	4731.0803	Operating and emergency procedures
39.65	4731.0802, item A and B	Personnel monitoring
39.67	4731.0807	Radiation surveys
39.69	4731.0804	Radioactive contamination control
39.71	4731.0809, items D and E	Security
39.73	4731.0188, subpart 1	Documents and records required at field stations
39.75	4731.0188, subpart 2	Documents and records required at temporary jobsites
39.77 a	4731.0161	Notification of incidents and lost sources; abandonment procedures for irretrievable sources

39.77 b		Notification of incidents and lost sources; abandonment procedures for irretrievable sources
39.77 c	4731.0810, subpart 2	Notification of incidents and lost sources; abandonment procedures for irretrievable sources
39.77 d	4731.0810, subpart 1	Notification of incidents and lost sources; abandonment procedures for irretrievable sources
39.91	4731.0107	Applications for exemptions
39.101	4731.0108	Violations
39.103	4731.0108	Criminal penalties

10 CFR 40 Chart

10 CFR	Minnesota Rule	CFR Title
40.1	4731.0101	Purpose
40.2	4731.0101	Scope
40.2a	Do not regulate	Coverage of inactive tailing sites
40.3	4731.0300, subpart 1	License requirements
40.4	4731.0100	Definitions
40.5	4731.0101, subpart 3	Communications
40.6	4731.0300, subpart 5	Interpretations
40.7	4731.0109	Employee protection
40.8	N/A	Information collection requirements: OMB approval
40.9	4731.0101, subpart 3	Completeness and accuracy of information
40.10	4731.0109	Deliberate misconduct
40.11	4731.3001, item D, subpart 1, item A	Persons using source material under certain Department of Energy and Nuclear Regulatory Commission contracts
40.12	4731.3001, item D, subpart 1, item B	Carriers
40.13	4731.3001, item D	Unimportant quantities of source material s1.1, C
40.14	4731.0300, subpart 7	Specific exemptions
40.20	4731.0102	Type of licenses
40.21	4731.0303, subpart 1, item D	General license to receive title to source or byproduct material
40.22	4731.0303, subpart 1, item A, B and C	Small quantities of source material
40.25	4731.0303, subpart 2	General license for use of certain industrial products or devices
40.26	Do not regulate uranium mills	General license for possession and storage of byproduct material as defined in this part
40.31	4731.0308	Application for specific licenses

40.32	4731.0309	General requirements for issuance of specific licenses
40.34	4731.0311, subpart 12, item A and B	Special requirements for issuance of specific licenses
40.35	4731.0311, subpart 12, item C	Conditions of specific licenses issued to pursuant oto 40.34
40.36	4731.0309, subpart 2, 3 and 4	Financial assurance and recordkeeping for decommissioning
40.41	4731.0300, subpart 5	Terms and conditions of licenses
40.42	4731.0314	Expiration and termination of licenses and decommissioning of sites and separate buildings or outdoor areas.
40.43	4731.0308, subpart 3	Renewal of licenses
40.44	4731.0308, subpart 4	Amendment of licenses at request of licensee
40.45	4731.0308, subpart 5	Commission action on applications to renew or amend
40.46	4731.0300, subpart 5, item G	Inalienability of licenses
40.51	4731.0315	Transfer of source or byproduct material
40.60	4731.0161, 4731.0162	Reporting requirements
40.61	4731.0183, 4731.0184	Records
40.62	4731.0106, subpart 1	Inspections
40.63	4731.0106, subpart 2	Tests
40.65	Do not regulate uranium mills	Effluent monitoring reporting requirements
40.71	4731.0300, subpart 4	Modification and revocation of licenses
40.81	4731.0108	Violations
40.82	4731.0108	Criminal penalties
Appendix A	Do not regulate uranium mills	Operation of uranium mills

10 CFR 61 Chart

10 CFR	Minnesota Rule	CFR Title
61.1	Do not regulate RAM waste site	Purpose and scope
61.2	4731.0100 - selected definitions	Definitions
61.55	4731.0136, subpart 6	Waste classifications
61.56	4731.0136, subpart 7	Waste characteristics
61.57	4731.0136, subpart 8	Labeling
61.80 61.80 (c) & (d)	4731.0183, subpart 1-10 4731.0168, subpart 1 and subpart 2	Maintenance of records, reports and transfers

10 CFR 70 Chart

10 CFR	Minnesota Rule	CFR Title
70.1	4731.0101	Purpose
70.3	4731.0300, subpart 2	License conditions
70.4	4731.0100-selected	Definitions
70.11	4731.3001, item D, subpart 1, item A	Persons using special nuclear material under certain Department of Energy and Nuclear Regulatory Commission contracts
70.12	4731.3001, item D, subpart 1, item B	Carriers
70.14	4731.0300, subpart 7	Specific exemptions
70.18	4731.0102	Types of licenses
70.19	4731.0304, subpart 5	General license for calibration or reference sources
70.20	4731.0304, subpart 4	General license to own special nuclear material
70.21	4731.0308, subpart 1	Filing
70.22	4731.0308, subpart 1	Contents of application
70.23	4731.0309, subpart 1	Requirements for approval
70.25	4731.0309, subpart 3 and 4	Financial assurance and recordkeeping for decommissioning
70.31	4731.0312, subpart 1 and 2	Issuance of license
70.32	4731.0313, item A-C 4731.0300, subpart 5, item G	Conditions of licenses
70.33	4731.0308, subpart 3	Renewal of license
70.34	4731.0308, subpart 4	Amendment of license
70.35	4731.0308, subpart 5	Commissioner action on applications to renew or amend
70.36	4731.0300, subpart 5, item G	Inalienability of licenses
70.38	4731.0314	Expiration and termination of licenses and decommissioning of sites and sites and separate buildings or outdoor areas

70.39	4731.0311, subpart 6	Special licenses for the manufacture or initial transfer of calibration or reference sources
70.41	4731.0313, subpart 4	Authorized use of special nuclear material
70.42	4731.0315	Transfer of special nuclear material
70.50	4731.0161 4731.0162	Reporting requirements
70.51	4731.0181	Material balance, inventory and records requirements
70.55	4731.0106, subpart 1	Inspections
70.56	4731.0106, subpart 2	Tests
70.61	4731.0300, subpart 4	Modification and revocation of licenses
70.71	4731.0108	Violations
70.72	4731.0108	Criminal penalties

10 CFR 71 Chart

10 CFR	Minnesota Rule	CFR Title
71.0	4731.0101 4731.1500	Purpose and scope
71.1	4731.0101, subpart 3 4731.0185	Communications and records
71.2		Interpretations
71.3	4731.1501, subpart 1	Requirement for license
71.4	4731.0100	Definitions
71.5	4731.1501, subpart 2	Transportation of licensed material
71.6	N/A	Information collection requirements: OMB approval
71.7	4731.0101, subpart 3	Completeness and accuracy of information
71.8	4731.0300, subpart 7	Specific exemptions
71.9	4731.3001, item D, subpart 2, item E (2)	Exemption of physicians
71.10	4731.1513	Exemption for low-level materials
71.11	4731.0109	Deliberate misconduct
71.12	4731.1505	General license: NRC-approved package
71.13	4731.1506	Previously approved package
71.14	4731.1507	General license: DOT specification container
71.16	4731.1508	General license: Use of foreign approved package
71.18	4731.1510	General license: Fissile material, limited quantity per package
71.20	4731.1511	General license: Fissile material, limited moderator per package
71.22	4731.1511, subpart 3	General license: Fissile material, limited quantity, controlled shipment
71.81	4731.1509	Applicability of operating controls and procedures
71.85	4731.1503	Preliminary determinations
71.87	4731.1504	Routine determinations

71.88	4731.1512	Air transport of plutonium
71.89	4731.1501, subpart 3	Opening instructions
71.91	4731.0185	Records
71.93	4731.0106	Inspections and tests
71.95	4731.0162, subpart 1, item C	Reports
71.97	4731.1514	Advance notification of shipment or irradiated reactor fuel and nuclear waste
71.99	4731.0108	Violations
71.100	4731.0108	Criminal penalties
71.101	4731.1502	Quality assurance requirements
71.103	4731.1502	Quality assurance organization
71.105	4731.1502	Quality assurance program
71.107-.137	did not include	
Appendix A	4731.3001, item I	Determination A_1 and A_2 values

10 CFR 150 Chart

10 CFR	Minnesota Rule	CFR Title
150.3	4731.0100 - selected definitions	Definitions
150.11	4731.0302	Critical mass
150.20	4731.03016	Recognition of agreement state licenses

CHARTS
RULE CHAPTER 4731
ORDER

10CFR	Compatibility	Rule 4731	Current Rule 4730	Definition
10CFR 71.4	B	4731.0100, subpart 1		A_1
10CFR 71.4	B	4731.0100, subpart 2		A_2
10CFR 20.1003	A	4731.0100, subpart 3	4730.0100, subpart 2	Absorbed dose
		4731.0100, subpart 4	4730.0100, subpart 4	Accelerator
		4731.0100, subpart 5	4730.0100, subpart 5	Accelerator-produced material
		4731.0100, subpart 6		Accident
10FR 20.1003	A	4731.0100, subpart 7		Activity
		4731.0100, subpart 8	4730.0100, subpart 6	Added filtration
10CFR 20.1003	A	4731.0100, subpart 9	4730.0100, subpart 6a	Adult
10CFR 150.3	B	4731.0100, subpart 10		Agreement State
10CFR 20.1003	B	4731.0100, subpart 11		Air-purifying respirator
10CFR 20.1003	A	4731.0100, subpart 12		Airborne radioactive material
10CFR 20.1003	A	4731.0100, subpart 13		Airborne radioactivity area
10CFR 20.1003	A	4731.0100, subpart 14		ALARA (as low as reasonably achievable)
10CFR 30.4	A	4731.0100, subpart 15		Alert
		4731.0100, subpart 16	4730.0100, subpart 7	Aluminum equivalent
		4731.0100, subpart 17	4730.0100, subpart 7a	Analytical radiation producing equipment
10CFR 36.2	D	4731.0100, subpart 18		Annually
10CFR 20.1003	A	4731.0100, subpart 19	4730.0100, subpart 7b	Annual Limit on Intake
10CFR 34.3	C	4731.0100, subpart 20		Annual refresher safety training
10CFR 35.2	D	4731.0100, subpart 21	4730.0100, subpart 8	Applicator
		4731.0100, subpart 22	4730.0100, subpart 9	Appropriate limit
10CFR 35.2	D	4731.0100, subpart 23		Area of use
		4731.0100, subpart 24	4730.0100, subpart 12	Assembler
10CFR 20.1003	B	4731.0100, subpart 25		Assigned protection factor

10CFR 34.3	B	4731.0100, subpart 26		Associated equipment
10CFR 20.1003	B	4731.0100, subpart 27		Atmosphere-supplying respirator
		4731.0100, subpart 28	4730.0100, subpart 13	Attenuation
		4731.0100, subpart 29	4730.0100, subpart 15	Automatic exposure control
10CFR 35.2	C	4731.0100, subpart 30		Authorized medical physicist
10CFR 35.2	D	4731.0100, subpart 31		Authorized nuclear pharmacist
10CFR 35.2	C	4731.0100, subpart 32		Authorized user
10CFR 20.1003	A	4731.0100, subpart 33		Background radiation
		4731.0100, subpart 34	4730.0100, subpart 16	Beam axis
		4731.0100, subpart 35	4730.0100, subpart 18	Beam-limiting device
		4731.0100, subpart 36	4730.0100, subpart 19	Beam monitoring system
		4731.0100, subpart 37	4730.0100, subpart 20	Beam scattering filter
10CFR 20.1005	A	4731.0100, subpart 38	4730.0100, subpart 22	Becquerel
10CFR 20.1003	A	4731.0100, subpart 39		Bioassay (radiobioassay)
		4731.0100, subpart 40	4730.0100, subpart 22a	Boring
		4731.0100, subpart 41		Brachtherapy
10CFR 35.2	D	4731.0100, subpart 42		Brachtherapy source
		4731.0100. subpart 43		Broadscope license
		4731.0100. subpart 44	4730.0100, subpart 23	Bucky
10CFR 150.3	A	4731.0100. subpart 45	4730.0100, subpart 24	Byproduct material
		4731.0100. subpart 46	4730.0100, subpart 25	C-arm
		4731.0100. subpart 47		Cabinet x-ray system
		4731.0100. subpart 48	4730.0100, subpart 26	Calibration
10CFR 71.4	B	4731.0100. subpart 49		Carrier
		4731.0100. subpart 50	4730.0100, subpart 28	Cephalometric device
		4731.0100. subpart 51	4730.0100, subpart 30	Certified components
		4731.0100. subpart 52	4730.0100, subpart 32	Certified system

10CFR 34.3	B	4731.0100. subpart 53		Certifying entity
		4731.0100. subpart 54	4730.0100, subpart 33	Changeable filter
		4731.0100. subpart 55		Chelating agent
10CFR 20.1003	A	4731.0100. subpart 56		Class
10CFR 35	D	4731.0100, subpart 57		Client address
		4731.0100. subpart 58	4730.0100, subpart 34	Clinical Range
		4731.0100. subpart 59	4730.0100, subpart 35	Coefficient of variation or C
		4731.0100. subpart 60	4730.0100, subpart 36	Cold flow
		4731.0100. subpart 61	4730.0100, subpart 37	Collimation
10CFR 34.3	B	4731.0100. subpart 62	4730.0100, subpart 38	Collimator
10CFR 20.1003	A	4731.0100. subpart 63		Collective Dose
		4731.0100. subpart 64	4730.0100, subpart 39	Commissioner
10CFR 20.1003	A	4731.0100. subpart 65	4730.0100, subpart 39a	Committed dose equivalent ($H_{t,50}$)
10CFR 20.1003	A	4731.0100. subpart 66	4730.0100, subpart 39b	Committed effective dose equivalent ($H_{e,50}$)
10CFR 30.4	D	4731.0100. subpart 67		Commencement of construction
		4731.0100. subpart 68	4730.0100, subpart 40	Computed tomography
10CFR 20.1003	C	4731.0100. subpart 69		Constraint (dose constraint)
10CFR 34.3	B	4731.0100. subpart 70		Control (drive) cable
10CFR 34.3	B	4731.0100. subpart 71		Control drive mechanism
10CFR 34.3	B	4731.0100. subpart 72	4730.0100, subpart 43	Control panel
10CFR 34.3	B	4731.0100. subpart 73		Control tube
10CFR 20.1003	D	4731.0100. subpart 74	4730.0100, subpart 44	Controlled area
10CFR 20.1004	A	4731.0100. subpart 75	4730.0100, subpart 45	Coulomb per kilogram
10CFR 20.1003	B	4731.0100. subpart 76		Critical group
		4731.0100. subpart 77	4730.0100, subpart 46	CT conditions of operation
		4731.0100. subpart 78	4730.0100, subpart 47	CT dose index (CTDI)

		4731.0100. subpart 79	4730.0100, subpart 48	CT gantry
		4731.0100. subpart 80	4730.0100, subpart 49	CT number
10CFR 20.1005	A	4731.0100. subpart 81	4730.0100, subpart 50	Curie
		4731.0100, subpart 82		Cyclotron
		4731.0100. subpart 83	4730.0100, subpart 51	Dead-man switch
10CFR 20.1003	A	4731.0100. subpart 84		Declared pregnant woman
10CFR 30.4	C	4731.0100. subpart 85		Decommission
10CFR 35.2	D	4731.0100. subpart 86		Dedicated check source
10CFR 20.1003	A	4731.0100. subpart 87		Deep-dose equivalent (H_d)
10CFR 20.1003	B	4731.0100. subpart 88		Demand respirator
		4731.0100. subpart 89	4730.0100, subpart 52	Densitometer
10CFR 40.4	A	4731.0100. subpart 90		Depleted uranium
10CFR 20.1003	A	4731.0100. subpart 91	4730.0100, subpart 52a	Derived air concentration (DAC)
FR 20.1003	A	4731.0100. subpart 92		Derived air concentration-hour (DAC-hour)
10CFR 35.2	D	4731.0100. subpart 93		Diagnostic clinical procedures manual
		4731.0100. subpart 94	4730.0100, subpart 55	Diagnostic radiographic imaging system
		4731.0100. subpart 95	4730.0100, subpart 56	Diagnostic radiographic system
		4731.0100. subpart 96	4730.0100, subpart 53	Diagnostic source assembly
		4731.0100, subpart 97	4730.0100, subpart 54	Diagnostic-type protective tube housing
10CFR 61.2	C	4731.0100. subpart 98		Disposal
10CFR 20.1003	B	4731.0100. subpart 99		Disposable respirator
10CFR 20.1003	B	4731.0100. subpart 100		Distinguishable from background
		4731.0100. subpart 101		Distribution

		4731.0100. subpart 102		Distributor
10CFR 20.1003	A	4731.0100. subpart 103	4730.0100, subpart 59	Dose equivalent (H_T)
		4731.0100, subpart 104		Dose limits
		4731.0100. subpart 105	4730.0100, subpart 60	Dose monitoring system
		4731.0100. subpart 106	4730.0100, subpart 61	Dose monitor unit
		4731.0100. subpart 107	4730.0100, subpart 62	Dose profile
10CFR 36.2	D	4731.0100. subpart 108		Doubly encapsulated sealed source
10CFR 20.1003	A	4731.0100. subpart 109	4730.0100, subpart 63	Effective dose equivalent (H_e)
10CFR 40.4	D	4731.0100. subpart 110		Effective kilogram
		4731.0100, subpart 111		Electron Volt (eV)
		4731.0100. subpart 112	4730.0100, subpart 65	Elemental area
10CFR 20.1003	A	4731.0100. subpart 113		Embryo/fetus
		4731.0100. subpart 114		Emergency
10CFR 39.2	B	4731.0100. subpart 115		Energy compensation source (ECS)
10CFR 20.1003	C	4731.0100. subpart 116		Entrance or access point
		4731.0100. subpart 117	4730.0100, subpart 66	Entrance exposure rate
		4731.0100, subpart 118		Equipment performance tests
		4731.0100. subpart 119	4730.0100, subpart 67	Entrance skin exposure (ESE)
10CFR 71.4	B	4731.0100. subpart 120		Exclusive use
10CFR 20.1003	D	4731.0100. subpart 121	4730.0100, subpart 68	Exposure
10CFR 34.3	B	4731.0100. subpart 122		Exposure head
		4731.0100. subpart 123	4730.0100, subpart 69	Exposure rate
10CFR 20.1003	D	4731.0100. subpart 124		External dose
10CFR 20.1003	A	4731.0100. subpart 125		Extremity
		4731.0100. subpart 126		Eye Dose Equivalent
		4731.0100. subpart 127	4730.0100, subpart 70	Facility

		4731.0100. subpart 128	4730.0100, subpart 71	Field emission equipment
		4731.0100. subpart 129	4730.0100, subpart 72	Field flattening filter
10CFR 34.3 10CFR 39.2	C B	4731.0100. subpart 130		Field station
		4731.0100. subpart 131	4730.0100, subpart 73	Filter or filtration
10CFR 20.1003	B	4731.0100. subpart 132		Filtering facepiece (dusk mask)
		4731.0100. subpart 133	4730.0100, subpart 73a	Fishpole radiography
10CFR 71.4	B	4731.0100. subpart 134		Fissile material
10CFR 20.1003	B	4731.0100. subpart 135		Fit factor
10CFR 20.1003	B	4731.0100. subpart 136		Fit test
		4731.0100. subpart 137	4730.0100, subpart 74	Fluoroscopic imaging assembly
		4731.0100. subpart 138	4730.0100, subpart 75	Focal spot
10CFR 39.2	D	4731.0100. subpart 139		Fresh water aquifer
		4731.0100. subpart 140	4730.0100, subpart 76	Gantry
		4731.0100. subpart 141		General License
		4731.0100. subpart 142		Geologic repository
		4731.0100. subpart 143	4730.0100, subpart 78	Gonad shield
10CFR 20.1004	A	4731.0100. subpart 144	4730.0100, subpart 79	Gray
10CFR 34.3	B	4731.0100. subpart 145		Guide tube (projection sheath)
		4731.0100. subpart 146	4730.0100, subpart 80	Half-value layer (HVL)
10CFR 34.3	C	4731.0100. subpart 147		Hands-on experience
10CFR 61.2	C	4731.0100. subpart 148		Hazardous waste
		4731.0100. subpart 149	4730.0100, subpart 81	Healing arts
		4731.0100. subpart 150	4730.0100, subpart 82	Healing arts screening or screening
10CFR 20.1003	B	4731.0100. subpart 151		Helmet
10CFR 20.1003	A	4731.0100. subpart 152	4730.0100, subpart 83	High radiation area
10CFR 35.2	D	4731.0100. subpart 153		High dose-rate remote afterloader

10CFR 20.1003	B	4731.0100. subpart 154		Hood
		4731.0100. subpart 155	4730.0100, subpart 85	Image intensifier
		4731.0100. subpart 156	4730.0100, subpart 86	Image receptor
		4731.0100. subpart 157		Incident
10CFR 34.3	B	4731.0100. subpart 158		Independent certifying organization
10CFR 20.1003	A	4731.0100. subpart 159	4730.0100, subpart 88	Individual
10CFR 20.1003	A	4731.0100. subpart 160		Individual monitoring
10CFR 20.1003	C	4731.0100. subpart 161		Individual monitoring devices
10CFR 34.3	C	4731.0100. subpart 162	4730.0100, subpart 89	Industrial radiographer
10CFR 34.3	B	4731.0100. subpart 163	4730.0100, subpart 89a	Industrial radiographer's assistant
		4731.0100, subpart 164		Industrial radiographer's certification
10CFR 34.3	B	4731.0100. subpart 165	4730.0100, subpart 90	Industrial radiography
		4731.0100, subpart 166		Inhalation class
		4731.0100. subpart 167	4730.0100, subpart 91	Inherent filtration
10CFR 39.2	D	4731.0100. subpart 168		Injection tool
		4731.0100. subpart 169	4730.0100, subpart 92	Inspection
		4731.0100. subpart 170	4730.0100, subpart 93	Interlock
10CFR 20.1003	A	4731.0100. subpart 171		Internal dose
		4731.0100. subpart 172	4730.0100, subpart 94	Ionizing radiation
		4731.0100. subpart 173	4730.0100, subpart 95	Irradiation
10CFR 36.2	C	4731.0100. subpart 174		Irradiator
10CFR 36.2	D	4731.0100. subpart 175		Irradiator operator
10CFR 39.2	D	4731.0100. subpart 176		Irretrievable well logging source
		4731.0100. subpart 177	4730.0100, subpart 96	Isocenter
		4731.0100. subpart 178	4730.0100, subpart 97	Iso-line

		4731.0100, subpart 179		Kilo electron volts (keV)
		4731.0100. subpart 180	4730.0100, subpart 98	Kilovolt peak (kVp)
		4731.0100. subpart 181	4730.0100, subpart 99	Kilowatt second (kWs)
		4731.0100. subpart 182		Land disposal facility
		4731.0100. subpart 183	4730.0100, subpart 100	Lead equivalence or lead equivalent
		4731.0100. subpart 184	4730.0100, subpart 101	Leakage radiation
		4731.0100. subpart 185	4730.0100, subpart 102	Leakage technique factors
10CFR 20.1003	A	4731.0100. subpart 186		Lens dose equivalent (LDE)
10CFR 20.1003	D	4731.0100. subpart 187		License
10CFR 20.1003	D	4731.0100. subpart 188		Licensed material
		4731.0100. subpart 189	4730.0100, subpart 103	Licensed practitioner of the healing arts
		4731.0100. subpart 190	4730.0100, subpart 104	Light field
10CFR 20.1003	A	4731.0100. subpart 191		Limits (dose limits)
		4731.0100. subpart 192	4730.0100, subpart 105	Line-voltage regulation
		4731.0100. subpart 193	4730.0100, subpart 106	Linear attenuation coefficient or u
10CFR 39.2	D	4731.0100. subpart 194	4730.0100, subpart 106b	Logging assistant
10CFR 39.2	C	4731.0100. subpart 195	4730.0100, subpart 106c	Logging supervisor
10CFR 39.2	D	4731.0100. subpart 196		Logging tool
10CFR 20.1003	B	4731.0100. subpart 197		Loose-fitting facepiece
10CFR 20.1003	B	4731.0100. subpart 198		Lost or missing licensed material
10CFR 32.2	B	4731.0100. subpart 199		Lot tolerance percent defective
10CFR 35.2	D	4731.0100. subpart 200		Low-dose rate remote afterloader
10CFR 71.4	B	4731.0100. subpart 201		Low Specific Activity Material (LSA)

		4731.0100, subpart 202		Low Specific Activity Material (LSA) group I
		4731.0100, subpart 203		Low Specific Activity Material (LSA) group II
		4731.0100, subpart 204		Low Specific Activity Material (LSA) group III
10CFR 71.4	B	4731.0100. subpart 205		Low toxicity alpha emitters
		4731.0100, subpart 206		Lung class
		4731.0100. subpart 207	4730.0100, subpart 107	mA
		4731.0100. subpart 208	4730.0100, subpart 108	mAs
10CFR 35.2	D	4731.0100. subpart 209		Management
10 CFR 35		4731.0100, subpart 210		Manual brachytherapy
		4731.0100. subpart 211	4730.0100, subpart 109	Maximum line current
10CFR 71.4	B	4731.0100. subpart 212		Maximum normal operating pressure
		4731.0100, subpart 213		Medical event
10CFR 35		4731.0100, subpart 214		Medical institution
10CFR 35.2	C	4731.0100. subpart 215		Medical use
10CFR 35		4731.0100, subpart 216		Medium dose rate afterloader
		4731.0100, subpart 217		Mega electron volts (MeV)
10CFR 20.1003	A	4731.0100, subpart 218		Member of the public
10CFR 20.1003	A	4731.0100. subpart 219		Minor
10CFR 35.2	D	4731.0100. subpart 220		Mobile medical service
10CFR 20.1003	A	4731.0100. subpart 221		Monitoring (radiation monitoring, radiation protection monitoring)
10CFR 36.2	D	4731.0100. subpart 222		Moving Web (product conveyor system)
		4731.0100, subpart 223	4730.0100, subpart 114	National Council on Radiation Protection and Measurements (NCRP)

		4731.0100, subpart 224		National Voluntary Laboratory Accreditation Program (NVLAP)
10CFR 71.4	B	4731.0100, subpart 225		Natural thorium
		4731.0100. subpart 226	4730.0100, subpart 115	NARM
10CFR 20.1003	B	4731.0100. subpart 227		Negative pressure respirator (tight fitting)
		4731.0100. subpart 228	4730.0100, subpart 116	Neutron generator
		4731.0100. subpart 229	4730.0100, subpart 117	Nominal tomographic section thickness
		4731.0100. subpart 230		Non-ionizing
10CFR 20.1003	A	4731.0100. subpart 231	4730.0100, subpart 118	Non-stochastic effect (deterministic effect)
10CFR 71.4	B	4731.0100. subpart 232		Normal form radioactive material
10CFR 20.1003	A	4731.0100. subpart 233	4730.0100, subpart 120	Occupational dose
FR150.3	B	4731.0100. subpart 234		Offshore waters
		4731.0100. subpart 235	4730.0100, subpart 120a	Open-beam configuration
		4731.0100. subpart 236	4730.0100, subpart 121	Optical density or O.D.
10CFR 35.2	D	4731.0100. subpart 237		Output
10CFR 71.4	B	4731.0100. subpart 238		Package
10CFR 71.4	B	4731.0100. subpart 239		Packaging
10CFR 36.2	D	4731.0100. subpart 240		Panoramic dry-source-storage irradiator
10CFR 36.2	D	4731.0100. subpart 241		Panoramic irradiator
10CFR 36.2	D	4731.0100. subpart 242		Panoramic wet-source-storage irradiator
		4731.0100. subpart 243		Particle accelerator
		4731.0100. subpart 244	4730.0100, subpart 122	Patient
10CFR 35		4731.0100, subpart 245		Patient intervention

		4731.0100. subpart 246	4730.0100, subpart 123	Peak tube potential
10CFR 34.3	C	4731.0100. subpart 247	4730.0100, subpart 124	Permanent radiographic installation
10CFR 150.3	C	4731.0100. subpart 248	4730.0100, subpart 125	Person
10CFR 39.2	D	4731.0100. subpart 249	4730.0100, subpart 125a	Personal supervision
10CFR 35.2		4731.0100. subpart 250		Pharmacist
		4731.0100. subpart 251	4730.0100, subpart 127	Phantom
		4731.0100. subpart 252	4730.0100, subpart 128	Phototimer
		4731.0100. subpart 253	4730.0100, subpart 128a	Physician assistant or registered physician assistant
10CFR 20.1003	D	4731.0100. subpart 254		Planned special exposure
10CFR 36.2	D	4731.0100. subpart 255		Pool irradiator
		4731.0100. subpart 256	4730.0100, subpart 131	Portal film or portal imaging
10CFR 20.1003	B	4731.0100. subpart 257		Positive pressure respirator
FR 20.1003	B	4731.0100. subpart 258		Powered air-purifying respirator (PAPR)
10CFR 34.3	C	4731.0100. subpart 259		Practical Examination
10CFR 35		4731.0100, subpart 260		Preceptor
10CFR 35.2	C	4731.0100. subpart 261		Prescribed dosage
10CFR 35.2	C	4731.0100. subpart 262		Prescribed dose
10CFR 20.1003	B	4731.0100. subpart 263		Pressure demand respirator
		4731.0100. subpart 264	4730.0100, subpart 132a	Primary beam
		4731.0100. subpart 265	4730.0100, subpart 133	Primary dose monitoring system
		4731.0100. subpart 266	4730.0100, subpart 134	Primary protective barrier
10CFR 30.4	D	4731.0100. subpart 267		Principal activities
10CFR 36.2	D	4731.0100. subpart 268		Product conveyor system (moving web)

		4731.0100. subpart 269	4730.0100, subpart 135	Protective apron
		4731.0100. subpart 270	4730.0100, subpart 136	Protective barrier or barrier
		4731.0100. subpart 271	4730.0100, subpart 137	Protective glove
10CFR 20.1003	A	4731.0100. subpart 272		Public dose
10CFR 35		4731.0100, subpart 273		Pulsed dose-rate remote ....
		4731.0100. subpart 274	4730.0100, subpart 137a	Pulsed mode
		4731.0100. subpart 275	4730.0100, subpart 138	Quality assurance program
10CFR 20.1003	A	4731.0100. subpart 276	4730.0100, subpart 139	Quality factor
10CFR 20.1003	B	4731.0100. subpart 277		Qualitative fit test (QLFT)
10CFR 20.1003	D	4731.0100. subpart 278		Quarter
10CFR 20.1003	B	4731.0100. subpart 279		Quantitative fit test (QNFT)
10CFR 20.1004	A	4731.0100. subpart 280	4730.0100, subpart 140	Rad
10CFR 20.1003	A	4731.0100. subpart 281	4730.0100, subpart 141	Radiation
10CFR 20.1003	A	4731.0100. subpart 282	4730.0100, subpart 142	Radiation area
		4731.0100. subpart 283	4730.0100, subpart 143	Radiation detector or detector
		4731.0100. subpart 284	4730.0100, subpart 144	Radiation hazard
		4731.0100. subpart 285	4730.0100, subpart 147	Radiation protection
10CFR 36.2	D	4731.0100. subpart 286		Radiation room
		4731.0100. subpart 287	4730.0100, subpart 148	Radiation safety
10CFR 34.3 10CFR 35.2 10CFR 36.2	C D D	4731.0100. subpart 288	4730.0100, subpart 149	Radiation safety officer
		4731.0100. subpart 289	4730.0100, subpart 150	Radiation therapy simulation system
10CFR 39.2	D	4731.0100. subpart 290		Radioactive marker
		4731.0100. subpart 291	4730.0100, subpart 151	Radioactive material
		4731.0100, subpart 292		Radioactive waste
		4731.0100. subpart 293	4730.0100, subpart 153	Radiograph

10CFR 34.3	C	4731.0100. subpart 294		Radiographer
10CFR 34.3	B	4731.0100. subpart 295		Radiographer's assistant
10CFR 34.3	C	4731.0100. subpart 296		Radiographer certification
10CFR 34.3	B	4731.0100. subpart 297	4730.0100, subpart 155	Radiographic exposure device
10CFR 34.3	C	4731.0100. subpart 298		Radiographic operations
10CFR 34.3	B	4731.0100. subpart 299		Radiography
		4731.0100. subpart 300	4730.0100, subpart 156	Rating
10CFR 20.1003	A	4731.0100. subpart 301	4730.0100, subpart 157a	Reference man
		4731.0100. subpart 302	4730.0100, subpart 158	Reference plane
		4731.0100. subpart 303	4730.0100, subpart 159	Registrant
		4731.0100. subpart 304	4730.0100, subpart 160	Registration
10CFR 20.1004	A	4731.0100. subpart 305	4730.0100, subpart 161	Rem
10CFR 30.4	D	4731.0100. subpart 306		Research and development
10CFR 20.1003	B	4731.0100. subpart 307		Residual radioactivity
10CFR 20.1003	C	4731.0100. subpart 308		Respiratory protective device
10CFR 20.1003	A	4731.0100. subpart 309	4730.0100, subpart 163	Restricted area
		4731.0100. subpart 310	4730.0100, subpart 164	Roentgen (R)
10CFR 34.3	B	4731.0100. subpart 311		S-tube
10CFR 39.2	D	4731.0100. subpart 312		Safety review
10CFR 20.1003	A	4731.0100. subpart 313		Sanitary sewerage
		4731.0100. subpart 314	4730.0100, subpart 166	Scan increment
		4731.0100. subpart 315	4730.0100, subpart 167	Scan sequence
		4731.0100. subpart 316	4730.0100, subpart 169	Scattered radiation
10CFR 30.4 10CFR 35.2	A B	4731.0100. subpart 317	4730.0100, subpart 169a	Sealed source
		4731.0100. subpart 318		Sealed source and device registry

		4731.0100. subpart 319	4730.0100, subpart 170	Secondary dose monitoring system
10CFR 36.2	D	4731.0100. subpart 320		Seismic area
10CFR 20.1003	B	4731.0100. subpart 321		Self-contained breathing apparatus (SCBA)
		4731.0100. subpart 322	4730.0100, subpart 173	Sensitometer
10CFR 20.1003	A	4731.0100. subpart 323		Shallow-dose equivalent
10CFR 34.3	C	4731.0100. subpart 324	4730.0100, subpart 174a	Shielded position
		4731.0100. subpart 325	4730.0100, subpart 175	Shutter
		4731.0100. subpart 326	4730.0100, subpart 176	SI equivalent
10CFR 20.1004	A	4731.0100. subpart 327	4730.0100, subpart 177	Sievert
10CFR 30.4	A	4731.0100. subpart 328		Site area emergency
		4731.0100. subpart 329	4730.0100, subpart 178	Source
10CFR 34.3	B	4731.0100. subpart 330		Source assembly
FR 34.3	B	4731.0100. subpart 331		Source changer
10CFR 39.2	D	4731.0100. subpart 332		Source holder
10CFR 150.3	A	4731.0100. subpart 333		Source material
		4731.0100. subpart 334	4730.0100, subpart 179	Source of radiation
		4731.0100. subpart 335	4730.0100, subpart 180	Source-to-image (receptor) distance (SID)
		4731.0100. subpart 336	4730.0100, subpart 181	Source-to-skin distance (SSD)
10CFR 71.4	B	4731.0100. subpart 337		Special form radioactive material
10CFR 150.3	A	4731.0100. subpart 338		Special nuclear material
10CFR 71.4	B	4731.0100. subpart 339		Specific activity of a radionuclide
		4731.0100. subpart 340		Specific license
		4731.0100. subpart 341	4730.0100, subpart 182	Spot check
		4731.0100. subpart 342	4730.0100, subpart 183	Spot film

		4731.0100. subpart 343	4730.0100, subpart 184	Spot-film device
		4731.0100. subpart 344	4730.0100, subpart 185	Stationary beam therapy
		4731.0100. subpart 345	4730.0100, subpart 186	Stepless adjustment
		4731.0100. subpart 346		Stereotactic radiosurgery
10CFR 20.1003	A	4731.0100. subpart 347	4730.0100, subpart 187	Stochastic effects
10CFR 34.3	D	4731.0100. subpart 348	4730.0100, subpart 187a	Storage area
10CFR 34.3	B	4731.0100. subpart 349	4730.0100, subpart 188	Storage container
10CFR 35	D	4731.0100, subpart 350		Structured education program
10CFR 39.2	D	4731.0100. subpart 351		Subsurface tracer study
10CFR 20.1003	B	4731.0100. subpart 352		Supplied-air respirator (SAR) or airline respirator
10CFR 39.2	D	4731.0100. subpart 353		Surface casing for protecting fresh water aquifers
10CFR 71.4	B	4731.0100. subpart 354		Surface Contaminated Object (SCO)
10CFR 20.1003	A	4731.0100. subpart 355	4730.0100, subpart 190	Survey or radiation safety survey
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		4731.0100. subpart 357	4730.0100, subpart 192	Technique factors
10CFR 35		4731.0100, subpart 358		Teletherapy
10CFR 34.3	B	4731.0100. subpart 359	4730.0100, subpart 193a	Temporary jobsite
10CFR 35		4731.0100, subpart 360		Therapeutic dosage
10CFR 35		4731.0100, subpart 361		Therapeutic dose
10CFR 20.1003	B	4731.0100. subpart 362		Tight-fitting facepiece
		4731.0100. subpart 363	4730.0100, subpart 198	Tomogram
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10CFR 20.1003	A	4731.0100. subpart 366		Total Effective Dose Equivalent (TEDE)
		4731.0100. subpart 367	4730.0100, subpart 201	Traceable to a standard
10CFR 70.4	D	4731.0100. subpart 368		Transient shipment
10CFR 71.4	B	4731.0100. subpart 369		Transport index
10CFR 35.2	C	4731.0100. subpart 370		Treatment site
10CFR 39.2	B	4731.0100. subpart 371		Tritium neutron generator target source
		4731.0100. subpart 372	4730.0100, subpart 202	Tube housing assembly
		4731.0100. subpart 373	4730.0100, subpart 203	Tube rating chart
10CFR 71.4	B	4731.0100. subpart 374		Type A quantity
10CFR 71.4	B	4731.0100. subpart 375		Type B quantity
		4731.0100. subpart 376	4730.0100, subpart 204	Type 1100 aluminum alloy
10CFR 36.2	D	4731.0100. subpart 377		Underwater irradiator
		4731.0100. subpart 378		Unit dosage
10CFR 40.4	B	4731.0100. subpart 379		Unrefined and unprocessed ore
10CFR 20.1003	A	4731.0100. subpart 380	4730.0100, subpart 208	Unrestricted area
10CFR 71.4	B	4731.0100. subpart 381		Uranium-depleted
10CFR 71.4	B	4731.0100, subpart 382		Uranium-enriched
10CFR 71.4	B	4731.0100, subpart 383		Uranium-natural
10CFR 39.2	D	4731.0100. subpart 384		Uranium sinker bar
		4731.0100. subpart 385	4730.0100, subpart 209	Useful beam
10CFR 20.1003	B	4731.0100. subpart 386		User seal check (fit check)
		4731.0100. subpart 387	4730.0100, subpart 210	Variable-aperture beam-limiting device
		4731.0100. subpart 388		Vendor
10CFR 20.1003	A	4731.0100, subpart 389	4730.0100, subpart 210a	Very high radiation area
		4731.0100. subpart 390	4730.0100, subpart 212	Visible area

10CFR 61.2	B	4731.0100. subpart 391		Waste
10CFR 20.1003	D	4731.0100. subpart 392		Week
		4731.0100. subpart 393	4730.0100, subpart 213	Wedge filter
10CFR 20.1003	A	4731.0100. subpart 394		Weighting factor W_t
10CFR 39.2	D	4731.0100. subpart 395	4730.0100, subpart 213a	Well
10CFR 39.2	C	4731.0100. subpart 396		Well logging or logging
10CFR 20.1003	A	4731.0100. subpart 397		Whole body
10CFR 19.3	C	4731.0100. subpart 398	4730.0100, subpart 213b	Worker
10CFR 20.1003	A	4731.0100. subpart 399		Working level
10CFR 20.1003	A	4731.0100. subpart 400		Working level month
10CFR 35.2	C	4731.0100. subpart 401		Written directive
		4731.0100. subpart 402	4730.0100, subpart 214	X-ray control
		4731.0100. subpart 403	4730.0100, subpart 215	X-ray equipment
		4731.0100. subpart 404	4730.0100, subpart 216	X-ray field
		4731.0100. subpart 405	4730.0100, subpart 217	X-ray generator
		4731.0100. subpart 406	4730.0100, subpart 218	X-ray high-voltage generator
		4731.0100. subpart 407		X-ray machine operator
		4731.0100. subpart 408	4730.0100, subpart 219	X-ray subsystem
		4731.0100. subpart 409	4730.0100, subpart 220	X-ray system
		4731.0100. subpart 410	4730.0100, subpart 221	X-ray tube or tube
10CFR 20.1003	A	4731.0100. subpart 411		Year

10CFR	Compatibility	Rule 4731	Current Rule 4730	Part
		4731.0100	4730.0100	Definitions
		4731.0101	4730.0200	Purpose
		4731.0101, subpart 1	4730.0200	Scope
		4731.0101, subpart 2		Exemptions
		4731.0101, subpart 3		Responsibilities
		4731.0102		License types for radioactive materials
		4731.0102, subpart 1		Specific license
		4731.0102, subpart 2		General license
		4731.0103	4730.0400	Registration of x-ray equipment and generally licensed devices that contain radioactive material
		4731.0103, subpart 1	4730.0400	Registration requirements of x-ray facilities
		4731.0103, subpart 2		Generally licensed devices
		4731.0103, subpart 3	4730.0500	Biennial renewal of registration for x-ray and generally licensed device facilities
		4731.0104		Fee schedules for radioactive material licenses, x-ray and generally licensed device registration
		4731.0104, subpart 1		Fees for radioactive material licenses and inspection
		4731.0104, subpart 2	4730.0600, subpart 1	Registration fees for x-ray facilities
		4731.0104, subpart 3		Registration fee for generally licensed devices will consist of the base fee
		4731.0105		Data privacy
		4731.0106	4730.1450	Opportunities to inspect and conduct tests all facilities

		4731.0106, subpart 1	4730.1450	Inspections
		4731.0106, subpart 2		Tests
		4731.0106, subpart 3		Allegations and complaints
		4731.0107	4730.0850	Variances
		4731.0108		Violations, enforcement and penalties for all facilities
		4731.0109		Deliberate misconduct and employee protection
		4731.0109, subpart 1		Any licensee, registrant, applicant.....
		4731.0109, subpart 2		Employee protection and employment discrimination issues
		4731.0110	4730.1210	Prohibitions
		4731.0110, subpart 1	4730.1210, subpart 1	General provisions for all facilities
		4731.0110, subpart 2	4730.1210, subpart 1a	Other prohibited radiation dose levels
		4731.0110, subpart 3	4730.1210, subpart 2	Prohibited radiation producing equipment and procedures
		4731.0110, subpart 4	4730.1210, subpart 3	Unauthorized exposure of individual monitoring devices
		4731.0110, subpart 5	4730.1210, subpart 4	Possession of radium-226 by secondary or elementary schools
		4731.0111	4730.0900	Vendor and manufacturers responsibility
		4731.0111, subpart 1	4730.0900, subpart 1	General requirements for all vendors and manufacturers
		4731.0111, subpart 2	4730.0900, subpart 2	Notification requirements
		4731.0111, subpart 3	4730.0900, subpart 3	Calibration reports at time of installation
		4731.0111, subpart 4	4730.0900, subpart 4	Individual monitoring devices
		4731.0111, subpart 5	4730.0900, subpart 5	Phantom use

		4731.0112		Environmental and health protection regulations
		4731.0120		Standards for protection against radiation
		4731.0121		Implementation of license or registration
		4731.0121, subpart 1, 2, 3, 4		Implementation of license or registration
		4731.0121, subpart 5		For license for medical use of radioactive material
		4731.0122	4730.0300	Safety posting procedures for all facilities
		4731.0122, subpart 1	4730.0300, subpart 2	Caution signs
		4731.0122, subpart 2	4730.0300, subpart 1a, item A	Posting requirements
		4731.0122, subpart 3		Posting of notices to employees for facilities using radioactive materials
		4731.0122, subpart 4		Exceptions to posting requirements
		4731.0123		Precautionary procedures for radioactive materials
		4731.0123, subpart 1		Use of individual respiratory protection equipment
		4731.0123, subpart 2		Use of process or other engineering controls
		4731.0123, subpart 3	4730.0300	Labeling containers and radiation producing equipment
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		4731.0123, subpart 4		Exemptions to labeling requirements
		4731.0123, subpart 5		Procedures for receiving and opening packages

		4731.0124	4730.0310	Dose limit requirements
		4731.0124, subpart 1	4730.0310, subpart 1	Occupational dose limits for adults
		4731.0124, subpart 2	4730.0360	Occupational dose limits for minors
		4731.0124, subpart 3	4730.0310, subpart 3	Occupational dose to an embryo/fetus of a declared pregnant woman
		4731.0124, subpart 4	4730.0310, subpart 2, item B, subitem 6	Occupational dose for a planned special exposure
		4731.0125		Determination of occupational dose for all licenses and registrants
		4731.0125, subpart 1		Determination of prior occupational dose
		4731.0125, subpart 2		Conditions requiring individual monitoring of occupational external and internal doses
		4731.0125, subpart 3		Compliance with requirements for summation of occupational external and internal doses
		4731.0125, subpart 4		Determination of occupational internal exposure
		4731.0125, subpart 5		Determination of occupational external dose from airborne radioactive material
		4731.0126	4730.0380	Dose limits for the public
		4731.0126, subpart 1	4730.0380	Dose limits for individual members of the public
		4731.0126, subpart 2		Compliance with dose limits for individual members of the public
		4731.0127	4730.0400, item B, subitem 4 and subitem 5	Radiation safety officer requirements for all facilities

		4731.0128	4730.0400, item B, subitem 1	Radiation safety officer training and experience
		4731.0128, subpart 1		General requirements for all facilities
		4731.0128, subpart 2		Industrial radiography facilities using radioactive material
		4731.0128, subpart 3		Industrial irradiator facilities
		4731.0128, subpart 4		Well logging facilities
		4731.0128, subpart 5		Accelerator and cyclotron (PET) facilities
		4731.0128, subpart 6		Sealed and unsealed sources in industrial and research facilities
		4731.0128, subpart 7		Healing arts facilities that use radioactive materials
		4731.0129		Radiation safety officer duties
		4731.0129, subpart 1		General requirements for all facilities
		4731.0129, subpart 1, item B, subitem 5	4730.0400, item B, subitem 4	
		4731.0129, subpart 2		Industrial radiography facilities that use radioactive materials
		4731.0129, subpart 3		Industrial irradiator facilities
		4731.0129, subpart 4		Well logging facilities
		4731.0129, subpart 5		Accelerator and cyclotron (PET) facilities
		4731.0129, subpart 6		Sealed and unsealed sources in industrial and research facilities
		4731.0130	4730.1510, subpart 11	Individual monitoring requirements
		4731.0130, subpart 1	4730.1510, subpart 11	General requirements for all facilities

		4731.0130, subpart 2	4730.1520	Individual monitoring notifications and reports for all facilities
		4731.0130, subpart 3	4730.1510, subpart 11, item C, subitems 1, 4, 7, 8, 9	Individual monitoring requirements for industrial facilities
		4731.0131	4730.0400	Radiation safety programs
		4731.0131, subpart 1	4730.0400, item B, subitem 4 and 4730.1670, subpart 1	General requirements for all facilities
		4731.0131, subpart 2	4730.0300, subpart 6	Control of access of high radiation areas
		4731.0131, subpart 3		Control of access to very high radiation areas
		4731.0131, subpart 4	4730.1520, subpart 1	Healing arts facilities using radiation producing equipment including x-ray
		4731.0132	4730.1670, subpart 1	Radiation safety surveys
		4731.0132, subpart 1		General requirements for all facilities
		4731.0132, subpart 2		Requirements for all facilities using radioactive materials
		4731.0132, subpart 3	4730.1670, subpart 1	Requirements for facilities using radiation producing equipment, including x-ray
		4731.0133	4730.1655, subpart 2	Requirements for radiation safety survey instrument calibration
		4731.0133, subpart 1	4730.1655, subpart 2	Requirements for all facilities
		4731.0133, subpart 2	4730.0300, subpart 7	Industrial facilities
		4731.0133, subpart 3		Industrial irradiator facilities
		4731.0134		Leak testing requirements
		4731.0134, subpart 1	4730.2580, subpart 4 4730.2710, subpart 10	All facilities using radioactive material, including medical facilities

		4731.0134, subpart 2	4730.1750, subpart 4 and subpart 5	Healing arts facilities using x-ray equipment
		4731.0135		Storage and control of licensed or registered sources of radiation
		4731.0135, subpart 1		Security of stored sources of radiation and gauges
		4731.0135, subpart 2		Control of sources of radiation not in storage
		4731.0136		Waste management for radioactive material facilities
		4731.0136, subpart 1		General requirements
		4731.0136, subpart 2		Method of obtaining approval of proposed disposal procedures
		4731.0136, subpart 3		Disposal by discharge into sanitary sewerage or by incineration
		4731.0136, subpart 4		Disposal of specific wastes
		4731.0136, subpart 5		Transfer for disposal and manifests
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		4731.0136, subpart 8		Labeling waste package
		4731.0137	4730.1600	General shielding requirements
		4731.0138	4730.1610	General shielding requirements for medical, chiropractic, podiatric,.....
		4731.0138, subpart 1	4730.1610	Applicability
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		4731.0138, subpart 4	4730.1610	Design requirements for a diagnostic radiographic facility
		4731.0138, subpart 5	4730.1610	Space requirements for an operator's booth in a diagnostic radiographic facility
		4731.0138, subpart 6	4730.1610	Structural requirements for an operator's booth in a diagnostic radiographic facility
		4731.0138, subpart 7	4730.1610	X-ray control placement for an operator's booth in a diagnostic radiographic facility
		4731.0138, subpart 8	4730.1610	Viewing system requirements for an operator's booth in a diagnostic radiographic facility
		4731.0139	4730.1620	General shielding requirements for all dental radiographic facilities
		4731.0139, subpart 1	4730.1620	General requirements
		4731.0139, subpart 2	4730.1620	Requirements for new or structurally remodeled facilities
		4731.0140	4730.1630	General shielding requirements for therapeutic facilities
		4731.0140, subpart 1	4730.1630	Applicability
		4731.0140, subpart 2	4730.1630	Shielding requirements for therapeutic systems and accelerators
		4731.0140, subpart 3	4730.1630	Facility design requirements for therapeutic x-ray systems with energies of 50 kVp above
		4731.0140, subpart 4	4730.1630	Additional requirements for therapeutic systems and accelerators with energies of 150 kVp and above
		4731.0140, subpart 5	4730.1630	Additional requirements for accelerators in therapy systems

		4731.0141	4730.1640	General shielding requirements for industrial x-ray.....
		4731.0141, subpart 1	4730.1640	Applicability
		4731.0141, subpart 2	4730.1640	General shielding and design requirements
		4731.0141, subpart 3	4730.1640	Shielding requirements; Class A industrial facilties
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		4731.0151, subpart 1		General requirements for all facilities
		4731.0151, subpart 2		Industrial radiography facilities using radioactive materials
		4731.0151, subpart 3		Industrial irradiator facilities
		4731.0151, subpart 4	4730.2750, subpart 4	Well logging facilities
		4731.0151, subpart 5		Industrial accelerator/cyclotron...
		4731.0151, subpart 6		Sealed and unsealed sources used in industrial or research facilities
		4731.0151, subpart 7	4730.1510, subpart 4	Healing arts facilities using x-ray
		4731.0151, subpart 8	4730.1510, subpart 4	Records
		4731.0152	4730.1510	Radiation user training requirements

		4731.0152, subpart 1	4730.1510	General requirements for all users
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		4731.0153, subpart 3		Industrial irradiator facilities
		4731.0153, subpart 4		Well logging facilities
		4731.0154, subpart 5		Accelerator/cyclotron (PET) facilities
		4731.0155, subpart 6		Sealed and unsealed sources used in industrial or research facilities
		4731.0155, subpart 7		Healing arts facilities that use radioactive material
		4731.0155, subpart 8		Training for experienced RSO, teletherapy or medical physicist.....
		4731.0161		Notification and follow-up report on stolen, lost, missing.....
		4731.0161, subpart 1		Telephone reports
		4731.0161, subpart 1, item D	4730.1110	
		4731.0161, subpart 2		Each licensee or registrant is required to make a written report
		4731.0161, subpart 3		Subsequent to filing the written report
		4731.0161, subpart 4		The licensee or registrant must prepare any report
		4731.0162		Notification and follow-up report of incidents or accidents, including x-ray
		4731.0162, subpart 1		Notification of incidents to the commissioner
		4731.0162, subpart 1, item B, subitem 1	4730.1120, subpart 2	

		4731.0162, subpart 2		Preparation and submission of written reports
		4731.0162, subpart 3		Industrial radiography notifications
		4731.0162, subpart 4		Medical event notifications
		4731.0162, subpart 5		Report of a dose to an embryo/fetus or a nursing child
		4731.0163		Notification and follow-up report of exposure, radiation levels.....
		4731.0163, subpart 1		Reportable events
		4731.0163, subpart 2		Contents of reports
		4731.0164		Reports of planned special exposures, including x-ray
		4731.0165		Notifications and reports of individual monitoring
		4731.0166		Requirements for vacating premises for all facilities
		4731.0166, subpart 1		License termination
		4731.0166, subpart 2		X-ray machine removal from registration
		4731.0168		General recordkeeping requirements for the format and retention of records for all facilities
		4731.0168, subpart 1		Retention period conflict
		4731.0168, subpart 2		Maintenance of appropriate records
		4731.0169		General requirements for keeping records of specific information for all facilities
		4731.0169, subpart 1		Records of radiation safety programs
		4731.0169, subpart 2		Records of radiation safety surveys

		4731.0169, subpart 3		Records of radiation survey equipment calibration
		4731.0169, subpart 4		Records of ambient radiation exposure rate for healing arts facilities using radioactive material
		4731.0169, subpart 5		Records of shielding survey results
		4731.0169, subpart 6		Records of quality assurance program for facilities that use.....
		4731.0169, subpart 7		Records of individual monitoring device calibrations
		4731.0169, subpart 8		Records of employee training
		4731.0171		Records of individual monitoring results
		4731.0172		Records of any planned special exposure
		4731.0172, subpart 1		Contents of records
		4731.0172, subpart 2		Retention period
		4731.0173		Records of testing entry control devices for very high radiation areas
		4731.0174		Records of equipment performance evaluation for x-ray
		4731.0180		General requirements for all facilities using radioactive materials
		4731.0181		Records of inventory and balance of radioactive material
		4731.0181, subpart 1		Inventory and balance
		4731.0181, subpart 2		Contents of records and providing copies
		4731.0183		Records for maintenance of radioactive waste transfer

		4731.0183, subpart 1		Records and reports for license activities
		4731.0183, subpart 2		Records retention period
		4731.0183, subpart 3		Record of location and quantity if radioactive wastes
		4731.0183, subpart 4		Record of receipt and acceptance of radioactive waste
		4731.0183, subpart 5		Record of safeguards
		4731.0183, subpart 6		Copy of financial report
		4731.0183, subpart 7		Annual reports to the commissioner
		4731.0183, subpart 8		Report of accidental criticality
		4731.0183, subpart 9		Transfer of radioactive materials
		4731.0183, subpart 10		Electronic recordkeeping system
		4731.0184		Records of receipt, transfer, disposal.....
		4731.0184, subpart 1		Activities that require records
		4731.0184, subpart 2		Record retention period
		4731.0184, subpart 3		Prior to license termination
		4731.0184, subpart 4		Records for activities that are transferred or assigned
		4731.0185		Transportation shipment records of radioactive materials
		4731.0186		Records for industrial radiography uses of radioactive material
		4731.0186, subpart 1	4730.1520, subpart 6	Field stations and temporary jobsites
		4731.0186, subpart 2		Records of receipt and transfer of sealed industrial radiography sources
		4731.0186, subpart 3		Records of quarterly inventory

		4731.0186, subpart 4		Utilization logs
		4731.0186, subpart 5	4730.1520, subpart 5, item 6	Records of inspection and maintenance of radiographic exposure devices.....
		4731.0186, subpart 6		Records of operator qualifications
		4731.0187		Records for industrial irradiators
		4731.0188		Records for well logging
		4731.0188, subpart 1		Records required at license's facility and field stations
		4731.0188, subpart 2		Records required at temporary jobsites
		4731.0189		Records of sealed and unsealed sources in industrial and research facilities
		4731.0190		Records for all records for all facilities using x-ray equipment
		4731.0191		Records for industrial radiation producing equipment facilities
		4731.0192		Healing arts facility records
		4731.0193		Equipment performance test records
		4731.0194		QA records

10CFR	Compatibility	Rule 4731	Current Rule 4730	Part
30.3 31.1 31.2 32.1	C D D D	4731.0300, subpart 1		Applicability
31.1 40.3 70.3	C C C	4731.0300, subpart 2		General License Requirements
30.61	D	4731.0300, subpart 3		Additional License Requirements
30.61 40.71 70.61	D D D	4731.0300, subpart 4		Modification or Revocation of License
40.6 40.41	D C	4731.0300, subpart 5		Terms and conditions of licenses
20.2302 70.32(b)	D D/H&S	4731.0300, subpart 5, item D		Terms and conditions of licenses
40.41	D/H&S	4731.0300, subpart 5, item E		Terms and conditions of licenses
40.41	D/H&S	4731.0300, subpart 5, item F		Terms and conditions of licenses
40.46 70.36	C C	4731.0300, subpart 5, item G		Terms and conditions of licenses
11 USC 101(2)		4731.0300, subpart 5, item H		Bankruptcy
30.62	D	4731.0300, subpart 6		Right to cause the withholding or recall of radioactive material
20.2301 30.11 35.19 40.14 70.14	D D D D D	4731.0300, subpart 7		Right to grant an exception to requirements
20.1401	C	4731.0301, subpart 1		General provisions and scope
20.1402	C	4731.0301, subpart 2		Criteria for unrestricted use after license termination

20.1403	C	4731.0301, subpart 3		Criteria for restricted conditions use after license termination
20.1404	C	4731.0301, subpart 4		Alternative Criteria for license Termination
20.1405	C	4731.0301, subpart 5		Public notification and public participation
20.1406	C	4731.0301, subpart 5, item C		Public notification and public participation
150.11	B	4731.0302, subpart 1		Critical mass
40.22	B	4731.0303, subpart 1, A, B, and C		For small quantities of source material
40.21	C	4731.0303, subpart 1, item D		For small quantities of source material
40.25	C	4731.0303, subpart 1, item E		Depleted uranium in industrial products and devices
31.3	B	4731.0304, subpart 1		Certain devices and equipment
31.5	D	4731.0304, subpart 2		Certain measuring, gauging or controlling devices
31.6	C	4731.0304, subpart 2, item E		General license to install devices generally licensed
31.7	B	4731.0304, subpart 3		Luminous safety devices for aircraft
31.9 70.20	C C	4731.0304, subpart 4		Ownership of radioactive material
31.8 70.19	D C	4731.0304, subpart 5		Calibration and reference source including special nuclear material
70.19	D	4731.0304, subpart 5, item G		The general license in 4731.0304, subpart 5
31.11	D	4731.0304, subpart 6		General license of use of radioactive material for in vitro
31.10	B	4731.0304, subpart 7		General license for strontium 90

10CFR	Compatibility	Rule 4731	Current Rule 4730	Part
30.32 33.12 40.31 70.21 70.22	D D D D D	4731.0308, subpart 1		Requirements for application
30.32(g) 32.210 ref	C D	4731.0308, subpart 2, item A 4731.0308, subpart 2, item A,(2)		Requirements for application for certain types of sources
40.31	DH&S	4731.0308, subpart 2, item B, subitem (3)		Application for unsealed sources
30.37 40.43 70.33	D D D	4731.0308, subpart 3		Application for renewal of licenses
30.38 40.44 70.34	D D D	4731.0308, subpart 4		Application for amendment of licenses
30.39 40.45 70.35	D D D	4731.0308, subpart 5		Commissioner action on application to renew or amend
30.33 40.32 70.23	DH&S DH&S DH&S	4731.0309, subpart 1, item A & B		A specific license application may be approved if the commissioner determines that...
30.33	D	4731.0309, subpart 1, item D, E, F and G		A specific license application may be approved if the commissioner determines that...
30.35	DH&S	4731.0309, subpart 2, item A		Decommissioning funding plan & certificate of financial assurance
40.36	DH&S	4731.0309, subpart 2, item A, subitem (3)		Each applicant.....100mCi of source material...
30.35 70.25	DH&S DH&S	4731.0309, subpart 2, item B		Each applicant....half-life greater than 120 days.....
40.367	DH&S	4731.0309, subpart 2, item C		Each applicant...10mCi....

30.35	D	4731.0309, subpart 3, item A		Financial assurance for decommissioning
30.35 70.25	D/H&S D/H&S	4731.0309, subpart 3, item B		Table of required amounts if financial assurance for decommissioning
30.35 40.36 70.25	D D/H&S D/H&S	4731.0309, subpart 3, item C		Financial assurance for decommissioning
30.35 70.25	D D/H&S	4731.0309, subpart 3, item D		Financial assurance for decommissioning
40.36(f) 70.25(g)	D/H&S D/H&S	4731.0309, subpart 4		Record keeping for decommissioning
33.1	D	4731.0310		Requirements for specific licenses of broad scope
33.11	D	4731.0310, subpart 1		The different types of broad scope licenses are set forth below
33.13	D	4731.0310, subpart 2		An application for a Type A specific license of broad scope will be ....
33.14	D	4731.0310, subpart 3		An application for a Type B specific license.....
33.15	D	4731.0310, subpart 4		An application for a Type C specific license.....
33.17	D	4731.0310, subpart 5		Specific licenses of broad scope are subject.....
32.11 (b)	B	4731.0311, subpart 1, A		Licensing the manufacture of products containing radioactive materials in exempt concentrations

10CFR	Compatibility	Rule 4731	Current Rule 4730	Part
32.11	C	4731.0311, subpart 1, A, (1)		Licensing and manufacture ..., specific licence authoring the use of radioactive material in a product...
32.11	B	4731.0311., subpart 1, A, (2)		Applicant provides reasonable assurance that the concentration ...
32.12	C	4731.0311, subpart 1, B		Records and transfer reports
32.13	C	4731.0311, subpart 1, C		Prohibition of introduction of radioactive material
32.17	B	4731.0311, subpart 1, D		Resins containing scandium-46 ...
32.51	B	4731.0311, subpart 4, A - D		Radioactive material contained in devices for use under 4731.0304, subp. 2
32.51a	B	4731.0311, subpart 4, E		Conditions of licenses
32.52	B	4731.0311, subpart 4, F		Material transfer reports and records
32.53	B	4731.0311, subpart 5		Luminous safety devices for use in aircraft
32.101 ref	B	4731.0311, subpart 5, A, (4), (d)		Prototype tests for luminous safety devices for aircraft
32.54	B	4731.0311, subpart 5, B		Labeling of devices
32.55	B	4731.0311, subpart 5, C		Quality assurance; prohibition of transfer
32.110 ref	B	4731.0311, subpart 5, C, (4), (b)		Acceptance sampling procedures
32.56	B	4731.0311, subpart 5, D		Material transfer reports
32.57	B	4731.0311, subpart 6, A		Calibration or reference sources..., an application for a specific license ...

32.102 ref	B	4741.0311, subpart 6, A, (4), (b)		Prototype tests for calibration and reference sources ...
32.58	B	4731.0311, subpart 6, B		Labeling of devices
32.59	B	4731.0311, subpart 6, C		Leak testing of each source
32.71	B	4731.0311, subpart 7		Manufacturing and distribution... in vitro clinical or laboratory...
32.61	B	4731.0311, subpart 8, A		Ice detection devices containing Sr-90
32.103 ref	B	4731.0311, subpart 8, A, (5), (d)		Prototype tests for ice detection devices containing Sr-90
32.62	B	4731.0311, subpart 8, B		Quality assurance; prohibition of transfer
32.72	B	4731.0311, subpart 9		Manufacture ...radioactive drugs...
32.74	B	4731.0311, subpart 10		Manufacture ...devices containing radioactive material for medical use
40.34	B	4731.0311, subpart 12, A		...license to manufacture...products containing depleted uranium
40.34	D	4731.0311, subpart 12, B		... product or device whose unique benefits have not been demonstrated
40.35	C	4731.0311, subpart 12, C, (1)		...maintain level of quality control required by license ...
40.35	B	4731.0311, subpart 12, C, (2) and (3)		...label or mark each unit ...
40.35	D	4731.0311, subpart 12, (4) to (7)		... furnish a copy of the general license ...
32.210 ref	D	4731.0311, subpart 13		A licensee, manufacturer, or an initial distributor of a sealed source device containing a sealed source whose product is ...
70.31	D	4731.0312, subpart 1, A		Issuance of specific licenses, license satisfies requirements

30.34, (e), (2) (4) 70.31	D D	4731.0312, subpart 2, B		Special license requirements
30.34, (f)	D	4731.0312, subpart 4		Emergency Plan
30.34 (g)	D	4731.0312, subpart 5		Preparation of Technetium-99m
30.34 (a) 40.41 (b) 70.32 (a) 70.51 (c)	C C C C	4731.0313, subpart 1		Specific terms and conditions of licenses, rules for license
30.34 (b)	C	4731.0313, subpart 2		License restrictions
30.34 (h) 70.32 (a), (9)	H&S H&S	4731.0313, subpart 3		Notification of bankruptcy
30.34 (c) 70.41	C C	4731.0313, subpart 4		Authorized use of radioactive material, including special nuclear material
36(a)	D	4731.0314, subpart 1, A		Final 60 days preceding expiration of license
30.36(c) 40.42(c)	H&S H&S	4731.0314, subpart 1, A, (4)		... each specific license continues in effect , beyond the expiration date, if necessary, ...
30.36 (d) 40.42 (d) 70.38 (d)	H&S H&S H&S	4731.0314, subpart 1, B		Action required within 60 days of license expiration date
30.36 (a), (3)	D	4731.0314, subpart 1, C		The following specific licenses are not subject to ...
30.36 (e)	H&S	4731.0314, subpart 2, C		Termination of license... coincident with the notification....
30.36 (k) 40.42 (k) 70.38(k)	H&S H&S H&S	4731.0314, subpart 2, F		Specific licenses, including expired licenses, may be terminated....
30.36 (g)(1) 40.42 (g) 70.38(g)	H&S H&S H&S	4731.0314, subpart 3, B		Submission of the decommissioning plan... in addition to the information ...

30.36 (g)(4)	H&S	4731.0314, subpart 3, C		The proposed decommissioning plan of the site or separate building ...
30.36 (h) 40.42 (h) 70.38 (h)	H&S H&S H&S	4731.0314, subpart 3, D		Except as provided ... the licensee shall complete ...
30.36 (i) 40.42 (i) 70.38 (i)	D H&S H&S	4731.0314, subpart 3, E		The commissioner may approve a request for an alternative ..
30.36 (j) 40.42 (j) 70.38 (j)	H&S H&S H&S	4731.0314, subpart 4, A		Upon approval of the decommissioning plan ...
30.35 (g)	H&S	4731.0314, subpart 5, A		Each licensee shall keep records of information ...
30.41	C	4731.0315		Transfer of radioactive materials
150.20	C	4731.0316		Reciprocal recognition of licenses for radioactive materials, including ...
30.32 (i)	H&S	4731.0317		Emergency Plan Requirements

10 CFR	Compatibility	Rule 4731	Current rule 4730	Part
34.1	D	4731.0500, subpart 1	4730.2580, subpart 1	Applicability
34.13	C	4731.0500, subpart 2		License or registration requirements for industrial radiography use
34.29 b	C	4731.0500, subpart 3		Records
34.20	B	4731.0501		Performance requirements for industrial radiography equipment
34.47 a	C	4731.0502		Individual monitoring
34.33 a	H&S	4731.0503		Entrances in permanent radiographic installations
34.45	C	4731.0504		Operating procedures
34.27 a	C	4731.0504, subpart 1, item F		
34.63	C	4731.0504, subpart 2, item C		
34.13 h	C	4731.0504, subpart 3		Specific operating procedures
34.71	B	4731.0504, subpart 3, item A		Utilization logs
34.81	C	4731.0505		Emergency procedures.
34.46	B	4731.0506	4730.2580, subpart 3	Supervision of industrial radiography operations
34.41	B	4731.0506, subpart 2	4730.2580, subpart 2	Two persons
34.31	C	4731.0507		Inspection and maintenance
34.75	D	4731.0507, subpart 2		Maintenance requirements
34.33 b	H&S	4731.0507, subpart 2, items B-E		
34.27 e	C	4731.0508		Depleted uranium (DU) shielding contamination
34.27 b	C	4731.0509		Opening of a source or source holder
34.85	D	4731.0510, subpart 1		Requirements of the surveys
34.21	B	4731.0510, subpart 1, D		
34.29 a	C	4731.0511		Visual inventory and records of radioactive material use
34.35	B	4731.0512 items A&B		Labeling and posting
34.53	C	4731.0512, item C		Posting
.35	B	4731.0513 items A&B		Security during storage, transportation and use

34.51	C	4731.0513, item C		Surveillance
34.23	B	4731.0513, items D, E&F		Locking of radiographic exposure devices, storage containers, and source changers
34.41 c	D	4731.0514		Offshore waters operations

10CFR	Compatibility	Rule 4731	Current Rule 4730	Part
		4731.0600, subpart 1	4730.2510, subpart 1	Applicability
		4731.0600, subpart 2	4730.2510, subpart 2	Classes
		4731.0600, subpart 3	4730.2510, subpart 3	Operating and emergency procedures
		4731.0601, subpart 1	4730.2510, subpart 5	Inspection & maintenance. of equipment
		4731.0601, subpart 1, item F	4730.2510, subpart 13, item D	Exposure rate survey
		4731.0601, subpart 2	4730.2510, subpart 7, item A	Calibrated & operable radiation survey instruments
		4731.0601, subpart 3	4730.2510, subpart 8	Use logs
		4731.0601, subpart 4	4730.2510, subpart 9 and 10	Bypassing a safety device & beam stop
		4731.0601, subpart 5	4730.0300, subpart 5	Warning devices
		4731.0601, subpart 6	4730.2510, subpart 11	Security
		4731.0601, subpart 7	4730.2510, subpart 12	Records
		4731.0601, subpart 8	4730.2510, subpart 13	Individual monitoring
		4731.0602, subpart 1	4730.2520, subpart 1	Applicability
		4731.0602, subpart 2	4730.2520, subpart 2 and 4	Permanent enclosure & enclosure requirements
		4731.0602, subpart 3	4730.2520, subpart 3	Interlocks
		4731.0602, subpart 4	4730.2520, subpart 5	Visible and audible signals
		4731.0602, subpart 5	4730.2520, subpart 6	Ceiling barriers
		4731.0603, subpart 1	4730.2530, subpart 1	Applicability
		4731.0603, subpart 2	4730.2530, subpart 2	Restricted areas
		4731.0604, subpart 1	4730.2540, subpart 1 and 3	Applicability & certified cabinet radiography systems
		4731.0604, subpart 2	4730.2540, subpart 2	Individual monitoring
		4731.0605, subpart 1	4730.2550, subpart 1	Applicability

		4731.0605, subpart 2	4730.2550, subpart 2	Ports
		4731.0605, subpart 3	4730.2550, subpart 3	Shutters
		4731.0605, subpart 4	4730.2550, subpart 4	Radiation shielding of components
		4731.0607, subpart 1	4730.2570, subpart 1	Applicability
		4731.0607, subpart 2	4730.2570, subpart 2, 3, 4 and 5	Permanent enclosure (housing), shielding, interlocks & visible signals
		4731.0607, subpart 3	Not in current rule	Equipment without housing (New)

10CFR	Compatibility	Rule 4731	Current Rule 4730	Part
36.1 a	D	4731.0700, subpart 1.		Applicability
36.1 b	C	4731.0700, subpart 1, item A,		Applicability
36.1 c	C	4731.0700, subpart 1, item B.		Applicability
36.13	DH&S	4731.0700, subpart 2.		Specific license requirements for irradiators
36.17	D	4731.0700, subpart 3.		Applications for proposed alternatives
36.21	B	4731.0701		Performance criteria for sealed irradiator sources
36.15	D	4731.0702, subpart 1		Start of construction
36.39	DH&S	4731.0702, subpart 2		Irradiator design requirements
36.41	DH&S	4731.0702, subpart 3		Construction monitoring and acceptance testing.
5	DH&S	4731.0703		Shielded dose rates
36.55	D	4731.0704		Individual monitoring
36.29	DH&S	4731.0705		Radiation monitors
36.33	DH&S	4731.0706, subpart 1		Requirements for irradiator pools
36.63	DH&S	4731.0706, subpart 2		Pool water purity
36.23 i	DH&S	4731.0706, subpart 3		Access control for underwater irradiators
36.31	DH&S	4731.0707, subpart 1		Control of panoramic irradiator source movement
36.23 a-h	DH&S	4731.0707, subpart 2		Access control for panoramic irradiators
36.67 a&b	DH&S	4731.0707, subpart 2, item B, subitems 2&3		Entering and leaving the radiation room
36.53	DH&S	4731.0708, subpart 1		Operating procedure requirements
36.65	DH&S	4731.0708, subpart 2		Attendance during operation

36.53	DH&S	4731.0708, subpart 3		Emergency procedure requirements
36.37	B	4731.0708, subpart 4, item A		Power failure for irradiators
36.59	DH&S	4731.0708, subpart 4, item B		Detection of leaking sources
36.53	DH&S	4731.0708, subpart 5		Revision of operating & emergency procedures
36.67 c	DH&S	4731.0708, subpart 4, item A, subitem 3		Entering and leaving the radiation room
36.61	DH&S	4731.0709		Inspection and maintenance
36.57	DH&S	4731.0710		Radiation safety surveys
36.69	DH&S	4731.0711		Irradiation of explosive or flammable materials

10CFR	Compatibility	Rule 4731	Current Rule 4730	Part
39.1	D	4731.0800, subpart 1	4730.2750, subpart 1	Applicability (Scope)
39.13	DH&S	4731.0800, subpart 2	4730.2750, Sub 2	Specific license requirements for well logging (Notification)
39.41	B	4731.0801		Design and performance criteria for sealed sources
39.65	C	4731.0802, item A and B		Individual monitoring
39.63	C	4731.0803, subpart 3	4730.2750, subpart 3	Operating and emergency procedures
39.69	C	4731.0804	4730.2750, subpart 6	Radioactive contamination control (Lodged, damaged or ruptured source)
39.43	C	4731.0805 and 4731.0806		Inspection, maintenance and opening of a source or source holder
39.67	C	4731.0807		Radiation safety surveys
39.3 a&b	C	4730.0807, subpart 2		Radiation survey instruments
39.37	DH&S	4731.0808	4730.2750, subpart 5	Physical inventory and records of material use (Inventory)
39.39	C	4731.0808		Physical inventory and records of material use (Inventory)
39.31	C	4731.0809		Labels, security during storage, transportation and use
39.71	C	4731.0809, items D and E	4730.1000	Labels, security during storage, transportation and use.
39.15	C	4731.0810, subpart 1		Agreement with well or boring owner or operator
39.77 c	C	4731.0810, subpart 2		Abandonment (sealing) procedures for irretrievable sources
		4731.0810, subpart 2, item E	4730.2750, subpart 6, item C	Abandonment (sealing)

39.15	C	4731.0810, subpart 3		Commissioner approval
39.51	D	4731.0811	4730.2750, subpart 7	Use of a sealed source in a well or boring without a surfacing casing
39.47	D	4731.0812, subpart 1		Radioactive markers
39.49	C	4731.0812, subpart 2		Uranium sinker bars
39.53	C	4731.0812, subpart 3		Energy compensation source
39.55	C	4731.0812, subpart 4		Tritium neutron generator target source
39.45	C	4731.0813		Subsurface tracer studies

10CFR	Compatibility	Rule 4731	Current Rule 4730	Part
		4731.0900, subpart 1	4730.2560, subpart 1	Applicability
		4731.0900, subpart 1	4730.2475, subpart 1	Applicability
		4731.0900, subpart 2	4730.2510, subpart 3, item J & subpart 12	Records
		4731.0901, subpart 1	4730.2475, subpart 4	Safety and warning lights or devices
		4731.0901, subpart 1, item A	4730.2510, subpart 10	
		4731.0901, subpart 1, item B	4730.2510, subpart 9	
		4731.0901, subpart 1, item C	4730.2560, subpart 5	
		4731.0901, subpart 2	4730.2510, subpart 11	Security
		4731.0901, subpart 3	4730.2475, subpart 3	Accelerator controls & interlock system
		4731.0901, subpart 3	4730.2560, subpart 2	Accelerator controls & interlock system
		4731.0901, subpart 4		Additional requirements for radiation monitoring of cyclotrons
		4731.0902	4730.2510, subpart 13, item A and B	Individual monitoring
		4731.0903	4730.2475, subpart 5	Operating & emergency procedures
		4731.0903	4730.2510, subpart 3	Operating & emergency Procedures
		4731.0904	4730.2510, subpart 8	Use Logs
		4731.0904, items E and F		
		4731.0905	4730.2510, subpart 5	Inspection and maintenance of equipment
		4731.0906		Radiation safety surveys

		4731.0907	4730.2475, subpart 2	Additional requirement for accelerators in medical treatment settings

10CFR	Compatibility	Rule 4731	Current Rule 4730	Part
		4731.1000		Sealed and unsealed sources used in industrial and research facilities
		4731.1000, subpart 1	4730.2710, subpart 1	Applicability
		4731.1000, subpart 2		License or registration requirements for specific industrial uses
		4731.1000, subpart 3		Records
		4731.1001		Design and performance criteria for sealed sources
		4731.1002		Individual monitoring
		4731.1002, subpart 1		NVLAP-accredited individual monitoring device
		4731.1002, subpart 2		Bioassay services
		4731.1003	4730.2710, subpart 2 and subpart 4	Operating and maintenance procedures
		4731.1003, subpart 1		Operating and maintenance procedures for sealed and unsealed sources
		4731.1003, subpart 2		Special operating procedures for sealed sources
		4730.1003, subpart 3		Special operating procedures for unsealed sources
		4731.1004	4730.2710, subpart 2	Emergency procedures
		4731.1004, subpart 1		Emergency procedures for both sealed and unsealed sources
		4731.1004, subpart 2		Special emergency procedures for sealed sources
		4731.1004, subpart 3		Special emergency procedures for unsealed sources
		4731.1005	4730.2710, subpart 4	Inspection of sealed and unsealed sources

		4731.1006		Opening of a source or source holder
		4731.1007	4730.2710, subpart 6	Radiation safety surveys
		4731.1007, subpart 1		Requirements of the surveys for both sealed and unsealed sources
		4731.1007, subpart 2		Special radiation safety surveys for sealed sources
		4731.1007, subpart 3		Special radiation safety surveys for unsealed sources
		4731.1007, subpart 4	4730.2710, subpart 7	Requirements of the radiation survey instruments
		4731.1008	4730.2710, subpart 5 and subpart 8	Visual inventory and records of radioactive material use.
		4731.1009		Labels and security during storage, transportation and use
		4731.1009, subpart 1		Label and package
		4731.1009, subpart 2		Storage
		4731.1009, subpart 3		Transport of the source
		4731.1009, subpart 4	4730.2710, subpart 8	Security
		4731.1010		Storage and control of volatiles and gases

10CFR	Compatibility	Rule 4731	Current Rule 4730	Part
35.1 35.7	D D	4731.1200		Applicability
35.11	C	4731.1201, subpart 1		License required
35.12	D	4731.1201, subpart 2		Application for license, amendment, or a renewal
35.13	D	4731.1201, subpart 3		License amendments
35.14	D	4731.1201, subpart 4		Notification of license changes
35.15	D	4731.1201, subpart 5		Exemptions regarding Type A specific licenses of broad scope
35.18	D	4731.1201, subpart 6		License issuance
35.1000	D	4731.1201, subpart 7		Other medical uses of radioactive material or radiation from radioactive material
35.24	H&S D	4731.1202, subpart 1 B and F 4731.1202, subpart1 A, C, D, E, G, and H		Authority and responsibilities for the radiation safety program
35.26	D	4731.1202, subpart 2		Radiation safety program changes
35.24, (f)	H&S	4731.1202, subpart 3	4730.0400, C 4730.2475, subpart 2	Radiation review committee
35.27	H&S	4731.1202, subpart 4		Preparation of radioactive material under supervision
35.40	H&S D	4731.1202. subpart 6, A and B 4731.1202, subpart 6, C and D		Written directives
35.41	H&S D	4731.1202, subpart 7, A 4731.1202, subpart 7, B and C		Procedures for administrations requiring a written directive
35.6	C	4731.1203, subpart 1		Provisions for research involving human subject

35.310	H&S D	4731.1203, subpart 2 A 4731.1203,subpart 2 B		Safety instruction on patient and human research subject who has been given unsealed radioactive material and who cannot be released under 4731.1204, subp. 2
35.315	H&S	4731.1203, subpart 3		Safety instructions for patient and human research subject who had been given unsealed radioactive material and who cannot be released under 4731.1204, subp. 2
35.410	H&S D	4731.1203, subpart 4, A 4731.1203, subpart 4, B		Safety instructions for patients and human receiving brachytherapy
35.415	H&S	4731.1203, subpart 5		Safety precautions for patients and human research subjects receiving brachytherapy
35.610	H&S D	4731.1203, subpart 6, A, B, C, D, E, G 4731.1203, subpart 6, F		Safety procedures and instructions for remote afterloader units, teletherapy units, and gamma stereotactic radiosurgery units
35.615	H&S	4731.1203, subpart 7		Safety precautions for temote afterloaders, teletherapy units, amd gamma stereotactic radiosurgery units
35.604	H&S D	4731.1204, subpart 1, A 4731.1204, subpart 1, B		Radiation surveys of patients and human research subjects treated with a remote afterloader unit
35.75	C D	4731.1204, subpart 2, A and B 4731.1204, subpart 2, C and D		Release of individuals containing radiopharmaceuticals or implants
35.652	D	4731.1205, subpart 1		Radiation surveys
35.655	D	4731.1205, subpart 2		Five-year service for teletherapy and gamma stereotactic radiosurgery
35.657	H&S	4731.1205, subpart 3		Therapy-related computer systems

35.69	H&S	4731.1206, subpart 1		Labeling and shielding of vials and syringes
35.70	H&S D	4731.1206, subpart 2, A 4731.1206, subpart 2, B and C		Surveys for ambient radiation exposure rate
35.80	H&S D	4731.1206, subpart 3, A and B 4731.1206, subpart 3, C		Provisions of mobile service
35.92	H&S	4731.1206, subpart 4		Decay-in-storage
35.605	H&S D	4731.1206, subpart 5, A, B, and C 4731.1206, subpart 5, D		Installation, maintenance, and repair of source and source holder for therapeutic medical devices
35.190	B	4731.1207, subpart 1		Training for uptake, dilution, and excretion studies
35.290	B	4731.1207, subpart 2		Training for imaging and localization studies
35.390	B	4731.1207, subpart 3		Training for use of unsealed radioactive material for which a written directive is required
35.490	B	4731.1207, subpart 4		Training for use of manual brachytherapy sources
35.590	B	4731.1207, subpart 5		Training for use of sealed sources for diagnosis
35.491	B	4731.1207, subpart 11		Training for ophthalmic use of strontium-90
35.392	B	4731.1207, subpart 12		Training for oral administration of sodium iodide I-131 requiring a written directive in quantities less than or equal to 33 millicuries (1.22 MBq)

35 394	B	4731.1207, subpart 13		Training for the oral administration of sodium iodide I-131 requiring a written directive in quantities greater than 33 millicuries (1.22 MBq)
35.690	B	4731.1207, subpart 14		Training for use of remote afterloader units, teletherapy units, and gamma stereotactic radiosurgery units
35.60	H&S D	4731.1208, subpart 1, A and B 4731.1208, subpart 1, C		Possession, use, and calibration of instruments to measure the activity of unsealed radioactive materials
35.61	H7S D	4731.1208, subpart 2, A, (1),&(2), B, C, D 4731.1208, subpart 2, A, (3)		Calibration and check of survey instruments
35.63	H&S D	4731.1208, subpart 4, A, b, c, D, 4731.1208, subpart 4, E		Determination of dosages of unsealed radioactive material for medical use
35.65	D	4731.1208, subpart 5		Authorization for calibration, transmission and reference sources
35.67	H&S D	4731.1208, subpart 6, A, B, C, D, E, and G 4731.1208, subpart 6, F		Requirements for possession of sealed sources and brachytherapy sources
35.630	H&S D	4731.1208, subpart 7, A and B 4731.1208, subpart 7, C		Dosimetry equipment for therapeutic medical devices
35.632	H&S D	4731.1209, subpart 1, A, B, C, D, E, and F 4731.1209, subpart 1, G		Full calibration measurements on teletherapy units

35.633	H&S D	4731.1209, subpart 2, A, B, C, D, E, F, G, and H 4731.1209, subpart 2, I		Full calibration measurements on remote afterloaders
35.635	H&S D	4731.1209, subpart 3, A, B,C, D, E, and F 4731.1209, subpart 3, G		Full calibration measurements of gamma stereotactic radiosurgery units
35.432	H&S D	4731.1209, subpart 4, A, B, and C 4731.1209, subpart 4, D		Calibration measurements of brachytherapy sources
35.642	H&S D	4731.1210, subpart 1, A, B, C, D, and E 4731.1210, subpart 1, F		Periodic spot-checks for teletherapy units
35.643	H&S D	4731.1210, subpart 2, A, B, C, D, and E 4731.1210, subpart 2, F		Periodic spot-checks for remote afterloader units
35.645	H&S D	4731.1210, subpart 4, A, B, C, D, E, and F 4731.1210, subpart 4, G		Periodic spot-checks for gamma sterereotactic radiosurgery units
35.647	H&S D	4731.1210, subpart 5, A, B, C, and D 4731.1210, subpart 5, E		Additional technical requirements for mobile remote afterloader units
35.500	C	4731.1211, subpart 1		Use of sealed sources for diagnosis
35.49	C	4731.1211, subpart 2		Suppliers for sealed sources or devices for medical use
35.600	C	4731.1211, subpart 3		Use of sealed source in a device for therapeutic medical uses

35.433	H&S D	4731.1211, subpart 4, A 4731.1211, subpart 4, B		Decay of strontium-90 sources for ophthalmic treatments
35.100	H&S	4731.1212, subpart 1		Use of unsealed radioactive material for uptake, dilution,, and excretion studies for which a written directive is not required
35.200	H&S	4731.1212, subpart 2		Use of unsealed radioactive material for imaging and localization studies for which a written directive is not required
35.204	H&S D	4731.1212, subpart 3, A and B 4731.1212, subpart 3, C		Permissible molybdenum-99 concentration
35.300	H&S	4731.1212, subpart 4		Use of unsealed radioactive material for which a written directive is required
35.400	C	4731.1213, subpart 1		Use of sources for manual brachytherapy
35.404	H&S D	4731.1213, subpart 2, A and B 4731.1213, subpart 2, C		Surveys of patients or human research subjects after source implant and removal
35.406	H&S D	4731.1213, subpart 3, A and B 4731.1213, subpart 3, C		Brachytherapy sources accountability

35.2080	D	4731.1214, subp 1, A		Records of administrative and technical requirements that apply to the provision of mobile services
35.2310	D	4731.1214, subp. 1, B		Records of safety instruction
35.2024	D	4731.1214, subp. 1, C		Records of authority and responsibilities for radiation protection programs
35.2026	D	4731,1214, subp. 1, D		Records of radiation protection program changes
35.2040	D	4731.1214, subp. 1, E		Records written directives
35.2041	D	4731.1214, subp. 1, H		Records for procedures for administration requiring a written directive
35.2075	D	4731.1214, subp. 2, B		Records of release of individuals containing unsealed radioactive material or implants containing radioactive material
35.2404	D	4731.1214, subp.2, C		Records of surveys after source implant and removal
35.2063	D	4731.1214, subp. 3, A		Records of dosages of unsealed radioactive material for medical use
35.2067	D	4731.1214, subp. 3, B		Records of leak tests and inventory of sealed sources and brachytherapy sources
35.2406	D	4731.1214, subp. 3, C		Records of brachytherapy source accountability
35.2204	D	4731.1214, subp. 3, D		Records of molydenum-99 concentrations
35.2092	D	4731.1214, subp. 3, E		Records of decay-in-storage

35.2060	D	4731.1214, subp. 4, A		Records of calibration of instruments used to measure the activity of unsealed radioactive material
35.2061	D	4731.1214, subp. 4, B		Records of radiation survey instrument calibrations
35.2630	D	4731.1214, subp. 4, C		Records of dosimetry equipment used with remote afterloader units, teletherapy units, and gamma stereotactic radiosurgery units
35.2432	D	4731.1214, subp. 4, D		Records of calibration measurements of brachytherapy sources
35. 2632	D	4731.1214, subp. 4, E		Records of teletherapy, remote afterloader, and gamma stereotactic radiosurgery full calibrations
35.2605	D	4731.1214, subp. 4, G		Records of installation, maintenance, adjustment, and repair of remote afterloaderunits, teletherapy units and gamma stereotactic radiosurgery units
35,2433	D	4731.1214, subp. 4, H		Records of decay of strontium-90 sources for ophthalmic treatments
35.2642	D	4731.1214, subp. 5, A		Records of periodic spot-checks for teletherapy units
35.2643	D	4731.1214, subp. 5, B		Records of periodic spot-checks for remote afterloader units
35.2645	D	4731.1214, subp. 5, C		Records of periodic spot-checks for gamma stereotactic radiosurgery units

35 2647	D	4731.1214, subp. 6, A		Records of additional technical requirements for mobile remote afterloader units
35.2652	D	4731.1214, subp. 6, B		Records of surveys of therapeutic treatment units
35.2655	D	4731.1214, subp. 6, C		Records of 5-year inspection for teletherapy and gamma stereotactic radiosurgery units

FR	Compatibility	Rule 4731	Current Rule 4730	Part
		4731.1300	4730.1510	Registrant's safety requirements
		4731.1300, subpart 1	4730.1510, subpart 1	Registrant's responsibility
		4731.1300, subpart 2	4730.1510, subpart 2	X-ray system and accelerator compliance
		4731.1300, subpart 3	4730.1510, subpart 3	Individuals who may apply radiation
		4731.1300, subpart 4	4730.1510, subpart 4	Procedure and safety instruction
		4731.1300, subpart 5	4730.1510, subpart 5	Radiographic technique chart
		4731.1300, subpart 6	4730.1510, subpart 6	Exposure of individuals other than the patient
		4731.1300, subpart 7	4730.1510, subpart 7	Gonad protection
		4731.1300, subpart 8	4730.1510, subpart 8	Holding
		4731.1300, subpart 9	4730.1510, subpart 9	Prevention of unauthorized use
		4731.1300, subpart 10	4730.1510, subpart 13	Facility design requirements
		4731.1301	4730.1510, subpart 10	Radiological Practice Standards
		4731.1301, subpart 1	4730.1510, subpart 10	Procedures and auxiliary equipment....
		4731.1301, subpart 2	4730.1510, subpart 10 items D through G	Darkroom standards
		4731.1302	4730.1530	Ordering of radiographic examinations
		4731.1303	4730.1655, subpart 1	Required Quality Assurance Program
		4731.1303, subpart 1, items A through H	4730.1655, subpart 1, Items A,B,C,D; subpart 2, items A,B,C & subpart 3A, B	Applicability
		4731.1303, subpart 2	4730.1655, subpart 3C	Registrant and registrant's employees
		4731.1304	4730.1675, subpart 1	Calibrations for Dx. Rad. Systems

		4731.1305	4730.1675	Calibrations for therapeutic x-ray systems
		4731.1305, subpart 1	4730.1675, subpart 2	Calibrations for therapeutic x-ray system calibrations for less than 1.0 MeV
		4731.1305, subpart 2	4730.1675, subpart 3	Calibrations for therapeutic x-ray system calibrations greater than 1.0 MeV
		4731.1306	4730.1680	Therapeutic x-ray system spot checks of calibration
		4731.1306, subpart 1	4730.1680, subpart 1	Therapeutic x-ray system spot checks of calibration less than 1.0 MeV.
		4731.1306, subpart 2	4730.1680, subpart 2	Therapeutic x-ray system spot checks of calibration greater than 1.0 MeV.
		4731.1307	4730.1665, subpart 1	Computed tomography equipment performance measurements and calibrations
		4731.1307, subpart 1	4730.1665, subpart 2	General equipment performance measurements and calibration procedures...
		4731.1307, subpart 2	4730.1665, subpart 3	Additional C.T. operator equipment performance measurements
		4731.1308	4730.1691	Diagnostic equipment performance tests for Q.A. program
		4731.1308, subpart 1	4730.1691, subpart 1	Frequency of tests
		4731.1308, subpart 1a	4730.1691, subpart 1a	Image receptors
		4731.1308, subpart 2	4730.1691, subpart 2	Automatic processing
		4731.1308, subpart 3	4730.1691, subpart 3	Manual processing
		4731.1308, subpart 4	4730.1691, subpart w	All diagnostic radiographic tubes...

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		4731.1308, subpart 5a	4730.1691, subpart 5a	Fluoroscopes and C-arm fluoroscopes...after 5/19/95
		4731.1308, subpart 6	4730.1691, subpart 6	Mammography systems
		4731.1308, subpart 7	4730.1691, subpart 7	Tomography systems other than C.T.
		4731.1308, subpart 8	4730.1691, subpart 8	Computed tomography scanners
		4731.1308, subpart 9	4730.1691, subpart 9	Cinefluorographic and special procedures systems
		4731.1308, subpart 10	4730.1691, subpart 10	Facilities with dental intraoral systems
		4731.1308, subpart 11	4730.1691, subpart 11	Dental intraoral systems
		4731.1308, subpart 12	4730.1691, subpart 12	Dental extraoral systems
		4731.1309	4730.1692	Exposure time controls limits for...
		4731.1310,	4730.1693	Therapy equipment performance tests and limits....
		4731.1310, subpart 1	4730.1693, subpart 1	Local standards
		4731.1310, subpart 2	4730.1693, subpart 2	Other field instruments
		4731.1310, subpart 3	4730.1693, subpart 3	Relative dosimetric equipment
		4731.1310, subpart 4	4730.1693, subpart 4	Survey instruments
		4731.1310, subpart 5	4730.1693, subpart 5	Positioning equipment
		4731.1310, subpart 6	4730.1693, subpart 6	Phantoms and attenautors
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		4731.1311, subpart 2	4730.1695, subpart 2	Geometry
		4731.1311, subpart 3	4730.1695, subpart 3	Constancy checks-electrons
		4731.1311, subpart 4	4730.1695, subpart 4	Treatment accessories

		4731.1311, subpart 5	4730.1695, subpart 5	Simulators
		4731.1312,	4730.1310	Healing arts screening
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		4731.1312, subpart 5	4730.1310, subpart 5	Changes in screening program
		4731.1312, subpart 6	4730.1310, subpart 6	Denial of approval
		4731.1312, subpart 7	4730.1310, subpart 7	Appeal procedure
		4731.1312, subpart 8	4730.1310, subpart 8	Renewal of screening application
		4731.1312, subpart 9	4730.1310, subpart 9	Commissioner-approved healing arts screening
		4731.1312, subpart 10	4730.1310, subpart 10	Withdrawal of approval for conditions allowing overexposure
		4731.1312, subpart11	4730.1310, subpart 11	Withdrawal of approval for noncompliance with application
		4731.1313	4730.1750	General requirements for all diagnostic radiographic system
		4731.1313, subpart 1	4730.1750, subpart 1	Applicability
		4731.1313, subpart 2	4730.1750, subpart 2	Warning label
		4731.1313, subpart 3	4730.1750, subpart 3	Battery charge indicator
		4731.1313, subpart 4	4730.1750, subpart 4	Leakage radiation from the .....
		4731.1313, subpart 5	4730.1750, subpart 5	Radiation from components other..
		4731.1313, subpart 6	4730.1750, subpart 6	Beam quality, half-value layer
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		4731.1313, subpart 8	4730.1750, subpart 8	Multiple tubes
		4731.1313, subpart 9	4730.1750, subpart 9	Mechanical support of tube head
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		4731.1313, subpart 15	4730.1850, subpart 11	Additional requirements for general purpose x-ray system
		4731.1314	4730.1850	General requirements for certified diagnostic radiographic systems other...
		4731.1314, subpart 1	4730.1850, subpart 1	Applicability
		4731.1314, subpart 2	4730.1750, subpart 15	Diagnostic radiographic systems
		4731.1314, subpart 3	4730.1850, subpart 2	Beam limitation
		4731.1314, subpart 4	4730.1850, subpart 3	General purpose stationary x-ray systems
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		4731.1314, subpart 8	4730.1850, subpart 11, Item D	Mammography x-ray systems after 9/5/78
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		4731.1317, subpart 9	4730.2150, subpart 9	Source-to-skin distance
		4731.1317, subpart 10	4730.2150, subpart 10	Fluoroscopic timer
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		4731.1319, subpart 7	4730.2350, subpart 7	Tube immobilization

		4731.1319, subpart 8	4730.2350, subpart 8	Focal spot marking
		4731.1319, subpart 9	4730.2350, subpart 9	Beam block
		4731.1319, subpart 10	4730.2350, subpart 10	Timer
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		4731.1320, subpart 14	4730.2450, subpart 14	Selection of radiation type
		4731.1320, subpart 15	4730.2450, subpart 15	Selection of energy
		4731.1320, subpart 16	4730.2450, subpart 16	Selection of stationary beam therapy or ....
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		4731.1320, subpart 18	4730.2450, subpart 18	System checking facilities
		4731.1320, subpart 19	4730.2450, subpart 19	Operating procedures.

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71.0	D	4731.1500, subpart 1		Transportation of Radioactive Materials
71.5 (b)	B	4731.1500, subpart 2		Transportation of Radioactive Materials
71. appendix A	B	4731.1500, subpart 3		Transportation of Radioactive Materials
71.3	D	4731.1501, subpart 1		General Requirements
71.5(a)	B	4731.1501, subpart 2		General Requirements
71.89	B	4731.1501, subpart 3		General Requirements
71.101 71.103 71.105	D D D	4731.1502		Quality Assurance Requirements
71.85	B	4731.1503		Preliminary Determinations
71.87	B	4731.1504		Routine Determinations
71.12	B	4731.1505		General License for use of NRC Approved packages
71.13	B	4731.1506		General License for the use of Previously Approved Type B Packages
71.14	B	4731.1507		General License for the Use of U.S. Department of Transportation Specification Container
71.16	B	4731.1508		General License Use of Foreign Approved Package
71.81	B	4731.1509		Applicability of Operating Controls and Procedures for Fissile Material
71.18	D	4731.1510		General License for Use of Fissile Material, Limited Quantity Package
71.20	D	4731.1511, subpart 1		General License for use of packages for fissile.....

71.22	D	4731.1511, subpart 2		General License for use of packages for fissile.....
71.88	B	4731.1512		Air Transport of Plutonium
71.10	B	4731.1513		Exemptions for Low Level Radioactive Materials
71.97	B	4731.1514		Advance Notification of Shipment of Radioactive Waste

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30.12	B	4731.3001(D), subpart 1		Radioactive material including source material - exemptions
40.11	B	4731.3001(D), subpart 1, item A		
70.11	B	4731.3001(D), subpart 1, item A, subitem 1		
30.13 40.12 70.12	B B C	4731.3001(D), subpart 1, item B		Carriers
40.13	B	4731.3001(D), subpart 1, item C		Unimportant quantities of source material
30.14	B	4731.3001(D), subpart 2, item A		Radioactive Material other than source material - exemptions
30.18	B	4731.3001(D), subpart 2, item B		Exempt quantities
30.15	B	4731.3001(D), subpart 2, item C		Exempt items
30.19	B	4731.3001(D), subpart 2, item C, subitem 2		Self-Luminous products containing.....
30.20	B	4731.3001(D), subpart 2, item C, subitem 3		Gas and aerosol detectors containing radioactive material
30.16	B	4731.3001(D), subpart 2, item C, subitem 4		Resigns containing.....
30.21	B	4731.3001(D), subpart 2, item D		Radioactive drug
71.9	D	4731.3001(D), subpart 2, item E		Exemptions for low-level material