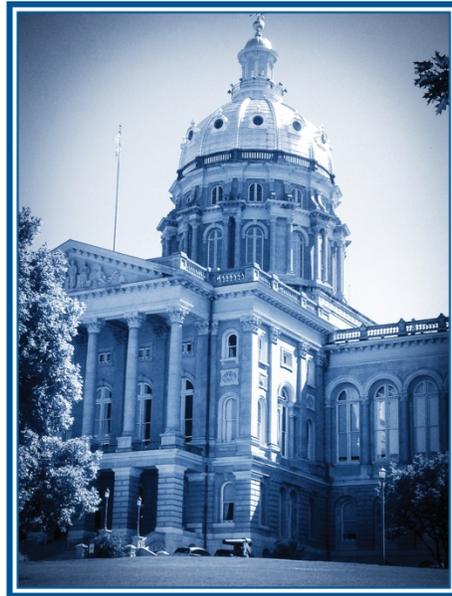

IOWA DEPARTMENT OF PUBLIC HEALTH

**MEDICAL USE OF RADIOACTIVE MATERIAL
FOR DIAGNOSTIC AND THERAPEUTIC
PROCEDURES REGULATORY GUIDE**



Iowa Department of Public Health
Bureau of Radiological Health
Radioactive Materials Section

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IDPH REGULATORY GUIDE FOR MEDICAL USE OF RADIOACTIVE MATERIAL FOR DIAGNOSTIC AND THERAPEUTIC PROCEDURES

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IDPH REGULATORY GUIDE FOR MEDICAL USE OF RADIOACTIVE MATERIAL FOR DIAGNOSTIC AND THERAPEUTIC PROCEDURES

1. INTRODUCTION

1.1 GENERAL

The Iowa Department of Public Health (IDPH), regulates the intentional internal or external administration of by-product material or the radiation produced by the material itself, to human beings. This type of use is called medical use, and a specific license is required. The regulations governing medical use are contained in Chapter 641-41.2, Use of radionuclides in the healing arts.

The IDPH usually issues a single by-product material license to cover a radioisotope program. However, gamma stereotactic radiosurgery devices ("gamma knives") and remote afterloading devices should not be included in this application. Contact IDPH for questions regarding which guidance document is applicable for the type of use requesting.

Separate licenses are not normally issued to different departments of a hospital or to individuals employed by a hospital. You should carefully study this guide and all the regulations identified in Chapter 641-41.2 before completing the application form. The IDPH may request additional information when necessary to provide reasonable assurance that the applicant has established an adequate radiation protection program

1.2 PURPOSE OF GUIDE

This guide is designed to describe the type and extent of information needed by the IDPH to evaluate an application for a medical use license and to describe the by-product material regulations for medical use.

1.3 APPLICABLE REGULATIONS

In addition to 641-41.2, other regulations pertaining to the medical use of by-product material are found in Chapters 38, 39, 40, and 42 of the Radiation Machines and Radioactive Materials Rules. To view these rules you may go to <https://idph.iowa.gov/radioactivematerials/rules>.

1.4 AS LOW AS REASONABLY ACHIEVABLE (ALARA) REQUIREMENTS

Paragraph 641-40.1(3) states "...In addition to complying with the requirements set forth in this Chapter, every reasonable effort should be made to maintain radiation exposures and releases of radioactive material in effluents to unrestricted areas as low as is reasonably achievable (ALARA)." As an applicant, you should consider the ALARA philosophy in the development of work plans involving radioactive materials.

The success of an ALARA program depends on the cooperation of each person who works at your facility. Management should make a formal policy commitment to the ALARA philosophy and implement that commitment with adequate resources. A Radiation Safety Committee composed of individuals who have special expertise in the safe use of by-product material is required by 641-41.2(9) to review uses for safety and ALARA considerations.

The Committee, the Radiation Safety Officer (RSO), and management are required to audit the by-product material program to ensure the continued safe use of by-product material. In addition to being a member of the Committee, the RSO serves as a technical consultant to the Committee and is responsible for the day-to-day operations of the radiation safety program.

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

2. FILING AN APPLICATION

You should apply for a license by completing an "Application for Radioactive Materials License" found on the IDPH website at <https://idph.iowa.gov/radioactivematerials/forms>. You should complete Items 1 through 5, and 14/15 on the form itself. For Items 6 through 12, submit the required information on supplementary pages. Identify each sheet or document with the item number on the application being addressed. All typed papers, sketches, and drawings should be on 8 1/2 x 11-inch paper to facilitate handling and review. If larger drawings are necessary, fold them to 8 1/2 x 11 inches, if possible.

You should complete all items in the application in enough detail for the IDPH to determine that your equipment, facilities, training, experience, and radiation safety program are adequate to protect the health and safety of the public as well as your employees.

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

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

Retain a copy of your application because the license will be issued based on the statements and representations in your application and any supplements to it as well as the requirements in the regulations. The statements and representations become enforceable as if they were regulations.

3. CONTENT OF APPLICATION

This portion of the guide explains, item by item, the information requested on the IDPH Application for Radioactive Materials License. The appendices to this guide serve to provide additional information on certain subject areas. Model procedures that the applicant may adopt in response to an item on the application form are provided. As an alternative, the applicant may use the procedures as an outline to develop a procedure for review by the IDPH staff.

If you have specific questions after careful review of this guide, contact the IDPH material licensing staff at Iowa Department of Public Health, Radioactive Materials Section, Lucas State Office Building, 5th Floor, 321 East 12th Street, Des Moines, Iowa 50319-0075, email iowaram@idph.iowa.gov, or call program staff listed on the website at <https://idph.iowa.gov/radioactivematerials/contacts>.

ITEM 1.a. -- APPLICANT'S NAME AND MAILING ADDRESS

The applicant should be the corporation or other legal entity applying for the license and with direct control over use of the radioactive material.

The address specified here should be the mailing address for correspondence. This may or may not be the same as the address at which the material will be used as specified in Item 1.b.

The IDPH must be notified and the transfer approved before control of the license is transferred. For more information see IDPH Information Notice 12-01, Unauthorized Transfer of Ownership or Control of Licensed Activities found at <https://idph.iowa.gov/radioactivematerials/notices>.

ITEM 1.b. -- LOCATIONS OF USE

You should specify each location of use and/or storage by the street address, city, and state or other descriptive address (such as 5 miles east on Highway 10, Anytown, Iowa) to allow us to easily locate your facilities. A post office box address is not acceptable. If by-product material is to be used at more than one location, you must give the specific address of each location. In items 6 through 12 of the application, describe the intended use and the facilities and equipment at each location.

A license amendment is required before receiving, using, or storing licensed material at an address or location not already authorized on the license.

ITEM 2. -- PERSON TO BE CONTACTED ABOUT APPLICATION

You should provide the name, telephone number, and email address of the individual who knows your proposed radioactive materials program and can answer informational questions only about the application. This individual, usually the Radiation Safety Officer (RSO) or a principal user of radioactive materials, will serve as the point of contact during the review of the application and during the period of the license. If this individual is not your full-time paid employee, specify your relationship with this individual. Notify the IDPH if this individual changes. Unless the contact person is the RSO, a contact change is for information only and it would not be considered an application for a license amendment.

Any requests from the IDPH concerning additional commitments, procedures, or for changes to the application will be addressed to the CEO or President with a copy to the RSO. The CEO can designate a different person if the authorization to make commitments on behalf of the licensee if the CEO or President provides that authorization in writing to IDPH.

The IDPH recognizes that licensees may use a consulting service to help prepare the license application and provide support to the radiation safety program. However, if you choose to have the consultant the point of contact for any IDPH questions, we remind you that the licensee management is ultimately responsible for all aspects of the program. This includes any services performed by the consultant.

ITEM 3. -- LICENSE INFORMATION

For a new license, amendment to a license or renewal of an existing license, check the appropriate block. Provide the license number where indicated for amendments or renewals.

ITEM 4. -- INDIVIDUAL USERS -- TRAINING AND EXPERIENCE

Responsible individuals are the authorized users and the RSO. 641-39.4(25) requires that an applicant be qualified by training and experience to use the requested radioactive materials for the purposes requested in such a manner as to minimize danger to public health and safety or property. 41.2(65) through 41.2(82) provides specific criteria for acceptable training and experience for authorized users, the RSO, and the associate radiation safety officer (ARSO). Note that curriculum vitae do not usually supply all the information needed to evaluate an individual's training and experience.

4.1. -- AUTHORIZED USERS FOR MEDICAL USE

The IDPH requires physicians and pharmacists to be licensed by the State of Iowa to practice medicine or pharmacy. Authorized users involved in medical use have the following special responsibilities:

1. Examination of patients and medical records to determine if a radiation procedure is appropriate,
2. Prescription of the radiation dosage or dose and how it is to be administered,
3. Actual use or direction of technologists or other paramedical personnel in the use of by-product material, and
4. Preparation of written directive (WD), if required.

There is no IDPH requirement that an AU must render an interpretation of a diagnostic image or results of a therapeutic procedure. The IDPH recognizes that the AU may or may not be the physician who interprets such studies.

Numbers 1 through 4 may be delegated to a physician who is under the direct supervision of an authorized user. Technologists or other personnel may use by-product material under an authorized user's supervision when permitted under Chapter 42. Supervision is defined in 641-41.2(11).

- A. Provide the full name of the RSO, ARSO (if proposed), and each individual user and note, by reference to Item 6, which proposed uses are requested for the individual.
- B. If a physician has been previously authorized for medical use and wishes to use material permitted by the previous Iowa Department of Public Health license, you only need to submit the previous license number. You should submit a copy of the license on which the physician was specifically named as an authorized user if the license was issued by any other Agreement State or the US NRC.
- C. If a physician is certified by an organization listed in the appropriate section of 641-41.2(65-82), submit a copy of the specialty board certificate indicating that the physician is "AU Eligible". Medical specialty board(s) certification recognized by IDPH are posted on the Nuclear Regulatory Commission's website at <https://www.nrc.gov/materials/miau/med-use-toolkit/spec-board-cert.html>. An individual that is board-eligible will not be considered for this pathway until the individual is actually board certified. Further, individuals holding other board certifications, but not certified by a board recognized by IDPH, will not be considered for this pathway.
- D. Physicians not previously authorized by NRC or an Agreement State and not certified by an appropriate organization must submit a complete description of their training and experience using the "*Authorized User (Diagnostic/Therapeutic/Brachytherapy) Training and Experience and Preceptor Attestation*" found on the IDPH website at <https://idph.iowa.gov/radioactivematerials/forms>. This documentation will be reviewed on a case-by-case basis.
- E. All training and experience shall have been obtained within the seven years preceding the date of application or the individual must submit verification of continuing applicable experience since the required training and experience was completed. See 41.2(77).
- F. Broad scope medical use applicants should submit the criteria they will use to evaluate the training and experience of authorized users. 641-41.2 (65 through 82) must be used as a guide. The criteria may include a provision that allows the applicant's Radiation Safety Committee to grant case-by-case exceptions.

4.2. -- AUTHORIZED USERS FOR NON-MEDICAL USE

List the full name of each individual proposed as an authorized user for non-medical use. Submit a complete description of the person's training and experience in non-medical use areas. This should focus on educational training and radiation safety training and experience specific to the radionuclides and uses requested.

For *in-vitro* and animal research (or other uses that do not involve the intentional exposure of humans), the list of proposed authorized users should include those individuals who will actually be responsible for the use of the requested by-product material. Indicate which user will be involved with which use by reference to Items 6 and 7 of the application. Those authorized users may direct the use of the by-product material by technologists or other individuals for the requested use.

4.3. – AUTHORIZED MEDICAL PHYSICIST

While authorized medical physicists (AMP) may not administer the dose, they are directly involved with the calculation and other tasks associated with delivering of the radiation dose. Provide the full name of each proposed authorized medical physicist and:

- A. If the individual has been previously authorized on an NRC or agreement state license and requests to use the same type material, provide a copy of the license on which the AMP was specifically named as an AMP for the uses requested.
- B. If the individual has been previously authorized on an NRC or agreement state license and requests a new medical use, provide a copy of the license on which the AMP was specifically named as an AMP and attach documentation of the additional training and experience specified in 41.2(74)"c" by using the Authorized Medical Physicist Training, Experience and Preceptor Attestation document found at <https://idph.iowa.gov/radioactivematerials/forms>.
- C. If the individual is qualifying by board certification, provide a copy of the board certificate issued by a specialty board whose certification process has been recognized by the NRC or an Agreement State, and attach documentation of the training and experience specified in 41.2(74)"c" by using the Authorized Medical Physicist Training, Experience and Preceptor Attestation document found at <https://idph.iowa.gov/radioactivematerials/forms>.

If applicable, attach documentation of recent, related continuing education and experience, as required by 41.2(77).

ITEM 5. -- RADIATION SAFETY OFFICER (RSO) AND ASSOCIATE RADIATION SAFETY OFFICER (ARSO)

Licensee's management must appoint an RSO who has adequate training and experience and agrees in writing to be responsible for implementing the Radiation Protection Program. State the name and title of the person designated by, and responsible to, the applicant's management as RSO. Submit a complete description of the individual's training and experience using "*RSO or ARSO Training, Experience and Preceptor Attestation*" as required by 41.2(65) & (75) found on the IDPH website at <https://idph.iowa.gov/radioactivematerials/forms>, or provide the previous license number (issued by IDPH), or a copy of the specific license issued by the NRC or another agreement state on which the individual was named as the RSO or ARSO. Even if the licensee employs a consultant as RSO, the licensee is still responsible for the radiation safety program as required by the license.

The RSO is responsible for the day to day oversight of the Radiation Protection Program. In accordance with 41.2(10), the licensee must provide the RSO sufficient time and commitment from management to fulfill certain duties and responsibilities to ensure that radioactive materials are used only by authorized individuals, in a safe manner, and have independent authority to stop operations that are considered unsafe. IDPH requires the name of the RSO on the license, and an agreement in writing from the RSO, to ensure that licensee management has identified a responsible, qualified person and that named individual knows of their designation and assumes the responsibilities of RSO. The RSO's duties and responsibilities should include those areas listed in Appendix B or its equivalent. A model RSO delegation of authority is also included in Appendix B.

A licensee may choose to identify one or more individuals as ARSOs to support the RSO in accordance with 41.2(10)"b". The ARSO can be delegated radiation safety duties and tasks by the RSO for the types of uses for which he or she is listed on the license. The ARSOs are required to complete the same training and experience requirements as the named RSO for their assigned sections of the radiation safety program. If proposing an ARSO, state the name of the individual(s), identify the sections(s) of the licensee's program for which the individual will be given duties and tasked in the oversight of radiation safety operations (e.g., 41.2(33) authorized uses or 41.2(33) uses at an alternate location), and provide documentation of completion of the training and experience requirements described in 41.2(65).

ITEM 6. -- RADIOACTIVE MATERIAL and ITEM 7. -- PURPOSE

641-41.2(31), 41.2(33), 41.2(37), 41.2(41), 41.2(43), and 41.2(88) divide by-product material for medical use into types of use. Using the table format of Table 1 as a guide, you may indicate only the types of use you want and the maximum amount. For radioactive materials described in 41.2(31) and 41.2(33), you may state, "As needed" in the "Amount" column as shown. For radioactive materials described in 41.2(37), 41.2(41), 41.2(43), and 41.2(88), express the total amount in millicuries (mCi). If you plan to have an eye applicator, list it as a separate item and note its total activity in mCi.

Table I

RADIOACTIVE MATERIAL	CHEMICAL/PHYSICAL FORM	AMOUNT	PURPOSE
6.a Material in 641-41.2(31)	Any	As needed	7.a Medical use described in 41.2(31)
6.b Material in 641-41.2(33)	Any	As needed	7.b Medical use described in 41.2(33)
6.c Material in 641-41.2(37)	Any	mCi	7.c Medical use described in 41.2(37)
6.d Gd-153 Material in 641-41.2(41)	Sealed source make/model	mCi	7.d Medical use described in 41.2(41)
6.e Implant and Material in 641-41.2(43)	Any sealed source authorized by 41.2(43)	mCi	7.e Medical use described in 41.2(43)
6.f Pd-103 Eye applicator in 641-41.2(43)	Sealed source make/model	mCi	7.f Medical use described in 41.2(43)
6.g Contact program staff for licensing guidance for emerging technologies regulated under 41.2(88).			

Note:

- Examples of known emerging technologies described in 41.2(88) include:
 - Germanium-68/Gallium-68 Pharmacy Grade Generator
 - Radioactive Seed Localization of Non-Palpable Lesions and Lymph Nodes
 - Leksell Gamma Knife ® Perfexion™ and Leksell Gamma Knife ® Icon
 - Yttrium-90 Microspheres
 - ViewRay System for Radiation Therapy
- Applicants must only use sealed sources as approved by sealed source and device registry in accordance with 41.2(43).
- Broad Scope medical use applicants may request "Any by-product material with atomic numbers 3 through 84 for medical use."

If you need other items, make a separate line entry for each isotope. Number each line entry consecutively following the 641-41.2 material. Each line entry must identify the radionuclide, the physical form, maximum amount on hand expressed in mCi, and the purpose for which the material will be used.

Examples:

- Calibration source not exempted under 41.2(20)
- Material for *in-vitro*, animal, or human studies (example: 39.4(20)"i")

For all calibration, transmission, and reference sources covered under 41.2(20), the specific sources do not need to be listed on the license as long as the licensee is authorized pursuant to 41.2(3) for the medical use of byproduct material.

ITEM 8. -- INDIVIDUALS RESPONSIBLE FOR RADIATION SAFETY PROGRAM

Licensees are responsible for their Radiation Protection Programs; it is essential that strong management control and oversight exist to ensure that licensed activities are conducted properly. Submit a description or chart of the overall organization pertaining to the radioactive materials program that specifies the name and title of each individual who has responsibility for management or supervision of the program.

NOTE: Items 9. - Through - 12.

Your response to these items can consist of one sentence that says that you will follow the model procedure in Appendix ___ in IDPH MEDICAL USE OF RADIOACTIVE MATERIAL FOR DIAGNOSTIC AND THERAPEUTIC PROCEDURES REGULATORY GUIDE, that you have enclosed your procedure for review, or "NA" for "not applicable." Before you respond to an item, read the introductory paragraphs of the referenced appendix. Your short sentence or "NA" response to Items 9 through 12 should run consecutively on one or more sheets. Longer responses should be appended as attachments.

If you edit a model procedure solely to name specific individuals, equipment by serial number, room numbers, or other site-specific information, there is no need to submit that procedure for review. Other than hot labs, procedures should allow for replacement of identical equipment, personnel, and administration rooms.

ITEM 9. -- TRAINING FOR INDIVIDUALS WORKING IN OR FREQUENTING RESTRICTED AREAS

All individuals working with or around licensed materials should receive safety instructions commensurate with their assigned duties, and if it is likely that they could receive doses over 100 mrem in a year, they must receive instructions, as specified by 40.111. Describe your training program for individuals who work with or near radioactive material described in Item 6.a. for medical use. Include the training for individuals who handle non-medical radioactive materials listed in Item 6.a. Appendix E of this guide provides a model training program that is one way to satisfy the requirements referenced above.

ITEM 10. -- FACILITIES AND EQUIPMENT

10.1. -- ANNOTATED DRAWING

Submit an annotated drawing of the room or rooms and adjacent areas where by-product material will be prepared, used, and stored. Append it as ATT 10.1. Note the following:

1. The scale. Use the same scale (preferably 1/4 inch = 1 foot) for all drawings.
2. The direction of north.
3. Room numbers and principal use of each room or area and indicate whether the areas are restricted or unrestricted, as defined in 38.2. (for example, *in-vitro*, hot lab, waiting, examining, imaging, reading, office, file, fresh materials storage, radioactive waste storage, film processor, toilet, closet, hallway).
4. Any shielding available.
5. Additional safety equipment (for example, fume hoods, L-blocks, or fixed area monitors) including manufacturer and model or serial numbers where appropriate.

10.2. -- OTHER EQUIPMENT AND FACILITIES

Describe any other equipment and facilities available for the use and/or storage that is listed in Item 6 of this application.

10.3. – SURVEY INSTRUMENTS

All licensees shall possess calibrated radiation detection instruments that will be used for radiation protection, including survey and monitoring instruments, and be sufficiently sensitive to measure the type and energy of radiation used. Provide the manufacturer name, model number, and range of the survey instruments being used. As an example:

MANUFACTURER	MODEL NUMBER	RANGE
Geotronics Industries	OMG-12	0.01 - 50 mR/hr
Flick Manufacturing Co.	BBSM-42	1 - 1000 mR/hr
Short Scientific, Inc.	LGD-310	1 - 100000 cpm

Radiation survey meter calibrations must be performed by people who are qualified to perform calibrations. If you plan to send your survey instruments to a private contractor for calibration, provide the name, address, and license number of the provider. If you plan to perform your own calibration, request the regulatory guide on survey instrument calibration from the IDPH.

Instruments must be calibrated annually and after servicing or repair. Electronic calibrations alone are not acceptable. Battery changes are not considered “servicing.” Records of the calibration of instruments and equipment used for quantitative radiation measurements must be retained for 3 years in accordance with 40.82

ITEM 11. -- RADIATION SAFETY PROGRAM

The elements of a radiation safety program are contained in Appendices A through U. Review each appendix carefully. (Some of these appendices are addressed elsewhere and need not be re-addressed.) Commit to the specific appendix, submit your own procedures using the appendix as a guide, or indicate “not applicable.”

Appendix A	Model program for maintaining occupational radiation exposure ALARA
Appendix B	Duties of the Radiation Safety Officer and RSO delegation of authority
Appendix C	Model procedure for calibrating dose calibrators
Appendix D	Personnel exposure monitoring program
Appendix E	Model Training Program
Appendix F	Radiation Safety Committee charter
Appendix G	Reserved
Appendix H	Leak-testing sealed sources
Appendix I	Safe use of radiopharmaceuticals
Appendix J	Spill procedures and action limits
Appendix K	Guidance for ordering and receiving radioactive material
Appendix L	Procedure for safely opening packages containing radioactive material
Appendix M	Records of Byproduct Material Use
Appendix M.1	Records for unit dosage use
Appendix M.2	Records for multi-dose vial use
Appendix M.3	Measuring and recording molybdenum concentration
Appendix M.4	Inventory of implant sources
Appendix N	Area survey procedures
Appendix O	Monitoring, calculating, and controlling air concentrations
Appendix O.1	Estimating worker dose from submersion in noble gases
Appendix O.2	Estimating worker dose from aerosol concentrations
Appendix O.3	Estimating aerosol and gas concentration in effluents
Appendix O.4	Calculating spilled gas clearance times
Appendix P	Radiation safety during radiopharmaceutical therapy
Appendix Q	Radiation safety during implant therapy
Appendix R	Model Procedure for Waste Disposal
Appendix S	Medical Use of Sr-90 Eye Applications
Appendix T	Reserved
Appendix U	Model Annual Audit Checklist

11.1. -- SEALED SOURCE INVENTORIES

Accountability of licensed material may be ensured by conducting physical inventories and maintaining records. State that you will conduct inventories, at six (6) month intervals, to account for all sealed sources received and possessed under your license. You should maintain records of the inventories for at least five (5) years from the date of the inventory. The record shall include:

- Model number of each source,
- Serial number if one has been assigned,
- Identity of each source radionuclide,
- Estimated activity,
- Location of each source,
- Date of inventory,
- Initials or name of individual performing the inventory, and
- Signature of the Radiation Safety Officer.

Licensed material must be tracked from “cradle to grave,” from receipt to its eventual transfer/disposal, to ensure accountability at all times.

11.2. -- ANNUAL AUDIT OF RADIATION /PROTECTION PROGRAM

40.10(3) requires an annual audit. Currently the IDPH emphasis in inspections is to perform observations of work in progress. As part of their audit programs, applicants should consider performing unannounced audits of their authorized users. The purpose is to determine that proper radiation safety and operating procedures are followed.

It is essential that problems be promptly and comprehensibly corrected. All identified deficiencies as well as the corrective actions taken should be documented. Subsequent audits should review the corrective actions to verify their effectiveness. The IDPH will review a licensee’s audit program and determine if corrective actions are thorough, timely, and sufficient to prevent recurrence.

The IDPH recognizes that some licensees may use a consulting service to perform audits. However, it is the licensee’s responsibility to maintain compliance with IDPH rules.

A model audit program is included as Appendix U of this Regulatory Guide.

ITEM 12. -- WASTE MANAGEMENT

Generally, medical licensees dispose of radioactive waste by decay in storage and/or transfer to an authorized recipient. Submit your procedures for waste disposal. See Appendix R. Be sure to include a procedure for all material listed in Item 6.

ITEM 13. -- LICENSE FEES

1. An application fee paid in full is required by 641-38.8(2) for all new licenses and amendments. Fee information is available in the above rule or our web site at <https://idph.iowa.gov/radioactivematerials/forms>. An application received without a fee or with an inadequate fee may be returned. Fees for processed applications are not refundable. Make check or money order payable to the IDPH.
2. An annual fee will be assessed based on the license category and is due by September 1st of each year. IDPH emails a billing invoice in July and August of each year for the annual fee. Make check or money order payable to the IDPH. You may also contact program staff at <https://idph.iowa.gov/radioactivematerials/contacts> to receive instruction on how to pay the annual fee via credit card.
3. Review 39.4(26) “Financial Assurance and Recordkeeping for Decommissioning.” Submit financial assurance as described or provide information that exempts the facility.

ITEM 14, 15 -- CERTIFICATION

A senior partner, the president, director or chief executive officer must sign the application. Identify the title of the office held by the individual who signs the application. If the application is for an institution, hospital, or medical center, the director or chief executive officer must sign it.

If the senior partner, president, director, or chief executive officer wishes another person to sign the application, a delegation of authority must be enclosed. The delegation of authority signed by the senior partner, president, director, or chief executive officer should state that the person signing the application has authority to commit the facility to the conditions of the application and any amendments submitted later.

4. AMENDMENTS TO LICENSE

A licensee must receive a license amendment before changing the scope of the program such as changing the Radiation Safety Officer, adding to the staff of authorized users, or location of use. See 641-41.2(4) for the specific requirements. An application for an amendment must be filed on IDPH application form or as a letter and must be signed by the person delegated in Item 14/15. The appropriate fee must be included.

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

5. RENEWAL OF LICENSE

Licenses are issued for a period of five (5) years. An application for the renewal should be filed at least 30 days before the expiration date. This will ensure that the license does not expire before the final action on the application has been taken by the IDPH as provided for in paragraph 641-39.4(34). The application for renewal should not reference material that was previously submitted. Each application is a stand-alone document.

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

6. IMPLEMENTATION

Except where specifically referenced, the information in this regulatory guide is guidance, not requirement. The IDPH reviews each application to ensure that users of by-product material are capable of complying with IDPH's regulations. This guide provides one set of methods approved by the IDPH for meeting the regulations and represents the minimum acceptable standards.

7. INSPECTIONS

IDPH conducts initial inspections of new radiological programs between six months and one year after licensed material is received and operations have begun. Subsequent routine inspections of licenses occur at the normal schedule after the initial inspection. The routine inspections are scheduled at intervals corresponding to frequency, which is indicated in the IDPH Radioactive Materials Fee Schedule. (For example, the routine inspection for a Nuclear Medical Van licensee would be scheduled two years after the initial inspection.)

APPENDIX A

MODEL PROGRAM FOR MAINTAINING OCCUPATIONAL RADIATION EXPOSURE AT MEDICAL INSTITUTIONS ALARA

In addition to 641-41.2(7)

You may use the text as it appears here, saying on your application, "We will establish and implement the model ALARA program that was published in Appendix A to IDPH MEDICAL USE OF RADIOACTIVE MATERIAL FOR DIAGNOSTIC AND THERAPEUTIC PROCEDURES." Submit the signed commitment in section number six (6) of this appendix.

If you prefer, you may develop your own ALARA program for IDPH review. If you do so, you should consider for inclusion all the features in the model and carefully review the requirements of 641-41.2(7). Say on your application, "We have developed an ALARA program for your review that is appended as Appendix A," and submit your program along with the signed commitment in section six (6) of this appendix.

ALARA PROGRAM

1. MANAGEMENT COMMITMENT

- a. We, the management of this facility, are committed to the program described herein for keeping individual and collective doses as low as is reasonably achievable (ALARA). In accord with this commitment, we hereby describe an administrative organization for radiation safety and will develop the necessary written policy, procedures, and instructions to foster the ALARA concept within our institution. The organization will include a Radiation Safety Committee (RSC), and a Radiation Safety Officer (RSO).
- b. We will perform a formal annual review of the radiation safety program, including ALARA considerations. This will include reviews of operating procedures and past dose records, inspections, etc., and consultations with the radiation safety staff or outside consultants.
- c. Modifications to operating and maintenance procedures and to equipment and facilities will be made if they will reduce exposures unless the cost, in our judgment, is considered unjustified. We will be able to demonstrate, if necessary, that improvements have been sought, that modifications have been considered, and that they have been recommended but not implemented, and we will be prepared to describe the reasons for not implementing the changes.
- d. In addition to maintaining doses to individuals as far as below the limits as is reasonably achievable; the sum of the doses received by all exposed individuals will also be maintained at the lowest practicable level. It would not be desirable, for example, to hold the highest doses to individuals to some fraction of the applicable limit if this involved exposing additional people and significantly increasing the sum of radiation doses received by all involved individuals.

2. REVIEW OF PROPOSED USERS AND USES

- a. Review of proposed users and uses
 - (1) The RSC will thoroughly review the qualifications of each applicant. To ensure that the applicant will be able to maintain ALARA, the review should include the types and quantities of materials and methods of use.
 - (2) When considering the use of by-product material, the RSC will review efforts of the applicant to maintain exposure ALARA.
 - (3) The RSC will ensure that the users justify their procedures and that individual and collective doses will be ALARA.

b. Delegation of authority

- (1) The RSC will delegate authority for enforcement of an ALARA program to the RSO.
- (2) The RSC will support the RSO when it is necessary for the RSO to assert authority. If the RSC has overruled the RSO, it will record the basis for its action in the minutes of the quarterly meeting.

c. Review of the ALARA Program

- (1) The RSC will encourage all users to review current procedures and develop new procedures as appropriate to implement the ALARA concept.
- (2) The RSC will perform a quarterly review of occupation radiation exposure with particular attention to instances in which the investigational levels in Table I are exceeded. The principal purpose of this review is to assess trends in occupational exposure as an index of the ALARA program quality and to decide if action is warranted when investigational levels are exceeded.

TABLE 1		
INVESTIGATIONAL LEVELS		
Investigational Levels (mrems per calendar quarter)		
	Level I	Level II
Total Dose Equivalent: whole body; head and trunk; active blood-forming organs; or gonads	200	400
Skin of whole body, extremities	2000	4000
Lens of eye	600	1200

- (3) The RSC will evaluate its institution's overall efforts for maintaining doses ALARA on an annual basis. This review will include the efforts of the RSO, authorized users, and workers as well as those of management.

3. RADIATION SAFETY OFFICER COMMITMENT

a. Annual and Quarterly Review:

- (1) Annual review of the radiation safety program. The RSC, along with the RSO, will perform an annual review of the radiation safety program for adherence to ALARA concepts. Reviews of specific methods of use may be conducted on a more frequent basis.
- (2) Quarterly review of occupational exposures. The RSC, along with the RSO, will review at least quarterly the external radiation doses of authorized users and workers to determine that their doses are ALARA in accordance with the provisions of Section 5 of this appendix.

b. Education Responsibilities for ALARA Program:

The RSO will schedule briefing and educational sessions to ensure that authorized users, workers, and ancillary personnel who may be exposed to radiation will be instructed in the ALARA philosophy. They should also be informed that management and the RSO are committed to implementing the ALARA concept.

c. Cooperative Efforts for Development of ALARA Procedures:

Radiation workers will be given opportunities to participate in formulating the procedures that they will be required to follow.

- (1) The RSO will be in close contact with all users and workers in order to develop ALARA procedures for working with radioactive materials.
- (2) The RSO will establish procedures for receiving and evaluating the suggestions of individual workers for improving health physics practices and will encourage the use of those programs.
- (3) Workers will be instructed in recourses available if they feel that ALARA is not being promoted on the job.

d. Reviewing Instances of Deviation from Good ALARA Practices:

The RSO will investigate all known instances of deviation from good ALARA practices and, if possible, will determine the causes. When the cause is known, the RSO will implement changes in the program to maintain doses ALARA.

e. The RSO is also responsible for assisting the RSC in the performance of its duties and serving as its secretary.

4. AUTHORIZED USERS COMMITMENT

a. New methods of Use Involving Potential Radiation Doses

- (1) The authorized user will consult the RSO and/or RSC during the planning stage before using radioactive materials for new uses.
- (2) The authorized user will review each planned use of radioactive materials to ensure that doses will be kept ALARA. Trial runs may be helpful.

b. Authorized User's Responsibility to Supervised Individuals

- (1) The authorized user will explain the ALARA concept and the need to maintain exposures ALARA to all supervised individuals.
- (2) The authorized user will ensure that supervised individuals who are subject to occupational radiation exposure are trained and educated in health physics practices and in maintaining exposures ALARA.

5. ESTABLISHMENT OF INVESTIGATIONAL LEVELS IN ORDER TO MONITOR INDIVIDUAL OCCUPATIONAL EXTERNAL RADIATION DOSES¹

This institution hereby establishes investigational levels for occupational external radiation doses which, when exceeded, will initiate review or investigation by the RSC and/or the RSO. The investigational levels that we have adopted are listed in Table 1. These levels apply to the exposure of individual workers.

The RSO, ARSO, or their designee will review current occupational external radiation exposures results of personnel monitoring not less than once in any calendar quarter. . The following actions will be taken at the investigational levels as stated in Table 1:

a. Personnel dose less than Investigational Level I:

Except when deemed appropriate by the RSO, no further action will be taken in those cases where an individual's dose is less than Table 1 values for the investigational Level I.

¹ IDPH emphasizes that the investigational levels in this program are not new dose limits but serve as check points above which the results are considered sufficiently important to justify investigations.

- b. Personnel doses equal to or greater than Investigation Level I but less than Investigational Level II:

The RSO will review the dose of each individual whose quarterly dose equals or exceeds Investigational Level I and will report the results of the reviews at the first RSC meeting following the quarter when the dose was recorded. If the dose does not equal or exceed Investigational Level II, no action related specifically to the exposure is required unless deemed appropriate by the Committee. However, the Committee will review each such dose in comparison with those of others performing similar tasks as an index of ALARA program quality and will record the review in the Committee minutes.

- c. Personnel dose equal to or greater than Investigational Level II:

The RSO will investigate in a timely manner the causes of all personnel doses equaling or exceeding Investigational Level II and, if warranted, will take action. A report of the investigation and any actions taken will be presented to the management following completion of the investigation.

- d. Re-establishment of investigational levels to levels above those listed in Table I.

In cases where a worker's or a group of workers' doses need to exceed an investigation level, a new, higher investigational level may be established with good ALARA practices. Justification for new investigational level will be documented.

The RSC will review the justification for and must approve all investigational level revisions.

6. SIGNATURE OF CERTIFYING OFFICIAL¹ Sign and submit as part of Appendix A.

I hereby certify that this institution has implemented the ALARA Program as set forth above.

Signature

Name (Print or type)

Title

¹ The person who is authorized to make commitments for the administration of the institution (e.g., hospital administrator).

APPENDIX B

DUTIES AND RESPONSIBILITIES OF THE RADIATION SAFETY OFFICER (RSO)

In Addition to 41.2(8)

You may use the following model guidelines to make commitments for your RSO. If you follow the model procedure, you may say on your application, "We will establish and implement the model procedure for RSO that was published in Appendix B to the IDPH MEDICAL USE OF RADIOACTIVE MATERIALS FOR DIAGNOSTIC AND THERAPEUTIC PROCEDURES REGULATORY GUIDE."

You may develop your own guidelines for review. If you do so, you should consider for inclusion all the features in the model and carefully review the requirements of the Iowa Rules. Say on your application, "We have developed an RSO procedure for your review that is appended as Appendix B," and submit your procedure.

MODEL PROCEDURE

The RSO is responsible for implementing the radiation safety program and ensuring that radiation safety activities are performed in accordance with approved procedures and regulatory requirements. The RSO's duties and responsibilities include:

1. Ensure that licensed material possessed by the licensee is limited to the kinds, quantities and forms listed on the license.
2. Ensure that individuals using the material are properly trained; designated by the RSO; have received refresher training at least annually; and are informed of all changes in regulatory requirements and deficiencies identified during annual audits or IDPH inspections.
3. Ensure that personnel monitoring devices are used as required and that reports of personnel exposure are reviewed in a timely manner.
4. Ensure that material is properly secured against unauthorized removal at all times when material is not in use.
5. Ensure that proper authorities are notified in case of accident, damage, fire, or theft.
6. Ensure that audits are performed at least annually to ensure that:
 - a. The licensee is abiding by IDPH and DOT regulations and the terms and conditions of the license (e.g., periodic leak tests, inventories, transportation, and use by trained users);
 - b. The licensee's radiation protection program content and implementation achieve occupational doses and doses to members of the public that are ALARA; and
 - c. The licensee maintains required records with all required information (e.g., records of personnel exposure; receipt, transfer, and disposal of licensed material; user training) sufficient to comply with IDPH requirements.
7. Ensure that the results of audits, identification of deficiencies, and recommendations for change are documented, provided to management for review, and maintained for at least 3 years. Ensure prompt action is taken to correct deficiencies.
8. Ensure that audit results and corrective actions are communicated to all personnel who use licensed material (regardless of their location or the license under which they normally work).
9. Ensure that all incidents, accidents, and personnel exposure to radiation more than ALARA levels or Chapter 40 limits are investigated and reported to IDPH within the required time limits.
10. Ensure that fume hood flow rates are tested at appropriate intervals and that employees use hoods in accordance with the safe use of radiopharmaceuticals.
11. Ensure that licensed material is transported in accordance with all applicable DOT requirements.
12. Ensure that licensed material is disposed of properly.
13. Ensure that the facility has up-to-date copies of IDPH's regulations, completing a review of new or amended IDPH regulations, and revising licensee procedures, as needed, to comply with IDPH regulations.
14. Ensure that the license is amended whenever there are changes in licensed activities, responsible individuals, or information or commitments provided to IDPH in the licensing process.

Model Delegation of Authority

Memo To: Radiation Safety Officer

From: Chief Executive Officer

Subject: Delegation of Authority

You, _____, have been appointed Radiation Safety Officer and are responsible for ensuring the safe use of radiation. You are responsible for managing the radiation protection program; identifying radiation protection problems; initiating, recommending, or providing corrective actions; verifying implementation of corrective actions; stopping unsafe activities; and ensuring compliance with rules. You are hereby delegated the authority necessary to meet those responsibilities, including prohibiting the use of radioactive material by employees who do not meet the necessary requirements and shutting down operations where justified by radiation safety. You are required to notify management if staff do not cooperate and do not address radiation safety issues. In addition, you are free to request amendment changes and raise issues with the Iowa Department of Public Health, Bureau of Radiological Health at any time.

Signature of Management Representative

Date

I accept the above responsibilities,

Signature of Radiation Safety Officer

Date

cc: Affected Department Heads

APPENDIX C

MODEL PROCEDURE FOR CALIBRATING DOSE CALIBRATORS

In addition to 641-41.2(17)

You or your contractor may use the following model procedure for checking and testing the dose calibrator. If you, or the contractor, follow the model procedure, you may say on your application, "We will establish and implement the model procedure for calibrating our dose calibrator that was published in Appendix C to IDPH MEDICAL USE OF RADIOACTIVE MATERIAL FOR DIAGNOSTIC AND THERAPEUTIC PROCEDURES."

If you develop your own dose calibrator calibration procedure for review, you should carefully review 641-41.2(17) and all the features in the model procedure, including Table C.1. Say on your application, "We have developed a dose calibrator calibration procedure for your review that is appended as Appendix C," and submit your dose calibrator calibration procedure.

MODEL PROCEDURE

Test at the indicated frequency in 41.2(17). Consider repair, replacement, or arithmetic correction if the dose calibrator falls outside the suggested tolerances. The recommended tolerances of ± 5 are more restrictive than those in the regulations to ensure that corrective action will be taken before the dose calibrator is outside permissible tolerances and must be removed from service.

1. Constancy

Constancy means reproducibility in measuring a source over a long period. In addition to the requirements of 41.2(17)"b"(1), consider the use of two or more sources with different photon energies and activities. Use the following procedure:

- a. Assay each reference source using the appropriate dose calibrator setting (i.e., use the Cs-137 setting to assay Cs-137).
- b. Measure background at the same setting, and subtract or confirm the proper operation of the automatic background subtract circuit, if it is used.
- c. Either plot on graph paper or log in a book the background level for each setting checked and the net activity of each constancy source.
- d. Using one of the sources, repeat the above procedure for all commonly used radioisotope settings. Plot or log the results.
- e. Establish an action level or tolerance for each recorded measurement at which the individual performing the test will automatically notify the chief technician or authorized user of suspected malfunction of the calibrator. These action levels shall be written in the logbook, posted on the calibrator, or maintained in a database. The regulation requires repair or replacement if the error exceeds ± 10 percent.

2. Inspect the instrument on a quarterly basis to ascertain that the measurement chamber liner is in place and that the instrument is zeroed according to the manufacturer's instructions.

3. Linearity

Linearity means that the calibrator is able to indicate the correct activity over the range of use between the maximum activity administered and 30 μCi according to the requirements of 41.2(17)"b"(3). This test is done using a vial or syringe of Tc-99m whose activity is at least as large as the maximum activity normally assayed for administration. The vial or syringe may be in a prepared radiopharmaceutical kit, in a unit dosage syringe, or in a radiopharmaceutical therapy, whichever is largest.

a. DECAY METHOD

- (1) Assay the Tc-99m syringe or vial in the dose calibrator, and subtract background to obtain the net activity in millicuries. Record the date, time (to the nearest minute), and net activity. This first assay should be done in the morning at a regular time, for example, 8 a.m.
- (2) Repeat the assay at approximately 4-hour intervals (i.e. noon and 4 p.m.). Continue on subsequent days until the assayed activity is less than 30 μ Ci. For dose calibrators with a range selection switch, select the range you would normally use for the measurement.
- (3) Convert the recorded time and date to hours elapsed.
- (4) On a sheet of semi-log graph paper label the logarithmic vertical axis in millicuries and label the linear horizontal axis in hours elapsed. At the top of the graph, note the date and the manufacturer, model number and serial number of the dose calibrator. Then plot the data.
- (5) Draw a "best fit" straight line through the data points. For the point farthest from the line, calculate its deviation from the value on the line. $(A_{\text{observed}} - A_{\text{line}})/A_{\text{line}} = \text{deviation}$.

b. SHIELD METHOD

If you decide to use a set of "sleeves" to test for linearity, it will first be necessary to calibrate them. The manufacturer provides specific procedures. Note that the decay method must be used upon initial installation. Calibration of the "sleeves" must be performed each time the dose calibrator is returned from repair.

Follow the manufacturer's instructions when performing the linearity test.

4. Geometry independence

Geometry means that the indicated activity does not change with volume or configuration and is conducted in accordance with 41.2(17)"b"(4). This test should be done using a syringe that is normally used for injections. Licensees who use generators and radiopharmaceutical kits should also do the test using a vial similar in size, shape, and construction to the radiopharmaceutical kit vials normally used. The following test assumes injections are done with 3-cc plastic syringes and that the radiopharmaceutical kits are made in 30-cc glass vials. If you do not use these, change the procedure so that your syringes and vials are tested throughout the range of volumes commonly used.

- a. In a small beaker or vial, mix 2.0 cc of a solution of Tc-99m with an activity concentration between 1 and 10 mCi/ml. Set out a second small beaker or vial with non-radioactive saline. You may also use tap water.
- b. Draw 0.5 cc of the Tc-99m solution into the syringes and assay. Record the column and millicuries.
- c. Remove the syringe from the calibrator, draw an additional 0.5 cc of non-radioactive saline or tap water, and assay again. Record the volume and millicuries indicated.
- d. Repeat the process until you have assayed a 2.0 - cc volume.
- e. Select as a standard the volume closest to that normally used for injections. For all the other volumes, divide the standard millicuries by the millicuries indicated for each volume correction factor. Alternatively, you may graph the data and draw horizontal ten (10) percent error lines above and below the chosen "Standard volume."
- f. If any correction factors are greater than 1.1 or less than 0.9, it will be necessary to make a correction table or graph that will allow you to convert from "indicated activity" to "true activity." This will also be necessary if any data points lie outside the ten (10) percent error lines. Be sure to label the table or graph "syringe geometry dependence," and note the date of the test and the model number and serial number of the calibrator.
- g. To test the geometry dependence of a 30-cc glass vial, draw 1.0 cc of the Tc-99m solution into a syringe and then inject it into the vial. Assay the vial. Record the volume and millicuries indicated.
- h. Remove the vial from the calibrator and, using a clean syringe, inject 2.0 cc of the non-radioactive saline or tap water, and assay again. Record the column and millicuries indicated.
- i. Repeat the process until you have assayed a 19.0-cc volume. The entire process must be completed within 10 minutes.
- j. Select as a standard the volume closest to that normally used for mixing radiopharmaceutical kits. For all the other volumes, divide the standard millicuries by the millicuries indicated for each

volume. The quotient is a volume correction factor. Alternatively, you may graph the data and draw horizontal ten (10) percent error lines above and below the chosen "standard volume."

- k. If any correction factors are greater than 1.1 or less than 0.9, it will be necessary to make a correction table or graph that will allow you to convert from "indicated activity" to "true activity." This will also be necessary if any data points lie outside the ten (10) percent error lines. Be sure to label the table or graph "vial" geometry dependence," and note the date of the test and the model number and serial number of the calibrator.
- l. Notify the RSO if any correction factors are greater than 1.1 or less than 0.9, or if any data points lie outside the +/- 10% error lines.

5. Accuracy

Accuracy means that for a calibrated reference source, the indicated activity (e.g. mCi) value is equal to the activity value determined by the National Institutes of Standards and Technology (NIST) or by the supplier. The supplier must compare that source to a source that was calibrated by the NIST. Certified sources are available from the NIST and from many radioisotope suppliers. In addition to the requirements of 41.2(17)"b"(2), consider using at least one reference source whose activity is within the range of activities normally assayed.

- a. Assay a calibrated reference source at the appropriate setting (i.e., use the Co-57 setting to assay Co-57), and then remove the source and measure background. Subtract background from the indicated activity to obtain the net activity. Record this measurement. Repeat for three determinations.
- b. Average the three determinations. The average value should be within five (5) percent of the certified activity of the reference source, mathematically corrected for decay.
- c. Repeat the procedure for other calibrated reference sources.
- d. If the average value does not agree, within five (5) percent, with the certified value of the reference source, the dose calibrator may need to be repaired or adjusted. The regulation requires repair or replacement if the error exceeds 10 percent and the RSO must be notified.
- e. At the same time the accuracy test is done, assay the source that will be used for the daily constancy test (it need not be a certified reference source) on all commonly used radioisotope settings. Record the settings and indicated millicurie values.

6. The RSO will review and sign the records of all geometry, linearity, and accuracy tests.

Table C.1 41.2(17) Reference Table

		Constancy	Accuracy	Linearity	Geometry
Calibration Requirement	Install		x	x	x
	Adjustment/Repair	x	x	x	x
	Periodicity	Each Use	12 month	3 month	N/A
Process	Sealed sources	≥ 1	≥ 2		
	Activity Level	≥ 50µCi y *	≥ 50µCi y *		
	Other Notes		1 with Primary between 100-500keV	Range: 30µCi to highest dosage used	
Recorded Data	Model # of DC	x	x	x	x
	Serial # of DC	x	x	x	x
	Check Source/Source				
	Serial #		x		
	Model #		x		
	Isotope Identity	x	x		
	Activity	Calibrated	x	Calculated	x
	Measured Activity	x		x	x
	Test Result		x		
	Volume Configuration				x
	Date	x	x	x	x
	Instrument Settings	x	x		for each volume
	Initials of Checker	x			
	Identity of Checker		x	x	x
RSO Signature		x	x	x	
Retention Period			3 yrs	Life of DC	
Error	Limits			>10%	
	Actions		Replace/Repair	Correct Mathematically	
	Recommended Investigation			>5%	

* If using Radium 226, at least 10 microcuries are required to perform test

This table does not supercede 41.2(17). While this table has been developed as a tool, Licensees will be held to the requirements in the Rule.

APPENDIX D

MODEL PERSONNEL EXPOSURE MONITORING PROGRAM

In addition to 641-40.36 and 40.37

"Dosimetry" is a broad term commonly applied to the use of monitoring devices, bioassay, and other methods to measure or otherwise quantify radiation doses to individuals. The licensee must control occupational doses and provide individuals with monitoring devices in accordance with the requirements of 40.37 and shall maintain records of doses received in accordance with 40.86.

It is necessary to assess doses to radiation workers to demonstrate compliance with regulatory limits and to help demonstrate that doses are maintained at ALARA levels. Providing for the safe use of radioactive materials is a management responsibility. It is important that management recognize the importance of radiation monitoring as part of the overall requirements for radiation protection.

You may use the following model program to monitor personnel external exposure. If you follow the guidance in the program, you may say on your application. "We will establish and implement the model personnel exposure monitoring program published in Appendix D to IDPH MEDICAL USE OF RADIOACTIVE MATERIAL FOR DIAGNOSTIC AND THERAPEUTIC PROCEDURES."

If you prefer, you may develop your own program for review. You should consider for inclusion all the features in the model program and carefully review the requirements of 641-40.36 and 40.37. Say on your application, "We have developed an external exposure monitoring program for your review that is appended as Appendix D," and submit your monitoring program.

MODEL PROGRAM FOR EXTERNAL EXPOSURE

1. The RSO, ARSO, or designee will promptly review all exposure records to look for workers or groups of workers whose exposure is unexpectedly high or low. This procedure does not apply to backup monitor records; for example, pocket ionization chambers, when the monitor of record is a film badge, thermoluminescent dosimeter (TLD), or optically stimulated dosimeter (OSD's).
2. All individuals who are occupationally exposed to ionizing radiation on a regular basis will be issued a film badge, TLD, OSD's, or other approved whole body monitor. The device should be processed by a contract service on a monthly basis if they exceed 500 millirem per quarter. Those licensees whose employees receive exposures of less than 500 millirem a quarter may request to extend the exchange frequency upon agency approval. To receive approvals submit a notification with the following information:
 - Supporting documentation that confirms that no employee will exceed 500 millirem/ quarter; and
 - Proposed frequency of exchange.
3. All individuals who, on a regular basis, handle radioactive material that emits ionizing radiation will be issued a film or TLD finger monitor. The device will be processed by a contract service on a monthly basis if they exceed 500 millirem per quarter. Those licensees whose employees receive exposures of less than 500 millirem a quarter may request to extend the exchange frequency upon agency approval. To receive approvals provide the following information:
 - Supporting documentation that confirms that no employee will exceed 500 millirem/ quarter; and
 - Proposed frequency of exchange.
4. All individuals who are exposed to radiation on an occasional basis will not normally be issued exposure monitors. Examples of such personnel are service personnel who deliver packages, secretarial personnel who work in the nuclear medicine clinic but do not work with patients, and nurses who occasionally care for patients who have received diagnostic dosages.
5. Submit the name, address, and license number of the company who will process the personnel monitoring as part of this procedure.

6. Instructions will be given to all employees about how and where dosimetry devices are to be stored when not in use. The storage place should be cool and dry.
7. In accordance with 40.15(6), the licensee must consider the dose that an individual may receive in the current year from all sources of employment where the individual's assigned duties involve exposure to sources of radiation.
8. If an individual's monitor is lost, the licensee needs to perform and document an evaluation of the dose the individual received and add it to the employee's dose record. Some methods for estimating an individual's dose, depending on the types of work, include:
 - Use his or her recent dose history.
 - Use doses of coworkers as the basis for the dose estimate (nonroutine types of work).
 - Use modeling and calculation (i.e. reconstruction) of scenarios leading to dose.
9. In accordance with 40.112, the licensee shall provide an annual radiation exposure report to monitored individuals under 40.37 if the individual's occupational dose exceeds 100 mrem TEDE, 100 mrem to any individual organ or tissue, or the individual requests the individual's annual dose report. This report shall contain all of the information described in 40.112.

MODEL PROGRAM FOR INTERNAL EXPOSURE

Licensees are required to monitor occupational intake of radioactive material and assess the resulting dose if it appears likely that personnel will receive in one (1) year an intake in excess of 10 percent of the applicable ALI in Table I, Columns 1 and 2, of Appendix B to Chapter 40.

The types and quantities of radioactive material manipulated at most medical facilities do not provide a reasonable possibility for an internal intake by workers. However, uses such as preparing a radioiodine capsule from liquid solutions, and opening and dispensing radioiodine from vials containing millicurie quantities, require particular caution. To monitor internal exposures from such operations, a routine bioassay program to periodically monitor workers should be established. **Commit to performing a bioassay for any liquid Iodine-131 administration, or any abnormal incident involving a compromised capsule (i.e. crushed, ruptured, vomited, etc.) with millicurie quantities of Iodine-131.**

If it is determined that a program for performing thyroid uptake bioassay measurements is necessary, a program should be established and include:

- Adequate equipment to perform bioassay measurements.
- Procedures for calibrating the equipment, including factors necessary to convert counts per minute into μCi units.
- Intervals between assays, differentiating between routine and special bioassays.
- Action levels
- The actions to be taken at those levels.

Pursuant to 40.16, "Compliance with requirements for summation of external and internal doses," the external and internal doses must be summed, if required to monitor both under 40.37. Records of measurement data, calculations of intakes, and methods for calculating dose must be maintained as required by 40.86.

APPENDIX E

MODEL TRAINING PROGRAM

In addition to 641-40.111 and 641-41.2(8)"b"(2)

The following guidance may be used to develop a training program. If you use the frequency and subject listings to develop your training program, you may say on your application, "We will establish and implement the model training program that was published in Appendix E to IDPH MEDICAL USE OF RADIOACTIVE MATERIAL FOR DIAGNOSTIC AND THERAPEUTIC PROCEDURES." You may use lectures, videotaped presentations, or demonstrations, for example, as methods of training.

If you prefer, you may develop your own training program for review. If you do so, you should consider for inclusion all the features in the model program and carefully review the requirements of 641-40.111. Say on your application, "We have developed a training program for your review that is appended as Appendix E." Be sure to include the groups of workers, the method of their training, and the frequency of training.

It may not be assumed that prior occupational training, board certification, etc have adequately covered safety instructions. Site-specific training should be provided for all workers. Ancillary personnel (e.g., nursing, clerical, housekeeping, security) whose duties may require them to work near radioactive material (whether escorted or not) need to be informed about radiation hazards and appropriate precautions. A training program that provides necessary instruction should be written and implemented.

MODEL PROGRAM

Personnel to be instructed:

1. All workers that might receive an occupational dose.
2. Ancillary personnel (e.g. nursing, clerical, housekeeping, security) whose duties may require them to work near radioactive material.

Frequency of instruction:

1. Before assuming duties with, or in the vicinity of, radioactive materials.
2. During annual refresher training.
3. Whenever there is a significant change in duties, regulations, or the terms of the license.

Instruction for individuals in attendance will include the following subjects in addition to 40.111:

1. Applicable regulations and license conditions.
2. Licensee's in-house work rules.
3. Locations where the licensees have posted or made available notices, copies of pertinent regulations, and copies of pertinent licenses and license conditions (including applications and applicable correspondence), as required by 641-40.110.
4. Question and answer period.
5. Record of date of program, subject and attendees.

APPENDIX F

MODEL RADIATION SAFETY COMMITTEE CHARTER

In addition to 641-41.2(8), 41.2(9), and 41.2(10)

You may use the following text as it appears here, saying on your application, "We will issue the model Radiation Safety Committee Charter and Radiation Safety Officer Delegation of Authority that was published in Appendix F to IDPH MEDICAL USE OF RADIOACTIVE MATERIAL FOR DIAGNOSTIC AND THERAPEUTIC PROCEDURES". Include the signed Delegation of Authority shown on the following page.

If you prefer, you may develop your own statement of authority, duties, administrative procedures, and delegation of authority. If you do so, you should consider for inclusion all the features in the model text and carefully review the requirements of 641-41.2(8) and (9) and 41.2(10). Say on your application, "We will issue the Radiation Safety Committee Charter and Radiation Safety Officer Delegation of Authority that are appended as Appendix F," and submit your charter and Delegation of Authority shown on the following page.

MODEL CHARTER CHARGE -- The Committee shall:

1. Ensure that licensed material will be used safely. This includes review as necessary of training programs, equipment, facility, supplies, and procedures.
2. Ensure that licensed material is used in compliance with IDPH regulations and the institutional license.
3. Ensure that the use of licensed material is consistent with the ALARA philosophy and program;
4. Establish a table of investigational levels for individual occupational radiation exposures; and
5. Identify program problems and solutions.

RESPONSIBILITIES -- The Committee shall:

1. Be familiar with all pertinent IDPH regulations, the license application, the license, and the amendments. Ensure that the by-product material license is amended, if required, before any changes in facilities, equipment, policies, procedures, and personnel.
2. Review the RSO's summary report of the radiation safety program at least annually. The review should be sufficient to determine that all activities are being conducted safely, in accordance with IDPH regulations and the conditions of the license, and consistent with the ALARA program and philosophy. The review should include an examination of records, reports from the RSO, results of IDPH inspections, written safety procedures, and the adequacy of the management control system.
3. Recommend remedial action to correct any deficiencies identified in the radiation safety program
4. Support the RSO when it is necessary for the RSO to assert authority. If the RSC has overruled the RSO, it will record the basis for its action in the minutes of the quarterly meeting.
5. Perform a quarterly review of occupational radiation exposure with particular attention to instances in which the investigational levels in Table 1 of Appendix A are exceeded. The principal purpose of this review is to assess trends in occupational exposure as an index of the ALARA program quality and to decide if action is warranted when investigational levels are exceeded.
6. Delegate authority to the Radiation Safety Officer (RSO) by submitting the following as part of Appendix F:

MANAGEMENT shall:

1. Management may appoint alternate members to participate in meetings in the case of absence of principal members and should consider appointing as adjunct representatives from security, physical plant, housekeeping, and other departments. Adjunct members should abstain from balloting on radiation safety questions.
2. To the extent that they do not interfere with the mission of the Committee, management may assign other responsibilities such as x-ray radiation safety, quality assurance oversight, and research project review and approval.

APPENDIX G

RESERVED

APPENDIX H

MODEL PROCEDURE FOR LEAK-TESTING SEALED SOURCES

In addition to 641-41.2(21)

As a licensee, you must perform leak testing of sealed sources according to 641-40.32. The IDPH requires tests to determine whether or not there is any leakage from the radioactive source. The leak test should be performed at 6-month intervals unless otherwise authorized by your license.

The options for leak testing are:

1. Engage the services of a consultant or commercial facility to take samples, evaluate the samples, and report the results to you.
2. Take the sample using a commercial leak-test kit and send the sample to the kit supplier who reports the results to you.
3. Perform the test and analysis yourself.

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

For Option 2, specify the kit model number and the name, address, and license number of the kit supplier and company who will analyze the samples. Commit to Appendix H.1 or submit your own procedures.

For Option 3, describe the procedure for taking the test sample. Identify the instrumentation that will be used for measurement. An instrument capable of making quantitative measurements should be used. Hand-held survey meters will not normally be considered adequate for these measurements. Include the minimum sensitivity for the instrument used for analysis and a sample calculation for conversion of the measurement data to microcuries. You should also specify the individual who will make the measurement and his or her qualifications. The individual should have prior experience in making quantitative measurements, and this experience should be documented in your application.

You may use the following model procedure to leak-test sealed sources. If you follow the model procedure you may say on your application, "We will establish and implement the model procedure for leak-testing sealed sources that was published in Appendix (H.1 and/or H.2) to IDPH MEDICAL USE OF RADIOACTIVE MATERIAL FOR DIAGNOSTIC AND THERAPEUTIC PROCEDURES."

You may develop your own procedure for review. If you do so, you should consider for inclusion all the features in the model and carefully review the requirements of 641-41.2(21). Say on your application, "We have developed a leak-test procedure for your review that is appended as Appendix H," and submit your leak-test procedure.

H.1. MODEL PROCEDURE FOR TAKING TEST SAMPLES (IN ADDITION TO 41.2(21))

(Option 2)

1. Make a list of all sources to be tested. This should include identifying information, such as sealed source serial number, manufacturer, model number, radionuclides, and activity.
2. If you will be testing sources stronger than a few millicuries, set out a survey meter, preferably with a speaker, so you can monitor your exposure rate.
3. Wear gloves and prepare a separate wipe sample for each source. A cotton swab, injection prep pad, filter paper, or tissue paper is suitable. Number each wipe so you will know for which source it is to be used. Samples should be taken as follows:
 - a. For small sealed sources, it may be easier to wipe the entire accessible surface area. Pay particular attention to seams and joints. However, do not wipe the port of beta applicators.
 - b. For larger sealed sources and devices (survey meter calibrator, bone mineral analyzer source), take the wipe near the radiation port and on the activating mechanism
 - c. If you are testing radium sources, you should also check for radon leakage. Submerging the source in a gas tight container or vial of fine-grained charcoal or cotton for a day (24 hours) can

do this. Then remove the source and immediately analyze the absorbent sample as described below. A survey should be done to be sure that sources are adequately shielded during the leak-test period.

H.2. MODEL PROCEDURE FOR ANALYZING TEST SAMPLES

(Option 3)

1. Select an instrument that is sufficiently sensitive to detect the levels in 40.32. For beta sources, a proportional flow counter, liquid scintillation counter, or thin-end-window GM survey meter may be appropriate. For gamma sources, a GM instrument or a scintillation detector with a ratemeter or scaler may be appropriate. Dose calibrators used in nuclear medicine are not sufficiently sensitive.
2. To estimate the detection efficiency of the analyzer used to assay the wipe samples, assay a check source (standard) that is the same isotope and whose activity the supplier certifies. If one is not available, it will be necessary to use a certified check source with a different isotope that has a similar spectrum.
3. Calculate the counting efficiency of the detector.

$$\text{Efficiency in cpm/A} = \frac{[(\text{cpm from std}) - (\text{cpm from bkg})]}{\text{Activity (A) of std in Bq}}$$

Where cpm = counts per minute
 std = standard
 bkg = background
 Bq = Becquerel (1 dps = 1 Bq = 2.7E-8 millicuries)
 1 min. = 60 seconds

4. If the sensitivity of the counting system is unknown, determine the minimum detectable activity (MDA). The MDA may be determined using the following formula (assuming the sample and background counting times are the same):

$$\text{MDA} = \frac{2.71 + 4.65\sqrt{\text{bkg}} \times t}{t \times E}$$

Where: MDA = minimum detectable activity in disintegrations per minute (dpm)
 bkg = background count rate in counts per minute (cpm)
 t = background count time in minutes
 E = detector efficiency in counts per disintegration

If calculations demonstrate that the instrument is not sufficiently sensitive to detect 0.005 microcuries, a different instrument must be used. Note: 1 Bq = 1 dps = 2.7E-8 millicuries. or 0.005 microcuries = 185 Bq,

3. Assay the wipe sample. It must be in the same geometry relative to the detector as was the certified check source.
4. Record the wipe sample in counts per minute. Then calculate and record the estimated activity in microcuries on the wipe sample:

$$\text{Activity of sample (Bq)} = \frac{[(\text{cpm from wipe sample}) - (\text{cpm from bkg})]}{\text{Efficiency in cpm/Bq}}$$

5. Continue the same analysis procedure for all wipe samples.
6. If the wipe sample activity is 0.005 microcurie or greater, notify the RSO. The source must be withdrawn from use to be repaired or disposed of in accordance with IDPH rules.
7. Record model number and serial number (if assigned) of each source tested, radionuclide and estimated activity, measured activity of each test sample in microcuries, description of method used to test each sample, date of test, and signature of RSO. Maintain records for five (5) years.

APPENDIX I

MODEL RULES FOR SAFE USE OF RADIOPHARMACEUTICALS

In addition to 641-41.2 and 40.61

You may use the following model rules as they appear here, saying on your application, "We will establish and implement the model safety rules published in Appendix I to IDPH MEDICAL USE OF RADIOACTIVE MATERIAL FOR DIAGNOSTIC AND THERAPEUTIC PROCEDURES."

If you prefer, you may develop your own rules for safe use of radiopharmaceuticals for review. If you do so, you should consider for inclusion all the items in the model rules and carefully review the requirements of 641-41.2. Say on your application, "We have developed rules for the safe use of radiopharmaceuticals for your review that is appended as Appendix I," and submit your model rules for the safe use of radiopharmaceuticals.

MODEL RULES

1. Protective clothing is to be worn at all times during the preparation, assay, and injection of radiopharmaceuticals. Wear long-sleeved laboratory coats, long pants, and closed toe and heel shoes in all areas where radioactive materials are being used. The protective clothing concept is for at least one protective layer over your skin in the event of a spill.
2. Wear disposable gloves at all times while handling radioactive materials.
3. Before leaving the restricted area, monitor your hands for contamination in a low-background area with an appropriate survey instrument.
4. Use syringe shields in accordance with to 41.2(22) and (23) for routine preparation of multi-dose vials and administration of radiopharmaceuticals to patients, except in those circumstances in which their use is contraindicated (e.g., recessed veins or infants). In these exceptional cases, consider the use of other protective methods such as remote delivery of the dose (e.g., through use of a butterfly valve so syringe shields can still be used).
5. Do not eat, drink, smoke, or apply cosmetics in any area where radioactive material is stored or used.
6. Do not store food, drink, or personal effects in areas where radioactive material is stored or used.
7. Wear personnel monitoring devices at all times while in areas where radioactive materials are used or stored. These devices should be worn as prescribed by the Radiation Safety Officer. When not being worn to monitor occupational exposures, personnel monitoring devices should be stored in the work place in a designated low-background area.
8. Wear a finger exposure monitor while handling radioactive material including during the elution of generators; during the preparation, assay, and injection of radiopharmaceuticals; and while in contact with patients that have been administered radiopharmaceuticals.
9. Dispose of radioactive waste only in designated, labeled, and properly shielded receptacles.
10. Never pipette by mouth.
11. Wipe-test by-product material, preparation and administration areas daily for contamination and each week where radioactive materials are stored. If necessary, decontaminate or secure the area for decay.
12. With a radiation survey meter, survey the generator storage, kit preparation, and injection areas daily for contamination. If necessary, decontaminate or secure the area for decay as appropriate.

13. Confine radioactive solutions in shielded containers that are clearly labeled. Multi-dose diagnostic vials and therapy vials should be labeled with the isotope, the name of the compound, and the date and time of receipt or preparation.
14. A log should be used to record additional information such as:
 - the total prepared activity,
 - specific activity (in mCi/cc) at a specified time,
 - total volume prepared,
 - the measured activity of each patient dosage, and
 - any other appropriate information.
15. Syringes and unit dosages should be labeled with the radiopharmaceutical name or abbreviation, type of study, or the patient's name.
16. Assay each patient dosage in the dose calibrator before administration. Only use a dosage that differs by more than 20 percent of the prescribed dosage with approval of an authorized user (except for prescribed dosages of less than 30 microcuries). When measuring the dosage, the radioactivity that adheres to the syringe wall or remains in the needle does not need to be considered.
17. Check the patient's name, the prescribed radionuclide, and the dosage before each administration to ensure it is in accordance with the approved procedure or written directive.
18. Always keep flood sources, syringes, waste, and other radioactive material in shielded containers.
19. Because sources with even small amounts of radioactivity exhibit a high dose rate on contact, you should use a cart or wheelchair to move flood sources, waste, and other radioactive material.
20. Secure all licensed material when not under the constant surveillance and immediate control of an individual authorized under the Iowa specific license (or such individual's designee).

APPENDIX J

MODEL SPILL PROCEDURES

In addition to 641-41.2 and 40.61(4)

You may use the following model procedures as they appear here, saying on your application, "We will establish and implement the model spill procedure published in Appendix J to IDPH MEDICAL USE OF RADIOACTIVE MATERIAL FOR DIAGNOSTIC AND THERAPEUTIC PROCEDURES."

If you prefer, you may develop your own spill procedures for review. If you do so, you should consider for inclusion all the items in the model procedures. Say on your application, "We have developed spill procedures for your review that are appended as Appendix J" and submit your spill procedures.

MODEL PROCEDURES

MINOR SPILLS OF LIQUIDS AND SOLIDS

1. Notify persons in the area that a spill has occurred.
2. Prevent the spread of contamination by covering the spill with absorbent material.
3. Clean up the spill by wiping from the perimeter of the spill to the center of the spill using disposable gloves and absorbent paper. Carefully fold the absorbent paper with the clean side out and place in a plastic bag labeled "Caution, Radioactive Material" for transfer to a radioactive waste container. Also put contaminated gloves and any other contaminated disposable material in the bag.
4. Survey the area with a low-range radiation detector meter. Check the area around the spill.
5. Survey for removable contamination to ensure contamination levels are below trigger levels.
6. Continue to clean up the spill and resurvey until radiation levels and removable contamination are below trigger levels.
7. Survey hands, clothing, and shoes for contamination prior to leaving the area.
8. Report the incident to the RSO promptly and follow any additional instruction.
9. The RSO will review the Radioactive Spill Contamination Survey records for trends, and as appropriate, determine cause and corrective actions needed; consider bioassay if licensed material may have been ingested, inhaled, or absorbed through the skin.

MAJOR SPILLS OF LIQUIDS AND SOLIDS

1. Clear the area. Notify all persons not involved in the spill to vacate the room
2. Prevent the spread of contamination by covering the spill with absorbent paper, but do not attempt to clean it up. To prevent the spread of contamination, clearly indicate the boundaries of the spill and limit the movement of all personnel who may be contaminated.
3. Shield the source if possible. This should be done only if it can be done without further contamination or a significant increase in radiation exposure.
4. Close the room and lock or otherwise secure the area to prevent entry. Post the room with a sign to warn anyone trying to enter that a spill of radioactive material has occurred.
5. Notify the RSO immediately.
6. Decontaminate personnel by removing contaminated clothing. Flush the contaminated skin with lukewarm water. Wash the affected area with mild soap. If contamination remains, induce perspiration by covering the area with plastic. Then wash the affected area again to remove any contamination that was released by the perspiration.
7. Cooperate and follow the instructions of the RSO.

MAJOR SPILLS AND MINOR SPILLS

The decision to implement a major spill procedure instead of a minor spill procedure depends on many incident-specific variables. These variables include the number of individuals affected, other hazards present, likelihood of spread of contamination, and types of surfaces contaminated as well as the radiotoxicity of the spilled material. For some spills of short-lived radionuclides, the best spill procedure may be restricted access pending complete decay.

TABLE J-1

Relative Hazards of Common Radionuclides

Estimate the amount of radioactivity spilled. Initiate a major spill procedure based on the following dividing line. Spills above these millicurie amounts are considered major, Spills below the amounts shown below are considered minor.

Relative Hazards of Common Radionuclides			
Radionuclide	mCi*	Radionuclide	mCi*
Fluorine-18	10	Technetium-99m	100
Gallium-67	10	Indium-111	10
Rubidium-82	10	Iodine-123	10
Strontium-82	1	Iodine-131	1
Strontium-89	1	Thallium-201	100
Yttrium-90	1	Alpha emitters	*

*For radiopharmaceuticals where the primary emission is Alpha, consider implementing major spill precautions.

APPENDIX K

MODEL GUIDANCE FOR ORDERING AND RECEIVING RADIOACTIVE MATERIAL

In addition to 641-40.65 and 641-41.2(11)"b"

You may want to use the following guidance to control the ordering and receipt of radioactive material. If you follow all the guidance, you may say on your application, "We will establish and implement the model guidance for ordering and receiving radioactive material that was published in Appendix K to IDPH MEDICAL USE OF RADIOACTIVE MATERIAL FOR DIAGNOSTIC AND THERAPEUTIC PROCEDURES."

If your procedure does not follow all the guidance in the model, you may develop your own procedure for review. If you do so, you should include 641-40.65 and 641-41.2(11)"b". Say on your application, "We have developed a procedure for ordering and receiving radioactive material that is appended as Appendix K," and submit your procedure.

MODEL GUIDANCE

1. The Radiation Safety Officer (RSO) or a designee shall ensure that the requested materials and quantities are authorized on the license. The material and quantity must also be approved for the requesting authorized user. Checks should be made to ensure that possession limits are not exceeded.
2. The RSO will establish and maintain a system for ordering and receiving radioactive material. The system must contain the following information:
 - a. For routinely used materials:
 - (1) Written records identifying the authorized user or department, isotope, chemical form, activity, and supplier
 - (2) Verification that material received was ordered through proper channels.
 - b. For occasionally used materials (e.g., therapeutic dosages):
 - (1) The authorized user who will perform the procedure will make a written request to confirm that the material received is what was ordered.
 - (2) The person who receives the material will check the physician's request to confirm that the material received is what was ordered.
3. For deliveries during normal working hours, the RSO shall instruct carriers to deliver radioactive packages directly to specified areas.
4. For deliveries during off-duty hours, the RSO shall instruct security personnel or other designated persons to accept delivery of radioactive packages in accordance with procedures outlined in the sample memorandum below.

SAMPLE MEMORANDUM

MEMO TO: Chief of Security

FROM: Radiation Safety Officer

SUBJECT: Receipt of Packages Containing Radioactive Material

The security guard on duty shall accept delivery of packages containing radioactive material that arrives during other than normal working hours. Packages should be placed on a cart or wheelchair and taken immediately to the Nuclear Medicine Department, Room _____. Unlock the door, place the package on top of the counter, and re-lock the door.

If the package appears damaged or leaking, you should immediately contact one of the individuals identified below. Ask the carrier to remain at the hospital until it can be determined that the driver and the delivery vehicle are not contaminated.

If you have any questions concerning this memorandum, please call our hospital Radiation Safety Officer, _____, at extension _____.

Name

Home Telephone

Radiation Safety Officer:

Chief of Nuclear Medicine:

Chief of Nuclear Medicine Technologist: _____

Nuclear Medicine Technologist on call
(Call page operator at extension _____)

Nuclear Medicine Physician on call
(Call page operator at extension _____)

APPENDIX L

MODEL PROCEDURE FOR SAFELY OPENING PACKAGES CONTAINING RADIOACTIVE MATERIAL

In addition to 641-40.65 and 39.5

You may use the following model procedure for opening packages. If you follow the model procedure, you may indicate on your application, "We will establish and implement the model procedure for opening packages that was published in Appendix L to IDPH MEDICAL USE OF RADIOACTIVE MATERIAL FOR DIAGNOSTIC AND THERAPEUTIC PROCEDURES."

If your procedure does not follow all the guidance in the model, you may develop your own procedure for review. If you do so, you should consider for inclusion 641-40.65 and 39.5. Indicate on your application, "We have developed a procedure for safely opening packages containing radioactive material that is appended as Appendix L," and submit your procedure.

MODEL PROCEDURE

1. All shipping packages received and known to contain radioactive material must be monitored for radiation levels and radioactive surface contamination as soon as practicable after receipt of the package, but no more than 3 hours after receipt during normal business hours, or no later than 3 hours from the beginning of the next working day if received after working hours according to 40.65.
2. The following procedure for opening each package will be followed:
 - a. Put on gloves to prevent hand contamination.
 - b. Visually inspect the package for any sign of damage (e.g., wet or crushed). If damage is noted, stop the procedure and notify the Radiation Safety Officer (RSO).
 - c. Measure the exposure rate from the package at one (1) meter and at the package surface. If it is more than 10 millirem per hour at three (3) feet (1 meter), stop and notify the RSO. (The "transport index" noted on packages with "Yellow II" or a "Yellow III" label is the approximate dose rate, in millirem per hour, at one (1) meter from the package surface).
 - d. Measure the dose rate on the surface of the package. The surface dose rate for such packages should not exceed 200 millirem per hour at any point on the package. The dose rate from packages with "White I" labels should be less than 0.5 millirem per hour on the external surface of the package.

Transport index (TI)	Max. radiation level at any point on the external surface (mrem/hr)	Label category	Example
0*	Less than or equal to 0.5.	White I	
More than 0 but less than 1	Greater than 0.5 but less than or equal to 50.	Yellow II	
More than 1 but less than 10	Greater than 50 but less than or equal to 200.	Yellow III	

* If the measured TI is not greater than 0.05, the value may be considered to be zero (0)

- e. Wipe the external surface of the package, approximately 300 square centimeters in the most appropriate location to detect contamination. The amount of radioactivity measured on any single wiping material when averaged over the surface wiped, must not exceed the following limits:

Table L-2: Non-Fixed External Radioactive Contamination Limits for Packages	
Containment:	Maximum Permissible Limit:
Beta & gamma emitters and low toxicity alpha emitters	240 dpm/cm ²
All other alpha emitting radionuclides	24 dpm/cm ²

- f. Immediately notify the final delivery carrier and IDPH when the limits of Table L-2, or 10 CFR 71.47 are exceeded.
- g. Open the package with the following precautionary steps:
- (1) Remove packing slip.
 - (2) Open outer package following the supplier's instructions, if provided.
 - (3) Verify that the contents agree with the packing slip.
 - (4) Check the integrity of the final source container. Look for broken seals or vials, loss of liquid, condensation, or discoloration of the packing material.
 - (5) If anything is other than expected, stop and notify the RSO.
- h. If there is any reason to suspect contamination, wipe the external surface of the final source container and remove the wipe sample to a low-background area. Assay the wipe sample to determine if there is any removable radioactivity. (The licensee should specify in the procedure manual which instrument, for example, a thin-end-window GM survey meter, a NaI(Tl) crystal and ratemeter, a liquid scintillation counter, or a proportional flow counter, should be used for these assays. The detection efficiency must be determined to convert wipe samples counts per minute to disintegrations per minute. Note that a dose calibrator is not sufficiently sensitive for this measurement.) Take precautions against the potential spread of contamination.
- i. Check the user request to ensure that the material received is the material that was ordered.
- j. Monitor the packing material and the empty packages for contamination with a survey meter before discarding.
- (1) If contaminated, treat this material as radioactive waste.
 - (2) If not contaminated, remove or obliterate the radiation labels before discarding it.
- k. Make a record of the receipt, package survey, and wipe test results.
3. For packages received under the general license in 641-39.4(22)"i", the following procedure for opening each package will be followed.
- a. Visually inspect the package for any sign of damage (e.g., wet or crushed). If damage is noted, stop the procedure and notify the RSO.
 - b. Check to ensure that the material received is the material that was ordered.

APPENDIX M

RECORDS OF BY-PRODUCT MATERIAL USE

GENERAL

Many suppliers include pressure-sensitive stickers or forms that have much of the information required by the regulations. You may use these in your records and need not duplicate the information on them. Be sure to write down whatever additional information is required but is not cued or printed on them. Information does not have to replicate entries. For example, if you prepare a multi-dose vial for use one day, you do not have to record the date each time you draw a dose from it. If you take thirty Ir-192 seeds that are 0.5 millicuries each, you do not have to list each seed individually.

M.1. RECORDS OF UNIT DOSAGE USE in addition to 641-40.90 and 41.2(19)

You may use the following model procedure to keep a record of unit dosage use. If you will follow the model procedure, you may indicate on your application, "We will establish and implement the model procedure for a unit dosage record system that was published in Appendix M.1 to IDPH MEDICAL USE OF RADIOACTIVE MATERIAL FOR DIAGNOSTIC AND THERAPEUTIC PROCEDURES."

If you prefer, you may develop your own unit dosage record system for review. If you do so, you should consider for inclusion all the features in the model procedures in the model procedure and carefully review the requirements of 641-40.90 and 41.2(19). Indicate on your application, "We have developed a procedure for a unit dosage record system for your review that is appended as Appendix M.1" and submit your unit dosage record procedure.

MODEL PROCEDURE

For each unit dosage received from a supplier, make a record of the:

1. Radionuclide;
2. Generic name or its abbreviation or trade name;
3. Date of receipt;
4. Supplier;
5. Lot number or control number, if assigned, and expiration date;
6. Activity in millicuries or microcuries as recorded on the unit dosage or packing slip and its associated time;
7. If administered,
 - a. Prescribed dosage (unless already recorded in clinical procedure manual),
 - b. Measured activity in millicuries or microcuries and date and time of assay and administration,
 - c. Patient name and identification number if one has been assigned;
8. If discarded, the date and method of disposal; and
9. Initials of the individual who performed the assay.
10. Maintain record of three (3) years.

M.2. RECORDS OF MULTI-DOSE VIAL USE in addition to 641-40.90 and 41.2(19)

You may use the following model procedure to keep a record of multi-dose vial use. If you will follow the model procedure, you may say on your application, "We will establish and implement the model procedure for a multi-dose vial record system that was published in Appendix M.2 to IDPH MEDICAL USE OF RADIOACTIVE MATERIAL FOR DIAGNOSTIC AND THERAPEUTIC PROCEDURES."

If you prefer, you may develop your own multi-dose vial record system for review. If you do so, you should consider for inclusion all the features in the model system and carefully review the requirements of 641-40.90 and 41.2(19). Say on your application, "We have developed a procedure for a multi-dose vial record system for your review that is submitted as Appendix M.2" and submit your multi-dose vial record procedure.

MODEL PROCEDURE

For each multi-dose vial that you receive from a supplier or that you prepare, make a record of the:

1. Radionuclide;
2. Generic name or its abbreviation or trade name;
3. Date of receipt or preparation;
4. Date and time of initial assay and amount in both millicuries and cubic centimeters (cc) or milliliters (ml);
5. Supplier or kit manufacturer;
6. If administered,
 - a. Prescribed dosage (unless already recorded in clinical procedure manual),
 - b. Date and time dosage was drawn and measured,
 - c. Calculated volume that is needed for the prescribed dosage,
 - d. Measured activity in millicuries or microcuries,
 - e. Patient name and identification number if one has been assigned;
7. If discarded, the method of disposal and date; and
8. Initials of the individual who performed the assay.
9. Maintain record of three (3) years.

M.3. MEASURING AND RECORDING MOLYBDENUM CONCENTRATION (641-41.2(34))

The regulations require that each licensee who uses a technetium generator to prepare radiopharmaceuticals must test each elution or extraction for its molybdenum concentration. (This does not have to be done when using radiopharmaceuticals obtained from a distributor.) This measurement is usually made with a dose calibrator. Licensees may not administer radiopharmaceuticals that contain more than 0.15 microcurie of Mo-99 per millicurie of Tc-99m at the time of administration. If an elution or extraction has a higher concentration, there may be a manufacturing defect. If so, it should be reported according to 641-41.2(34)"d."

The model procedure for measuring molybdenum concentration is based on the use of a "molybdenum breakthrough pig." Your dose calibrator manufacturer will usually supply, as an option, a molybdenum breakthrough pig made of lead. The pig is usually thick enough to shield all the technetium photons but only a fraction of the molybdenum photons. The manufacturer will specify the Mo-99 correction factor to convert the measured Mo-99 to total Mo-99.

The following model procedure may be used to measure the molybdenum concentration in Mo-99/Tc-99m generator elution. If you will follow the model procedure, you may say on your application, "We will establish and implement the model procedure for measuring and recording molybdenum concentration that was published in Appendix M.3 to IDPH MEDICAL USE OF RADIOACTIVE MATERIAL FOR DIAGNOSTIC AND THERAPEUTIC PROCEDURES."

If you prefer, you may develop your own molybdenum concentration procedure for review. If you do so, you should consider the inclusion of all the features in the model procedure and carefully review the requirements of 641-41.2(34). Say on your application, "We have developed a procedure for measuring and recording molybdenum concentration for your review that is appended as Appendix M.3" and submit your procedure for measuring and recording molybdenum concentration.

MODEL PROCEDURE

Each time a generator is eluted, make records of the items required by 41.2(34)"c":

In addition to 41.2(34)"c", record:

1. Date the generator was received.
2. Product of the measured Mo-99 activity and the correction factor. This is noted by the manufacturer.
3. Maintain record of three (3) years.

RECOMMENDED ACTION LEVEL -- An action level of 0.07 allows for the decay of the Tc-99m throughout the day of use. It is assumed that the material will be used within six (6) hours, at which time the concentration of Mo-99 to Tc-99m would have doubled.

In conformance with 641-41.2(34)"d", the licensee must notify the IDPH if a leaking generator is detected.

M.4. INVENTORY OF IMPLANT SOURCES in addition to 641-41.2(46)

You may use the following model procedure to keep an inventory and use record for implant sources. If you will follow the model procedure, you may say on your application, "We will establish and implement the model procedure for keeping an inventory of implant sources that was published in Appendix M.4 to IDPH MEDICAL USE OF RADIOACTIVE MATERIAL FOR DIAGNOSTIC AND THERAPEUTIC PROCEDURES."

If you prefer, you may develop your own procedure for keeping an inventory and use record for implant sources. If you do so, you should consider for inclusion all the features in the model system and carefully review the requirements of 641-40.82, 40.90, and 41.2(46). State in your application, "We have developed a procedure for keeping an inventory of implant sources for your review that is appended as Appendix M.4." Submit your procedure for keeping an inventory and use record for implant sources.

MODEL PROCEDURES

1. Use a locking installed cabinet or safe to store all implant sources.
2. Make a list of names of those individuals you allow to handle the implant sources and have them initial beside their names.
3. For long-lived sources, draw a map of the storage drawer and indicate the activity of the source at each storage point. For short-lived sources that you store in the manufacturer's shipping container, indicate the area in the safe where you put the container. Also, be sure to add the sources to the inventory log.
4. Post the map and the list of individuals whom you permit to handle the sources in the storage area or on the inventory log.
5. Each time you return sources to storage, immediately count them to ensure that every source removed has been returned. Make appropriate records (41.2(46)).
6. If you ever perceive a discrepancy between the record and the number of sources in use and in storage, notify the RSO immediately.

APPENDIX N

MODEL PROCEDURE FOR AREA SURVEYS

In addition to 641-40.27 and 41.2(26)

You may use the following procedure to perform area surveys. If you follow this procedure, you may say on your application, "We will establish and implement the model procedure for area surveys that was published in Appendix N to IDPH MEDICAL USE OF RADIOACTIVE MATERIAL FOR DIAGNOSTIC AND THERAPEUTIC PROCEDURES."

You may develop your own procedure for review. If you do so, you should consider for inclusion all the features in the model procedure and carefully review the requirements of 641-40.27 and 41.2(26). Say on your application, "We have developed survey procedures for your review that are appended as Appendix N" and submit your survey procedures.

MODEL PROCEDURE

AMBIENT DOSE RATE SURVEYS in addition to 41.2(26)

1. Surveys -- Restricted Areas:

- a. Survey at the end of each day of use all areas where radiopharmaceuticals are routinely prepared for use or administered. If diagnostic administrations are occasionally made in patients' rooms (e.g. Tc-99m labeled bone scan, or heart agents) and special care is taken to remove all paraphernalia, those rooms need not be surveyed.
- b. Survey at least once each week all areas where radiopharmaceuticals or radioactive wastes are stored.
- c. In areas where only small quantities of gamma-emitting radioactive material are processed (less than 200 microcuries at a time), survey monthly with a radiation survey meter.
- d. In sealed source and brachytherapy storage areas, survey quarterly with a radiation survey meter.
- e. The wearer should survey protective clothing after use if significant contamination is possible. Contaminated clothing should be removed before leaving a restricted work area. Hands should be washed and surveyed. Personal clothing should also be surveyed before leaving the restricted areas. Any contamination above expected levels should be reported to the RSO.

2. Surveys -- Unrestricted Areas:

Quarterly surveys should be accomplished in areas

- Adjacent to restricted areas
- Through which radioactive materials are transferred
- Where radioactive material is temporarily stored before shipment.

More frequent surveys will be necessary if radiation levels are suspect.

3. Trigger levels for ambient radiation level surveys:

Trigger levels for ambient radiation level shall be established. If exceeded, would require the individual performing the survey to immediately notify the radiation safety officer, and follow instruction to responding and investigating the cause of the increase radiation level.

Examples of trigger levels for restricted and unrestricted areas are presented in Table N-1:

Type of Survey	Area Surveyed	Trigger Level
Ambient Dose Rate	Unrestricted	0.04 mR/hr
Ambient Dose Rate	Restricted	1.0 mR/hr

REMOVABLE CONTAMINATION SURVEYS in addition to 41.2(26)

Removable contamination is the amount of removable radioactive material per 100 cm² of surface area by wiping that area with a filter or soft absorbent paper, applying moderate pressure, and assessing the amount of radioactive material on the wipe with an appropriate instrument of known efficiency.

1. Survey Areas:

Survey for removable contamination each day of use all areas where radiopharmaceuticals are routinely prepared for use or administered and each week where radioactive materials are stored. If diagnostic administrations are occasionally made in patients' rooms (e.g. Tc-99m labeled bone scans, heart agents), with special care taken to remove all paraphernalia, those rooms need not to be surveyed.

Survey quarterly any area where the potential for spreading contamination is likely to occur, (cafeterias, snack bars, furniture and equipment). Random wipe testing of floors alone is acceptable for most unrestricted areas. If such surveys reveal that radioactive contamination is being transferred out of restricted areas, immediate decontamination of the area and corrective action should be taken to eliminate such transfers. Surveys that are more frequent should be conducted until a trend of negative results is again established.

2. The wipe sample assay procedure should be sufficiently sensitive to detect the presence of 2000 dpm/100 cm² of removable contamination (200-dpm/100 cm² for isotopes of iodine). You must use a radioactive source with a known amount of activity to convert sample measurements (usually in counts per minute or cpm to disintegrations per minute or dpm).
3. Immediately notify the RSO if you find levels that exceed the established action levels. Recommended removable surface contamination action levels are listed in Table N-2. Contamination found in unrestricted areas and on personal clothing will be immediately decontaminated to background levels. When it is not possible to decontaminate to background levels, the licensee must shield, post, and restrict from use.

Area, clothing	Restricted areas, protective clothing used only in restricted area	*Unrestricted area
Alpha emitters	200	20
Beta/Gamma emitters	2,000	200
*Licensee shall make a reasonable effort to decontaminate to background levels.		

RECORDS

1. Records must contain the information required by 41.2(26)"h", which includes the date of the survey, a sketch of each area surveyed, action levels established for each area, the measured dose rate at several points in each area expressed in millirem (microSievert) per hour or the removable contamination in each area expressed in disintegrations per minute (Becquerel's) per 100 square centimeters, the serial number and the model number of the instrument used to make the survey or analyze the samples, and the initials of the individual who performed the survey.
2. In those cases in which radiation or contamination action levels were exceeded, a follow-up survey shall be completed and recorded. The RSO shall promptly review and sign survey records that document the results of any actions implemented to correct the excessive radiation or contamination levels.
3. Maintain record of two (2) years.

APPENDIX O

MODEL PROCEDURE FOR MONITORING, CALCULATING, AND CONTROLLING AIR CONCENTRATIONS

In addition to 641-40.15, 16, 17, and 18; 41.2(29) and 41.2(35)

WORKER DOSE FROM NOBLE GASES (ITEM 11.13.1)

Noble gases such as xenon in the air present an external source of radiation exposure that must be calculated. Many commercially available dosimeters and survey instruments are not capable of accurately measuring worker doses from immersion in noble gases.

You may respond by saying "We will collect spent noble gas in a shielded trap and monitor the trap effluent with an air contamination monitor that we will check regularly according to the manufacturer's instructions."

If you are not monitoring trap effluent, you must estimate worker dose by calculation. If you exhaust spent gas to the atmosphere, you must also estimate worker dose by calculation. It is not necessary to submit the calculations, but you should keep them for IDPH review during inspections. If you will follow the model procedure for calculating worker dose from noble gases, you may respond by saying, "We will follow the model procedure for calculating worker dose from noble gases that was published in Appendix O, IDPH MEDICAL USE OF RADIOACTIVE MATERIAL FOR DIAGNOSTIC AND THERAPEUTIC PROCEDURES."

If none of the above applies, you may develop your own procedure for review. If you do so, you should consider all the above information and carefully review the requirements of 641-40.15, 16, 17, and 18, 41.2(29) and 41.2(35). Say on your application, "We have developed a procedure for monitoring worker dose due to submersion in noble gases that is appended as Appendix M," and append your procedure for monitoring worker dose from noble gases.

WORKER DOSE FROM AEROSOLS (ITEM 11.13.2)

You may respond by saying, "We will collect spent aerosol in a shielded trap and, for reusable traps, monitor the trap effluent with an air contamination monitor that we will check regularly according to the manufacturer's instructions." You do not have to monitor the trap effluent of single-use devices.

If you are not monitoring reusable trap effluent or if you are exhausting spent aerosol to the atmosphere, you must estimate worker dose by calculation. (You do not have to submit the calculations, but you should keep them for IDPH review during inspections.) If you follow the model procedure below for calculating worker dose from aerosols, you may respond by saying "We will follow the model procedure for calculating worker dose from aerosol concentrations that is appended as Appendix O.2." Submit your procedure for monitoring worker dose from aerosols.

O.1 MODEL PROCEDURE FOR CALCULATING WORKER DOSE FROM CONCENTRATIONS OF GASES AND AEROSOLS IN WORK AREAS

1. Determine the highest dose to an individual from all external radiation for the previous 12-month period by reviewing personnel monitoring records (film, TLD, OSD'S, etc.). If necessary, modify the dose to account for an anticipated increase or decrease in patient workload.
2. Modify the derived air concentration (DAC) for Xenon-133 (or other gas to be used) to allow for the estimated annual external exposure. A simplified method is to subtract the estimated external dose from the occupational dose limit of five (5) rem (50 mSv) and divide this number by five (5) rem.
 - a. This yields the fraction of the dose limit of five (5) rem that would still be permitted from internal sources. Multiplying this fraction by the DAC value yields a modified DAC. These DAC values are provided in Appendix B to Chapter 40 in Table 1, column 3.

- b. If the highest annual external dose is 2 rem, and the listed DAC value for xenon-133 is 1E-4 mCi/ml, then the modified DAC value should be based on 3 rem that could still be incurred from internal exposure.
3. The following calculations must be made:
- a. The sum of all measured exhaust rates and the sum of all measured supply rates. If the former is larger than the latter, this ensures that the imaging room is at negative pressure.
 - b. The estimated activity released to the restricted areas.
 - (1) The total activity released to the restricted area divided by the total air exhausted must be less than the applicable DAC for a restricted area. The total activity released to the restricted area is activity used each week multiplied by estimated fractional loss per study. The total air exhausted is the sum of all exhaust rates multiplied by the length of the workweek.
 - (2) If this is not the case, plan for fewer studies and do the calculations again. An increase in the ventilation rate will not significantly reduce the downwind effluent concentration because it is primarily a function of the natural dispersion in the atmosphere.

O.2 MODEL PROCEDURE FOR CALCULATING AIRBORNE EFFLUENT CONCENTRATION

- 1. Divide the total activity released to an unrestricted area (activity used each week that is released in an exhaust system) by the total volume of air exhausted over the week ("on" time multiplied by measured airflow rate). The quotient must be less than the applicable DAC value for an unrestricted area.
- 2. If this is not the case, plan for fewer studies and do the calculation again. Alternatively, you may consider collection and decay-in-storage for waste, or restriction of access to the release point and calculation of concentration at the boundary of the restricted area.

O.3 MODEL PROCEDURE FOR MONITORING OR CHECKING TRAP EFFLUENT

Charcoal traps can significantly reduce air contamination. They can also become saturated or be spoiled by improper use, humidity, chemicals, or inadequate maintenance.

- 1. If the trap effluent is continuously monitored by a radiation detector designed to monitor effluent gas, check the detector according to the manufacturer's instructions. Keep a record of the checks.
- 2. If you do not continuously monitor the trap effluent, check it on receipt and once each month. During one patient study, collect the effluent from the trap in a plastic bag and then monitor the activity in the bag by holding the bag against a camera. With the camera adjusted to detect the noble gas, compare its counts per minute (cpm) to background cpm with no other radioactivity in the area. Keep a record of the date, background cpm, and bag cpm. **If there is a significant increase in the activity measured on the bag, the trap must be replaced.**
- 3. The charcoal Xenon trap should be replaced at time intervals recommended by the manufacturer.

PUBLIC DOSE FROM AIRBORNE EFFLUENT (ITEM 11.13.3)

Effluent release presents a potential source of dose to the public. Usually a calculation of concentration at the release point is done and compared to the appropriate value of Table II of Appendix B to Chapter 641-40.

If you are not directly venting aerosols and gases to the atmosphere, you may respond by saying "We will not directly vent spent aerosols and gases to the atmosphere and, therefore, no effluent estimation is necessary."

If you are going to vent aerosols or gases to the atmosphere, you must estimate effluent concentrations by calculation. (You do not have to submit the calculations with your application, but you should keep them for IDPH review during inspections.) If you will follow the model procedure below for calculating release concentrations, you may respond by saying "We will follow the model procedure for calculating airborne effluent concentration that was published in Appendix O.3 to IDPH REGULATORY GUIDE."

If neither of the above applies, you may develop your own procedure for review. If you do so, you should consider all the above information and carefully review the requirements of 641-40.15, 16, 17, and 18, 41.2(29) and 41.2(35). Say on your application, "We have developed a procedure for monitoring airborne effluent concentration that is appended as Appendix O.3" and append your procedure for monitoring airborne effluent concentration.

SPILLED GAS CLEARANCE TIME (ITEM 11.13.4)

Because normal room ventilation is usually not sufficient to ensure clearance of spilled gas, the calculations described in Appendix O.4 should be done to determine for how long a room should be cleared in case of a gas spill. This clearance time should be posted in the room.

O.4 MODEL PROCEDURE FOR CALCULATING SPILLED GAS CLEARANCE TIME

1. Collect the following data:
 - a. A -- the highest activity of gas in a single container, in microcuries.
 - b. Measured airflow supply from each vent in the room (if different during heating and cooling seasons, use the lesser values), in milliliters per minute.
 - c. Q -- the total room air exhaust determined by measuring, in milliliters per minute, the airflow to each exhaust vent in the room. The exhaust should be vented and not re-circulated within the facility. This may be the normal air exhaust or a specially installed exhaust gas exhaust system
 - d. C -- the modified derived air concentrations (DAC) in restricted areas. These should be figured according to O.1. Numbers 1 and 2.
 - e. V -- the volume of the room in milliliters.
2. Make the following calculations for each room:
 - a. The airflow supply should be less than the airflow exhaust to ensure the room is at negative pressure.
 - b. The evacuation time $t = -V/Q \times \ln(C \times V/A)$.
3. The radiation levels in unrestricted areas from operations or releases of radionuclides in effluents are restricted to:
 - 2.0 mRem in any one (1) hour from external sources, and
 - 100 mRem in a year (Total Effective Dose Equivalent) for individual members of the public.

Depending on how the facility areas are controlled and monitored, hallway areas outside patient diagnostic areas will usually need to be limited to the radiation levels for unrestricted areas.

APPENDIX P

PATIENTS RECEIVING RADIOPHARMACEUTICAL THERAPY

In addition to 641-41.2(27) and 41.2(39)

You may use the following procedure for reducing worker and public dose during radiopharmaceutical therapy. If you will follow the model procedure, you may say on your application, "We will establish and implement the model procedure for radiation safety during radiopharmaceutical therapy that was published in Appendix P to IDPH MEDICAL USE OF RADIOACTIVE MATERIAL FOR DIAGNOSTIC AND THERAPEUTIC PROCEDURES."

If you prefer, you may develop your own procedure for review. If you do so, you should consider for inclusion all the features in the model procedure and carefully review the requirements of 641-41.2(27) and 41.2(39). Say on your application, "We have developed a procedure for radiation safety during therapeutic use of radiopharmaceuticals for your review that is appended as Appendix P" and include your procedure.

MODEL PROCEDURE

1. The patient's room will be as far away from the nursing station and heavy traffic hallways as is consistent with good medical care and still allow staff to control access. Access can be controlled by routine surveillance and by posting instructions for hospital staff and visitors at the entrance to the patient's room
2. Prepare the room for the procedure as follows:
 - a. Use the leak-proof absorbent paper to cover large surfaces (the bed, chairs, and the floor around the toilet) that are likely to be contaminated. Small items (telephone, doorknobs, bed remote control, television control, and nurse call cord) may be covered with absorbent paper or plastic bags.
 - b. Prepare separate boxes for linen, disposable waste, and for non-disposable contaminated items. Place a single large, re-closing plastic bag in each box, or supply several small plastic bags.
 - c. Prepare a station with disposable gloves and shoe covers (booties) outside the restricted area.
 - d. Prepare a station inside the restricted area, near the exit, for disposal of gloves and booties upon exiting the restricted area. All waste must be considered contaminated until surveyed and verified that it is not radioactive.
 - e. Determine whether urine will be discarded by release to the sanitary sewer or collected. If urine will be collected, prepare collection containers.
 - (1) Containers should be unbreakable and re-closing.
 - (2) If there is no need for assay or volumetric determination and urine will be decayed in storage, add to each container an absorbent such as vermiculite.
 - (3) To avoid room contamination in the case of a spill, place containers in a box or deep tray that has been lined with a plastic bag and absorbent paper or vermiculite.
 - (4) Supply a few half-value layers of shielding for each container. (For I-131, one half-value layer is approximately three (3) mm of lead.)
 - (5) Supply a wide-mouth anti-splash funnel.
 - f. Stock additional disposable gloves, absorbent paper, and radioactive waste, labels in the room for use as necessary by nursing, nuclear medicine, and radiation safety personnel.
3. Order disposable table service for the duration of the patient's stay. Inform the Housekeeping Office that personnel should stay out of the room until otherwise notified.
4. Supply the nurses with film badges, TLD's, OSD's, or pocket ionization chambers.
5. Brief the nurses on radiation safety precautions. Include instruction on entering and exiting the restricted area. The instruction should include wearing disposable gloves and booties upon entering the restricted area and the proper removal and disposal of those items upon exiting. A sample form is included in this regulatory guide. Allow time for questions and answers during the briefing. Leave a written copy of the radiation safety precautions in the patient's chart or at the nurses' station.

6. Limit laboratory testing as much as possible. If laboratory testing, such as blood testing and urinalysis, is not avoidable, provide radiation safety instruction to the laboratory personnel.
7. Brief the patient on radiation safety procedures for the dosage administration, visitor control, urine collection, radioactive waste, and other items as applicable.
8. Only those persons needed for medical, safety, or training purposes should be present during the administration.
9. Mark a visitor "safe line" on the floor with tape as far from the patient as possible.
10. Following administration of the dosage, measure the exposure rate in mR/hr at bedside, at one (1) meter from bedside, at the visitor's "safe line," and in the surrounding hallways and rooms to ensure compliance with 641-40.26. Record this and any other necessary information on the nursing instruction form or the nurses' dosimeter sign-out form. Post the room with a "Radioactive Materials" sign.
11. As the therapy proceeds, pick up waste for transfer to a decay-in-storage or decontamination area.
12. Do not release any patient until they have met the criteria of 641-41.2(27).
13. Before using the room for general occupancy, it must be decontaminated and released to the Admitting Office.
 - a. Remove all absorbent paper, and place it in the appropriate container.
 - b. Transfer all containers to a decay-in-storage or decontamination area.
 - c. Use a radiation detection survey meter to check for room contamination. Clean contaminated areas until removable contamination is less than 200-dpm/100 cm².
 - d. Call the Housekeeping Office to remove the cleaning restriction and call the Admitting Office to return the room to the vacant list.

Model Radiation Safety Checklist for Iodine Therapy

Patient Name: _____ Room: _____ Date: _____

PREPARATION:

- Private room with private sanitary facilities
- Large room surfaces and walk areas covered with absorbent paper
- Devices that the patient will come in contact with are protected (e.g., telephone, doorknobs, toilet handles etc.)
- Station containing disposable gloves and booties placed outside room
- Housekeeping notified not to clean the room until further notice
- Plastic trash bags located inside the room for waste
- Brief nursing staff on radiation safety precautions
- Issue personnel dosimetry devices to nursing staff and instruction proper wear
- Insure that nursing staff caring for the patient is neither pregnant or breast feeding
- Order disposable table service
- Prepare urine containers if urine is collected
- If laboratory analysis is needed, instruct laboratory personnel in radiation safety precautions

ADMINISTRATION:

- Clear the room of all unnecessary personnel
- Brief patient on the clinical procedure and radiation safety precautions
- Administer dose
- Measure dose rates at bedside, one (1) meter from bedside, visitors' "safe line," and unrestricted areas around the patient's room
- Calculate visiting and care time
- Post room with "Caution- Radioactive Materials" sign

FOLLOW-UP:

- Periodically survey dose rates at bedside, one (1) meter from patient, and door
- Measure the thyroid burden of all personnel involved in the preparation and administration of the dose in accordance with 641-41.2(39)"a"(8)
- Release patient when they meet the criteria in 641-41.2(27)
- Survey and decontaminate the patient room Remove postings
- Release room for general use

List Individuals involved in the preparation and administration of the patient dose:

NAME	DEPARTMENT

**Model Nursing Instructions for Patients Receiving
Radiopharmaceutical Therapy and Hospitalized
In Accordance with 641-41.2(27)**

Patient Name: _____ Patient ID#: _____

Authorized User: _____ Contact No.: _____

Patient Room: _____

Dose: _____ mCi of _____ Time: _____ Date: _____

Authorized User Signature: _____ Date: _____

Radiation Exposure Rates

Unrestricted Areas Surveyed and Dose Rates (mR/hr):

Initial Exposure Rate at one (1) meter from Patient (mR/hr): _____ Patient Position: _____

DATE	TIME	BEDSIDE	1 METER FROM PATIENT	DOOR

Instructions:

Visitor Restrictions:

- No visitors
- No visitors under 18 years of age, breast feeding, or pregnant
- No visitors in the patient room more than _____ minutes per day
- Visitor must stay behind line on floor at all times

Nursing Restrictions:

- Patient is restricted to the room
- No nurses who are pregnant or breast-feeding may render care
- No nurse shall be in the patient's room for more than _____ minutes per day

Patient Care:

- Wear disposable gloves and booties when entering the patient's room
- Proper disposal of gloves and booties when exiting the patient's room
- Proper disposal of linen, bedclothes, plates, utensils, dressings, etc.
- Discard urine and feces in toilet. Flush three times
- Housekeeping personnel are not permitted to enter the room unless authorized by the RSO
- Proper wearing of personnel dosimetry when caring for the patient
- Do not share personnel dosimetry. Return dosimetry to designated area before end of shift
- Emergency Procedures

Acknowledgment of Training:

NAME	SIGNATURE

In the case of emergency, or if any questions arise call:

Radiation Safety Officer: _____

Work: _____

Home: _____

Pager: _____

APPENDIX Q

MODEL PROCEDURE FOR RADIATION SAFETY DURING IMPLANT THERAPY

In addition to 641.40.61, 40.95, 41.2(27), 41.2(45) and 41.2(47)

You may use the following procedure to reduce worker and public dose during implant therapy. If you will follow the model procedure, indicate on your application, "We will establish and implement the model procedure for radiation safety implant therapy that was published in Appendix Q to IDPH MEDICAL USE OF RADIOACTIVE MATERIAL FOR DIAGNOSTIC AND THERAPEUTIC PROCEDURES."

If you prefer, you may develop your own procedure for review. If you do so, you should consider for inclusion all the features in the model procedure and carefully review the requirements of 641-41.2(27), 41.2(45) and 41.2(47). Indicate on your application, "We have developed a procedure for radiation safety and implant therapy for your review that is appended as Appendix Q" and submit your procedure.

ITEMS TO BE CONSIDERED A model checklist is provided in this regulatory guide.

1. The patient's room will be as far away from the nursing station and heavy traffic hallways as is consistent with good medical care. It will be a private room unless the dose at one meter from the implant meets the requirements in 641-40.26.
2. Supply the nurses with film badges, TLD's, OSD's, or pocket ionization chambers.
3. Brief the nurses on radiation safety precautions. Allow time for questions and answers during the briefing.
4. Brief the patient on radiation safety procedures for confinement to bed, visitor control, and other items as applicable consistent with good medical care.
5. Only those persons needed for medical, safety, or training purposes should be present during the implant procedure.
6. Mark a visitor "safe line" on the floor with tape as far from the patient as possible.
7. Following the implant, measure the exposure in mR/hr at bedside, at one (1) meter from bedside, at the visitors' "safe line," and in the surrounding hallways and rooms to ensure compliance with 641-40.26. Record all necessary information on the nursing instruction form or the nurses' dosimeter sign-out form. Post the room with a "Radioactive Materials" sign.
8. Do not release any patient who has received a temporary implant from the hospital until a radiation survey of the patient and a count of implant sources, trains, or ribbons confirm that all sources have been removed from the patient. Perform this check immediately after the removal of the sources. Keep records confirming the source count and radiation survey on the implant source running inventory form. For low-activity seeds (less than one (1) millicurie), use an individual seed to check the survey meter to be sure it will easily detect a seed that has not been removed or has been lost.
9. Do not release any patient who has received a permanent implant from the hospital until the exposure rate from the patient is less than five (5) mR/hr at one (1) meter. Measure this exposure rate at a distance of one (1) meter from the umbilicus while the patient is standing.

**Model Radiation Safety Checklist for
Temporary Implant Therapy**

Patient Name: _____ Room: _____ Date: _____

PREPARATION:

- Private room with private sanitary facilities preferably in a low traffic area
- Housekeeping notified not to clean the room until further notice
- Plastic trash bags located inside the room for waste
- Brief nursing staff on radiation safety precautions
- Issue personnel dosimetry devices to nursing staff and instruct on proper wear
- Insure that nursing staff caring for the patient is neither pregnant or breast feeding

ADMINISTRATION:

- Clear the room of all unnecessary personnel
- Brief patient on the clinical procedure and radiation safety precautions
- Insert implant(s)
- Measure dose rates at bedside, one (1) meter from bedside, visitors' "safe line," and unrestricted Areas around the patient's room
- Calculate visiting and care time
- Post room with "Caution- Radioactive Materials" sign

FOLLOW-UP:

- Perform a survey of the patient to insure that all sources were removed
- Survey linen, bedclothes and dressings to insure no sources were dislodged
- Count the number of sources removed to insure that all sources were removed
- Remove postings and release room for general use

Temporary Implant Therapy Removal Log

NUMBER OF SOURCES REMOVED	SOURCE STRENGTH	DATE REMOVED

**Model Nursing Instructions for Patients Receiving
Temporary Implant Therapy and Hospitalized
In Accordance with 641-41.2(27)**

Patient Name: _____ Patient ID#: _____

Authorized User: _____ Contact No.: _____ Patient Room: _____

Dose: _____ mCi of _____ Time: _____ Date: _____

The sources will be removed: Time: _____ Date: _____

Authorized User Signature: _____ Date: _____

NUMBER OF SOURCES INSERTED	SOURCE STRENGTH	DATE INSERTED

Radiation Exposure Rates

UNRESTRICTED AREAS SURVEYED AND DOSE RATES (MR/HR):	
Patient Position:	

Survey Results

DATE	TIME	BEDSIDE	1 METER FROM PATIENT	DOOR

Instructions:

Visitor Restrictions:

- No visitors
- No visitors under 18 years of age or pregnant
- No visitors in the patient room more than _____ minutes per day
- Visitor must stay behind line on floor at all times

Nursing Restrictions:

- Patient is restricted to the room
- Patient is restricted to bed
- Patient must not move
- No nurses who are pregnant or breast-feeding may render care
- No nurse shall be in the patient's room for more than _____ minutes per day.

Patient Care:

- If the source becomes dislodged, call the attending physician and RSO
- Omit bed bath
- No perineal care. Pad may be changed as necessary
- Save linen, bedclothes, and dressings for survey
- Housekeeping personnel are not permitted to enter the room unless authorized by the RSO
- Proper wearing of personnel dosimetry when caring for the patient
- Do not share personnel dosimetry. Return dosimetry to designated area before end of shift
- Emergency Procedures

Acknowledgment of Training:

NAME	SIGNATURE

In the case of emergency, or if any questions arise call:

Radiation Safety Officer: _____

Work: _____

Home: _____

Pager: _____

APPENDIX R

MODEL PROCEDURE FOR WASTE DISPOSAL

In addition to 641-40.70, 40.88 and 41.2(30))

The following general guidance and procedure may be used for disposal of radioactive waste. If you follow all the general guidance and procedures, you may say on your application, "We will establish and implement the general guidance and model procedures for waste disposal that was published in Appendix R to IDPH MEDICAL USE OF RADIOACTIVE MATERIAL FOR DIAGNOSTIC AND THERAPEUTIC PROCEDURES."

If you prefer, you may develop your own procedure for review. If you do so, you should consider for inclusion all the features in the general guidance and models and carefully review requirements of 641-40.70 and 41.2(30). Say on your application, "We have developed a procedure for waste disposal for your review that is appended as Appendix R" and attach your procedure.

OVERVIEW

40.70 describes methods of waste disposal:

- Release to the environment through the sanitary sewer or by evaporative release;
- Decay-in-storage (DIS);
- Transfer to a burial site or back to the manufacturer; and
- Release to in-house waste for materials described in 39.4(22)"i".

With the exception of the patient excreta (see 641-40.72) and generally licensed *in-vitro* kit exemptions (see 641-39.4(22)"i"), nothing in these guidelines relieves the licensee from maintaining records of the disposal of licensed material. (See 641-38.4(1) and 40.88.)

GENERAL GUIDANCE

1. All radioactive labels must be defaced or removed from containers and packages before disposal. If waste is compacted, all labels that are visible in the compacted mass must be defaced or removed.
2. Remind employees that non-radioactive waste such as leftover reagents, boxes, and packing material should not be mixed with radioactive waste.
3. Occasionally monitor all procedures to ensure that no unnecessary radioactive waste is created. Review all new procedures to ensure that waste is handled in a manner consistent with established procedures.
4. In all cases, consider the entire impact of various available disposal routes. Consider occupational and public exposure to radiation, other hazards associated with the material and routes of disposal (e.g., toxicity, carcinogenicity, and pathogenicity), and expense.

MODEL PROCEDURE FOR DISPOSAL OF LIQUIDS

Release to the sanitary sewer may be used to dispose of liquids. This does not relieve licensees from complying with other regulations regarding toxic or hazardous properties of these materials.

Regulations for disposal in the sanitary sewer appear in 641-40.72. There are specific limits based on the total sanitary sewerage release of your facility. (Excreta from patients undergoing medical diagnosis or therapy are exempt from all the above limitations.)

Liquid scintillation-counting media containing 0.05 microcurie per gram of H-3 or C-14 may be disposed of without regard to its radioactivity (641-40.74). Make a record of the date, radionuclide, estimated activity (in millicuries or microcuries), calculated concentration in microcuries per gram, and how the material was disposed of.

1. Confirm that the sewer system is a public system, not a private sewer, septic system, or leach field.
2. Confirm that the liquid waste being discharged is soluble (or is biological material that is readily dispersible) in water.

3. Calculate the amount of each radionuclide that can be discharged by using the information in 641-Chapter 40, Appendix B.
4. Make sure that the amount of each radionuclide does not exceed the monthly and annual discharge limits specified in 40.72 and 641-Chapter 40, Appendix B, Table 3
5. If more than one radionuclide is released, the sum of the ratios of the average monthly discharge of each radionuclide to the corresponding limit for each radionuclide in 641-Chapter 40, Appendix B, Table 3 must not exceed unity.
6. Record the date, radionuclide(s), estimated activity of each radionuclide, location where the material is discharged, and the name of the individual discharging the waste.
7. Liquid waste should be discharged only via designated sinks, toilets, or other release points.
8. Discharge liquid waste slowly, to minimize splashing, with water running to be sure that the material moves out of the sink and into the sewer system.
9. Survey the sink and surrounding work surfaces to confirm that no residual material or contamination remained in the sink or on work surfaces.
10. Decontaminate all areas or surfaces if found to be contaminated.
11. Maintain records of releases of licensed material to the sanitary sewer system. These records should include, for each release, the date, radionuclide(s), estimated activity of each radionuclide, location where the material is discharged, and the initials of the individual discharging the waste. For the licensed facility as a whole, records should be maintained of the quantity and concentration of radionuclides that are released into the sewer system that demonstrate compliance with the regulatory limits for total quantity released and concentrations released by the licensed facility.

MODEL PROCEDURE FOR DISPOSAL BY DECAY-IN-STORAGE (DIS)

41.2(30) describes the requirements for disposal by “decay-in-storage.” Short-lived material (physical half-life less than 120 days) may be disposed of by DIS. Facilities should ensure that adequate space are available and containers should have shielded covers to maintain occupational exposure ALARA. Storage areas must be in a secure location. If you use this procedure, keep material separated according to half-life, and consider short-term and long-term storage.

1. Waste should be stored in suitable well-marked containers, and the containers should provide adequate shielding.
2. Consider using separate containers for different types of waste (e.g., capped needles and syringes in one container, other injection paraphernalia such as swabs and gauze in another, and unused dosages in a third container). Smaller departments may find it easier to use just one container for all DIS waste. Because the waste will be surveyed with all shielding removed, the containers in which waste will be disposed of must not provide any radiation shielding for material.
3. When the container is full, seal it with string or tape and attach an identification tag that includes the date sealed the longest-lived radioisotope in the container, and the initials of the person sealing the container.
4. The container should be labeled in accordance with 641-40.63 and 641-40.64. The container may then be transferred to the DIS area.
5. Decay the material for at least 10 half-lives. The expected radiation levels in most cases should not be distinguishable from background, but this depends of the radionuclides and original activity present.
6. Before disposal as in-house waste, monitor each container as follows:
 - a. Check your radiation detection survey meter for proper operation.
 - b. Plan to monitor in a low-level background radiation area away from all sources of radioactive material.
 - c. Remove any shielding from around the container.
 - d. Monitor, at contact, all surfaces of each individual container, with the survey meter on its most sensitive setting.
 - e. Make a record of each disposal as described in 41.2(30)“b”:
 - Date of disposal
 - Date on which the radioactive material was placed in storage
 - Radionuclides disposed
 - Model and serial number of the survey instrument used
 - The background dose rate
 - The radiation dose rate measured at the surface of each waste container

- The name of the individual who performed the survey
- f. Discard as in-house waste only those containers that cannot be distinguished from background. Remove or deface any radioactive material labels that are visible.
 - g. Containers that can be distinguished from background radiation levels must be returned to the storage area for further decay or transferred for burial.
7. If possible, Mo-99/Tc-99m generators should be held 60 days before being dismantled because of the occasional presence of a long-lived contaminant. When dismantling generators, keep a radiation detection survey meter (preferably with a speaker) at the work area. Dismantle the oldest generator first, and then work forward chronologically. Hold each individual column in contact with the radiation detection survey meter in a low-background (less than 0.05 mR/hr) area. Record the generator date and disposal date for your waste disposal records. Remove or deface the radiation labels on the generator shield.
 8. Short half-life radionuclide products, such as Y-90 microspheres, Lu-177 dotatate may contain long half-life contaminants that may preclude disposal by decay-in-storage. Licensees need to perform surveys and dispose of long half-life contaminants in accordance with 641-40.70.

Note: Any calibration sources with half-lives greater than 120 days (e.g. cobalt-57, germanium-68, and gadolinium-153) may not be held for decay-in-storage and must be disposed of in accordance with 641-39 and 641-40.

MODEL PROCEDURE FOR TRANSFER FOR BURIAL

Except for material suitable for DIS and some animal carcasses, solids must be transferred to a burial site. Follow the packaging instructions you received from the transfer agent and the burial site operator. For your record of disposal, keep the consignment sheet that the transfer agent gave you.

MODEL PROCEDURE FOR RETURNING GENERATORS TO THE MANUFACTURER

Used generators (i.e. Mo-99/Tc-99m, Sr-82/Rb-82, or Ge-68/Ga-68) may be returned to the manufacturer. This permission does not relieve licensees from the requirement to comply with 641-39.5 and Department of Transportation (DOT) regulations.

1. Retain the records needed to demonstrate that the package qualifies as a DOT Specification 7A container (see DOT regulations, paragraph 173.415(a) of 49 CFR Part 173).
2. Assemble the package in accordance with the manufacturer's instructions.
3. Perform the dose rate and removable contamination surveys required by 39.5
4. Label the package and complete the shipping papers in accordance with the manufacturer's instructions.
5. Retain records of receipts and transfers in accordance with 641-39.4(52).

Model Procedure for Return of Licensed Material to Authorized Recipients

Perform the following steps when returning licensed material to authorized recipients:

1. In accordance with 641-39.4(41), confirm that persons are authorized to receive byproduct material prior to transfer (e.g. obtain a copy of the transferee's NRC or Agreement State license that authorizes the byproduct material).
2. Retain the records needed to demonstrate that the package qualifies as a DOT Type A package.
3. Assemble the package in accordance with the manufacturer's instructions.
4. Perform the dose rate and removable contamination measurements.
5. Label the package and complete the shipping papers in accordance with the manufacturer's instructions and 641-39.5 regulations.
6. Retain records of receipts and transfers in accordance with 641-39.4(52).

MODEL PROCEDURE FOR RELEASE TO IN-HOUSE WASTE

Waste from *in-vitro* kits that are generally licensed pursuant to 641-39.4(22)"i" is exempt from waste disposal regulations. Radioactive labels should be defaced or removed. There is no need to keep any record of release or make any measurement.

APPENDIX S

MEDICAL USE OF STRONTIUM-90 EYE APPLICATORS – REQUIREMENTS FOR CALIBRATION AND DECAY CORRECTION

New Sr-90 eye applicators typically contain a 54-millicurie (2 Gigabecquerel) source, exhibiting a surface dose rate of about 0.50 Gy (50 rad/sec). The half-life of the parent Sr-90 is 28.5 years [maximum beta energy equal to 0.54 MeV, and the Yttrium-90 daughter half-life is 64.2 hours (beta-max, 2.27 MeV)]; therefore, both isotopes are in equilibrium on the eye applicator. **Since Sr-90 and Y-90 are in equilibrium, emissions from both isotopes must be accounted for in dosimetry calculations.**

The source output or activity that is used for ophthalmic treatments must be determined using a dosimetry system that has been calibrated using a system or source traceable to the National Institute of Science and Technology (NIST) and published protocols accepted by nationally recognized bodies, or calibrated by a calibration laboratory accredited by the American Association of Physicists in Medicine (AAPM). The licensee is allowed to use measurements provided by the source manufacturer, or by a calibration laboratory accredited by the AAPM, that are made in accordance with the requirements of 10 CFR 35.432(a). **Most licensees possessing Sr-90 eye applicators do not have their applicators calibrated to current standards.** It should be noted that NIST-traceable calibrations of Sr-90 eye applicators proceeding August of 1990 do not meet the revised criteria. In August of 1990, NIST implemented a new Sr-90 eye applicator calibration procedure that established the currently accepted national standards. Any NIST-traceable calibrations performed after this date should ensure compliance.

Licensees must develop written procedures for any brachytherapy dose, including assurance that the prescribed dose is the administered dose. A necessary part of this is to ensure that the dose rate emitted from an applicator is correct. If the manufacturer's certificate of calibration or original activity/dose rate nameplate is missing, the licensee should arrange with a qualified expert to determine the dose rate from the Sr-90 source. Only an authorized medical physicist can calculate the activity of each Sr-90 source that is used to determine the treatment times for ophthalmic treatments. Medical licensees who use Sr-90 eye applicators should check calibration records and take steps to assure that they will be in compliance.

APPENDIX T

RESERVED

APPENDIX U

MODEL ANNUAL AUDIT CHECKLIST

Auditor: _____
Date of Audit: _____
Management review: _____

ORGANIZATIONAL STRUCTURE

- a. Radiation Safety Committee (RSC)
 - (1) Meetings held quarterly. [41.2(9)"a"(2)] N/A Yes No
 - (2) Quorums established. [41.2(9)"a"(3)] N/A Yes No
 - (3) Committee reviews program annually. [41.2(9)"b"(7)] N/A Yes No
 - (4) Record of Committee meetings. [41.2(9)"a"(4)] N/A Yes No
- b. Radiation Safety Officer (RSO) same as listed on the license N/A Yes No
- c. Visiting Authorized User(s)
 - (1) Has written permission. [41.2(12)"a"(1)] N/A Yes No
 - (2) Visitor authorized user's license on file. [41.2(12)"a"(2)] N/A Yes No
 - (3) Performs only those procedures authorized on visitor's license. [41.2(12)"a"(3)] N/A Yes No
 - (4) Uses materials under licensee's license or 60 days per year or less. [41.2(12)"a"] N/A Yes No
 - (5) Records maintained five (5) years after the visiting authorized user's last visit. [41.2(12)"c"] N/A Yes No
- d. Mobile Nuclear Medicine Service meets technical requirements. [41.2(28)] N/A Yes No

AUDIT HISTORY

- a. Last audit conducted on: _____ N/A Yes No
- b. Deficiencies identified. N/A Yes No
- c. Were they corrected? N/A Yes No

SCOPE OF PROGRAM

- a. Are there multiple authorized locations of use? N/A Yes No
If multiple locations authorized, list locations audited. N/A Yes No
- b. Have there been radiation safety program changes? [41.2(4)"f"] N/A Yes No
If yes, list changes.

TRAINING, RETRAINING, AND INSTRUCTION TO WORKERS

- a. Instructions to workers provided. [40.111] N/A Yes No
- b. Training program conducted according to license commitments. N/A Yes No

FACILITIES, MATERIALS, AND EQUIPMENT

- a. Facilities are as described in the license application. N/A Yes No
- b. Storage and use of radioactive material
 - (1) Adequate method to prevent unauthorized individuals from entering restricted area. N/A Yes No
 - (2) Radioactive material secured to prevent unauthorized removal or access. [40.55"a"] N/A Yes No
- c. Dose Calibrator
 - (1) Constancy checked. [41.2(17)"b"(1)] N/A Yes No

- | | | | |
|---|------------------------------|------------------------------|-----------------------------|
| (2) Linearity tested. [41.2(17)"b"(3)] | <input type="checkbox"/> N/A | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| (3) Accuracy tested. [41.2(17)"b"(2)] | <input type="checkbox"/> N/A | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| (4) Geometry dependence test. [41.2(17)"b"(4)] | <input type="checkbox"/> N/A | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| (5) Readings mathematically corrected if linearity error is greater than 10%. [41.2(17)"c"] | <input type="checkbox"/> N/A | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| (6) Records maintained. [41.2(17)"e"] | <input type="checkbox"/> N/A | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| (7) RSO signs linearity, accuracy, and geometry dependence tests. [41.2(17)"e"] | <input type="checkbox"/> N/A | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| d. Survey instruments. | | | |
| (1) Appropriate operable survey instruments. [41.2(32); 41.2(36); and 41.2(40); 41.2(42)] | <input type="checkbox"/> N/A | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| (2) Calibration, as required. [41.2(18)"a"] | <input type="checkbox"/> N/A | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| (3) Records maintained. [41.2(18)"e"] | <input type="checkbox"/> N/A | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| e. Syringes containing RAM properly labeled and shielded, unless contraindicated. [41.2(22)"b"] | <input type="checkbox"/> N/A | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| f. Syringes properly labeled. [41.2(23)] | <input type="checkbox"/> N/A | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| g. Vials containing RAM properly shielded. [41.2(24)] | <input type="checkbox"/> N/A | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| h. Vials properly labeled. [41.2(25)] | <input type="checkbox"/> N/A | <input type="checkbox"/> Yes | <input type="checkbox"/> No |

RADIOLOGICAL PROTECTION PROCEDURES

- | | | | |
|--|------------------------------|------------------------------|-----------------------------|
| a. Individual has understanding of procedures. | <input type="checkbox"/> N/A | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| (1) In general, rules for safe use. | <input type="checkbox"/> N/A | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| (2) In emergency procedures | <input type="checkbox"/> N/A | <input type="checkbox"/> Yes | <input type="checkbox"/> No |

MATERIALS

- | | | | |
|---|------------------------------|------------------------------|-----------------------------|
| a. Molybdenum-99 breakthrough tests performed. | <input type="checkbox"/> N/A | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| b. Records Molybdenum-99 breakthrough tests maintained. | <input type="checkbox"/> N/A | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| c. Leak tests of sealed sources performed at appropriate intervals. [41.2(21)"b"] | <input type="checkbox"/> N/A | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| (1) Leak test records in units of microcuries. [41.2(21)"d"] | <input type="checkbox"/> N/A | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| (2) Leak test records signed by RSO. [41.2(21)"d"] | <input type="checkbox"/> N/A | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| (3) Records of leak tests kept for five (5) years. [41.2(21)"d"] | <input type="checkbox"/> N/A | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| d. Inventories | | | |
| (1) Inventory of sealed sources at six month intervals. [41.2(21)"g"] | <input type="checkbox"/> N/A | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| (2) Inventory records signed by RSO. [41.2(21)"g"] | <input type="checkbox"/> N/A | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| (3) Records of leak tests and inventories kept for five years. [41.2(21)"g"] | <input type="checkbox"/> N/A | <input type="checkbox"/> Yes | <input type="checkbox"/> No |

RECEIPT AND TRANSFER OF RADIOACTIVE MATERIAL

- | | | | |
|---|------------------------------|------------------------------|-----------------------------|
| a. Procedure for opening packages adequate. [40.65(5)] | <input type="checkbox"/> N/A | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| b. Incoming packages monitored for radioactive contamination. [40.65(2)"a" or "c" and 40.65(3)] | <input type="checkbox"/> N/A | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| c. Incoming packages monitored for external radiation levels. [40.65(2)"b" and 40.65(3)] | <input type="checkbox"/> N/A | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| d. Transfers performed, as required. [39.4(41)] | <input type="checkbox"/> N/A | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| e. Records of receipt surveys. [40.82(1)] | <input type="checkbox"/> N/A | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| f. Records of receipt, transfer, & disposal of radioactive material. [38.4(1)] | <input type="checkbox"/> N/A | <input type="checkbox"/> Yes | <input type="checkbox"/> No |

AREA SURVEYS

- | | | | |
|---|------------------------------|------------------------------|-----------------------------|
| a. Ambient dose rate surveys performed. [41.2(26)"a" and "b"] | <input type="checkbox"/> N/A | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| b. Contamination surveys conducted. [41.2(26)"e"] | <input type="checkbox"/> N/A | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| c. Trigger levels established. [41.2(26)"d" and "g"] | <input type="checkbox"/> N/A | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| d. Dose rate survey records in mR/hr. [41.2(26)"h"] | <input type="checkbox"/> N/A | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| e. Contamination survey records maintained in dpm/100 cm ² . [41.2(26)"h"] | <input type="checkbox"/> N/A | <input type="checkbox"/> Yes | <input type="checkbox"/> No |

RADIOPHARMACEUTICAL THERAPY

- a. Oral and written safety instructions provided to personnel caring for patients. [41.2(38)"a"] N/A Yes No
- b. Record of training maintained. [41.2(38)"c"] N/A Yes No
- c. Patient room surveys. [41.2(39)"a"(4) and (7)] N/A Yes No
- d. Record of room survey. [41.2(39)"a"(4) and (7)] N/A Yes No
- e. Performed according to license commitments. N/A Yes No
- f. Release of patients containing radiopharmaceuticals meets [41.2(27)"a"]. N/A Yes No
- g. Thyroid burden measurements on all individuals involved in dose administration. [41.2(39)"a"(8)] N/A Yes No
- h. Record of thyroid measurements. [41.2(39)"a"(8)] N/A Yes No

BRACHYTHERAPY

- a. Oral and written safety instructions provided to personnel caring for patients. [41.2(44)"a"] N/A Yes No
- b. Record of training maintained. [41.2(44)"c"] N/A Yes No
- c. Patient area surveyed. [41.2(45)"a"(4)] N/A Yes No
- d. Release of patients containing permanent implants according to license commitments. [41.2(27)] N/A Yes No
- e. Surveys performed before releasing patients being treated with temporary implants. [41.2(47)] N/A Yes No
- f. Record of patient survey. [41.2(47)"b"] N/A Yes No
- g. Brachytherapy sources inventoried each time sources are returned to storage after use. [41.2(46)"a"] N/A Yes No
- h. Record of brachytherapy source utilization. [41.2(46)"b"] N/A Yes No
- i. Brachytherapy sources inventoried each quarter. [41.2(21)"g"] N/A Yes No
- j. Record of inventory. [41.2(21)"g"] N/A Yes No
- k. Brachytherapy source storage area surveyed. [41.2(21)"h"] N/A Yes No
- l. Record of survey of storage area. [41.2(21)"i"] N/A Yes No

PERSONNEL RADIATION MONITORING – EXTERNAL

- a. Supplier NVLAP approved. [40.36(3)"a" and "b"] N/A Yes No
- b. Dose(s) exceeded regulatory limits. [40.15] N/A Yes No
- c. ALARA program implemented. [41.2(7)"a"] N/A Yes No
- (1) Annual review by radiation safety committee completed. [41.2(7)"c"] N/A Yes No
- (2) Written description of ALARA program available. [41.2(7)"d"] N/A Yes No

PERSONNEL RADIATION MONITORING – INTERNAL

- a. Bioassay program implemented and performed at proper intervals N/A Yes No
- b. Radioactive gases N/A Yes No
- (1) Clearance time and safety procedures are posted. [41.2(35)"e"] N/A Yes No
- (2) Reusable collection system checked monthly. [41.2(35)"f"] N/A Yes No
- (3) Ventilation rates checked for negative pressure at six-month intervals. [41.2(35)"f"] N/A Yes No

WASTE DISPOSAL

- a. Radioactive material disposed of as authorized. [40.70(1)] N/A Yes No
- b. Record of disposal by decay in storage maintained. [41.2(30)"b"] N/A Yes No
- c. Survey of waste before disposal. [40.36] N/A Yes No
- d. Records of waste surveys. [40.82(2)"d"] N/A Yes No

NOTIFICATION AND REPORTS

- a. Notifications and reports provided to individuals. [40.112] N/A Yes No
- b. Reporting theft or loss compliant with rules. [40.95] N/A Yes No

- c. Compliant regarding overexposures notification of incidents. [40.96] N/A Yes No
- d. Compliant regarding reporting of excessive levels and concentrations. [40.97] N/A Yes No
- e. Termination reports furnished, if requested by workers. [40.112(5)] N/A Yes No

MISADMINISTRATIONS

- a. Misadministrations occurred N/A Yes No
- b. Compliant with reporting requirements for misadministration. [41.2(14)"a" or "c"] N/A Yes No
- c. Appropriate action taken to prevent recurrence. N/A Yes No
- d. Records maintained. [41.2(14)"d"] N/A Yes No

POSTING AND LABELING

- a. Radiation Areas posted. [40.61(1)] N/A Yes No
- b. High Radiation Areas posted. [40.61(2)] N/A Yes No
- c. Use or storage areas posted "Caution Radioactive Material." [40.61(5)] N/A Yes No
- d. Containers or devices labeled. [40.63] N/A Yes No
- e. Notice to Workers posted. [40.110(1) and (2)] N/A Yes No
- f. Notice to Employees posted. [40.110(3)] N/A Yes No

TRANSPORTATION (641-39.5) AND 49 CFR 171-178

- a. Authorized packages used. N/A Yes No
- b. DOT-7A performance test records on file. [173.415(a)] N/A Yes No
- c. For special form sources, performance test records on file. [173.476(a)] N/A Yes No
- d. Packages properly labeled. [172.403(b)] N/A Yes No
- e. Packages properly marked. [172.301(a)] N/A Yes No
- f. Proper shipping papers prepared. [172.200] N/A Yes No
- g. Shipping paper contains emergency response telephone number. [172.201(d)] N/A Yes No

SUMMARY OF REVISIONS

<u>REVISION</u>	<u>SECTION</u>	<u>DESCRIPTION</u>
MRG1-99 (01/08/99)	Item 2	Added statement regarding using a consultant
	Item 11.2	Auditing guidance
	Appendix D	Modified exchange frequency criteria Modified bioassay program to reflect current rule revision
	Appendix P	Incorporated new patient release criteria for patients receiving radiopharmaceutical therapy.
	Supplement D	Model Audit Checklist
	Supplement E	Release criteria for release of patients administered RAM
09/02/99	Introduction	Indicated the devices requiring separate licensing.
07/21/00	Appendix R	Model Procedure for Disposal by Decay-in-Storage - Rearrange the information in items 3.d and 3.e.
09/15/00	Appendix B Appendix C	Edited duties of RSO to replace verbiage with radioactive materials instead of "gauges." Delete 5.f. "Put a sticker on the dose calibrator that says when the next linearity test is due."
10/06/00	Item 11.2	Amended verbiage regarding audits
10/06/00	Supplement E	Removed
10/06/00	Appendix J	Remove item 7 under major spills, which required the RSO to supervise cleanup and to complete surveys and the spill report.
12/22/00	10.3	Removed verbiage associated with mobile nuclear medicine services. This material is now in a separate regulatory guide.
12/26/00	ALL	Reformat text. Changed address for Bureau of Radiological Health
01/10/01		Removed Preceptor Statement – made separate document.
02/27/01	ALL	Corrected paragraph numbers in Appendix M. Reorganized the list of appendices. Created a section for survey meters. Re-titled the regulatory guide to 2-01.
11/01/01	Appendix N	Edited portion pertaining to records to clarify when the RSO should sign survey documents.
01/18/02	Appendix I	Revised guidelines to reflect actual practices.
01/18/02	Section 7	Added information concerning inspections.
06/19/02	Appendix J	Added additional isotopes in the spill procedures.
0624/02	Appendix S	New – Added to address material in IDPH IN 2002-04 (NRC Information Notice 02-017)
01/24/03	ALL	Name updated and entire guide reviewed.
03/08/03	Appendix I	Revised the requirement for wearing extremity monitors (Paragraph 8).
03/13/03	Section 1.3	Change address for web access to IDPH rules and publications.
07/01/05	ALL	Changed address for the Bureau of Radiological Health
02/27/07	Appendix T	Added new Appendix T, re-lettered old Appendix to U
06/29/07	Appendix B	Added new Model Delegation of Authority/Removed old Model Delegation of Authority from Appendix F
09/07/10	Sections 3.13 & 7	Removed references to renewal and inspection fees. Added reference to annual fee.
08/08/12	Item 4.1	Updated the requirements for physician authorized user approval.
02/28/17	Section 1.3 Item 11.1 Appendix G Appendix J	Replace the website address of the IDPH rules. Revised frequency of sealed source inventory to align with IAC 641-41.2(21). Revised model rule number 16 to align with IAC 641-41.2(19). Revised non-fixed external radioactive contamination limits for packages to align with 49 CFR 173.433.
07/22/2020	ALL	Entire guide reviewed & updated to reflect rule changes for 641-41.2

10/7/20	Appendix A	Changed ALARA note from per month to per calendar quarter.
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