



# ILLINOIS EMERGENCY MANAGEMENT AGENCY

INSTRUCTIONAL SET NO. 64.0

REVISION 0  
February 1997

Instructions for Preparing Applications  
for Radioactive Material Licenses Authorizing the

## **USE OF SEALED SOURCES IN FIXED GAUGES**

BUREAU OF RADIATION SAFETY  
Radioactive Materials Section  
1035 Outer Park Drive  
Springfield, Illinois 62704



## TABLE OF CONTENTS

<u>Section</u>	<u>Page</u>
I. INTRODUCTION .....	1
A. General.....	1
B. Purpose of Instructions .....	1
C. Purpose of Appendices to these Instructions.....	2
D. Applicable Regulations.....	2
E. Retention of Records .....	3
F. Radiation Protection Program .....	3
G. As Low As Is Reasonably Achievable (ALARA).....	3
H. Système International (SI) Units .....	4
II. FILING AN APPLICATION .....	4
III. CONTENTS OF AN APPLICATION .....	5
Item 1 - Type of Application .....	5
Item 2 - Applicant's Name and Mailing Address.....	5
Item 3 - Person to Contact Regarding this Application.....	6
Item 4 - Address(es) Where Radioactive Material will be Used and/or Stored .....	6
Item 5 - Individual(s) Who Will Use Radioactive Material .....	6
Item 6 - Radiation Safety Officer (RSO).....	7
Item 7 - Radioactive Material .....	8
Item 8 - Instrumentation.....	8
Item 9 - Instrument Calibration and Operability Checks.....	9
Item 10 - Facilities and Equipment.....	9
Item 11 - Personnel Training Program .....	10
Item 12 - Procedure for Ordering and Receiving Radioactive Material.....	12
Item 13 - Procedure for Safely Opening Radioactive Material Packages .....	12
Item 14 - General Rules for the Safe Use of Radioactive Material .....	13
Item 15 - Emergency Procedure .....	15
Item 16 - Monitoring Procedure .....	15
Item 17 - Transfer or Disposal.....	16
Item 18 - Testing Sealed Sources for Leakage and/or Contamination .....	16
Item 19 - Personnel Monitoring.....	16
Item 20 - License Fee.....	17
Item 21 - Financial Assurance .....	17
Item 22 - Certification.....	17
IV. LICENSE AMENDMENTS.....	17
V. LICENSE RENEWALS .....	18
VI. LICENSE TERMINATIONS .....	19

## APPENDICES

A.	Retention of Documents .....	21
B.	Guide to SI Units .....	23
C.	Duties and Responsibilities of the Radiation Safety Officer .....	25
C.1.	Provision for Delegating Duties to Authorized Individuals .....	27
D.	Sample Minimum Detectable Activity Calculations .....	29
E.	Method for Calibrating Radiation Monitoring Instruments.....	31
F.	Sample Facility Diagram for Fixed Gauge Storage and Use.....	37
G.	Basic Subjects to be Covered During Radiation Safety Training.....	39
H.	Sample Procedure for Ordering and Receiving Radioactive Material .....	45
I.	Procedure for Safely Opening Radioactive Material Packages.....	47
J.	General Rules for the Safe Use of Radioactive Material.....	49
J.1.	Information to be Submitted by Applicants Requesting Authorization to Perform Installation, Initial Radiation Monitoring, Relocation, Removal, Repair or Maintenance .....	51
K.	Fixed Gauge Physical Inventory, Inspection and Monitoring Form .....	53
L.	Emergency Procedure .....	55
M.	Testing Sealed Sources for Leakage and/or Contamination.....	57
N.	Direct Reading Dosimeter Use and Calibration .....	59

## EXHIBITS

A. -	Form – Application for a Radioactive Material License Authorizing the Use of Sealed Sources in Fixed Gauges.....	61
B. -	Instrumentation Form.....	65
C. -	Certificate – Termination and Disposition of Radioactive Material (IL 473-00084) (KLM.007) .....	67

## I. INTRODUCTION

### A. General

ILLINOIS EMERGENCY MANAGEMENT AGENCY (herein referred to as IEMA or the Agency) regulates the possession and use of radioactive material. Certain uses of radioactive material require a specific license to be issued by the Agency pursuant to 32 Illinois Administrative Code 330 (the IEMA administrative rules, herein referred to as 32 Ill. Adm. Code or the regulations).

The Agency usually issues a single radioactive material license to cover an entire radioactive material program. Separate licenses are not normally issued to different departments of a facility, nor are they issued to individuals associated with the facility. Facilities with more than one license may wish to combine those licenses where feasible.

### B. Purpose of Instructions

These instructions describe the information needed by the Agency's Radioactive Materials Section staff to evaluate an application for a specific license for the possession and use of radioactive material in the form of sealed sources in fixed gauging devices herein referred to as fixed gauges or devices.

Prior to submitting an application for fixed gauge use, the applicant should carefully study these instructions and the regulations listed in Section I.D. and submit all applicable information requested. The Radioactive Materials Section staff will request additional information when necessary to ensure that the applicant has established an adequate radiation safety program (see 32 Ill. Adm. Code 330.240 and 330.250). Such requests for additional information will delay final action regarding the application and may be avoided by a thorough study of the regulations and these instructions prior to filing the application.

These instructions are intended only for general guidance in the preparation of the license application and should not be considered as a substitute for the applicant's careful evaluation of the proposed use of radioactive material. Applicants must ensure that the application correctly and adequately describes radiation safeguards and procedures to be followed in their radioactive material use program.

### C. Purpose of Appendices to these Instructions

The regulations require licensees to develop and implement written policies and procedures which ensure compliance with the regulations. This instructional set's appendices provide sample radiation safety procedures which the licensee may choose to use in their radiation safety program. Applicants should carefully read the applicable regulations and sample procedures and then decide if the sample procedures are appropriate for their specific radiation safety needs. In the application, applicants may certify that they will follow a sample procedure or develop and submit an equivalent procedure for Agency review. If a sample procedure is followed, applicants must ensure that references to that procedure are clear and specific (e.g., references should include instructional set number, revision number, revision date and appendix identification), which may be done by placing a check mark at the appropriate places on the application form (See Exhibit A).

### D. Applicable Regulations

The following portions of the regulations are applicable to the use of radioactive material in the form of sealed sources in fixed gauges and should be used in conjunction with these instructions:

1. 32 Ill. Adm. Code 310 - "General Provisions"
2. 32 Ill. Adm. Code 330 - "Licensing of Radioactive Material"
3. 32 Ill. Adm. Code 331 - "Fees for Radioactive Material Licenses"
4. 32 Ill. Adm. Code 340 - "Standards for Protection Against Radiation"
5. 32 Ill. Adm. Code 341 - "Transportation of Radioactive Material"
6. 32 Ill. Adm. Code 400 - "Notices, Instructions and Reports to Workers; Inspections"

The Agency may amend these regulations periodically. The licensee will be notified of these changes as they occur and shall incorporate them into their program, if applicable.

E. Retention of Records

The licensee must maintain certain records for specified periods of time for compliance purposes. These intervals have been established in order for the inspection staff and other authorized entities to have access to these documents as required by the regulations. Appendix A of this instructional set contains the record retention requirements for these documents.

F. Radiation Protection Program

As specified in 32 Ill. Adm. Code 340.110, the licensee must develop, document and implement a radiation protection program. Specifically, this program should include provisions for ensuring compliance with the requirements of Part 340 of the regulations, the license, the license conditions with all active amendments for establishing an ALARA program and for performing reviews of the program at 12-month intervals. In developing a radiation protection program, the licensee should design the program based on the size of the facility, potential hazards associated with radiation exposure and the physical characteristics of the radionuclides. The commitments made to the Agency, which lead to the issuance of the license, the regulations and the complete license document are considered the applicant's radiation protection program.

Active control over the radiation protection program should be exercised by management personnel in positions of authority. In addition, management should be aware that the assignment of duties to individuals (e.g., the Radiation Safety Officer) does not relieve management of the responsibilities to review and control the licensed activities.

G. As Low As Is Reasonably Achievable (ALARA)

Persons engaged in activities authorized by radioactive material licenses issued by the Agency must, to the extent practicable, make every reasonable effort to maintain the release of radioactive material and the total effective dose equivalent (TEDE) ALARA for both workers and members of the public. License applicants must give consideration to the ALARA philosophy when designing facilities, procuring equipment and for developing procedures for work with radioactive material. The ALARA concept is a key element in establishing any radiation protection program as described above. The definition of ALARA may be found in 32 Ill. Adm. Code 310.20.

## H. Systeme International (SI) Units

In accordance with State and federal policy, the Agency is making an effort to implement the SI system of units. If applicants wish to utilize SI units in their application, please feel free to do so. However, this conversion is not mandatory at this time. The Agency will continue to recognize SI and English units.

Appendix B of this instructional set has been included to assist applicants in the use of SI units.

## II. FILING AN APPLICATION

An application for a specific license for the use of radioactive material in the form of sealed sources in fixed gauges should be submitted on the "Application Form for a Radioactive Material License Authorizing the Use of Sealed Sources in Fixed Gauges", in accordance with 32 Ill. Adm. Code 330.240(a) (see Exhibit A). All items on the application form must be completed in sufficient detail for the Agency staff to determine that the applicant's equipment, facilities and radiation protection program are adequate to protect health and minimize danger to life and property.

Since the space provided on the application form is limited, separate 8.5 by 11 inch sheets of paper may be appended for Items 5 through 19 listed on the form. Each appended sheet should contain the item number, page number, applicant's name and the application date in the lower right corner.

The application must be completed in triplicate. The original and one copy of the application form, along with duplicate copies of supporting documents, must be mailed to:

Illinois Emergency Management Agency  
Radioactive Materials Section  
Licensing Section  
1035 Outer Park Drive  
Springfield, Illinois 62704

At least one copy of the submitted application form, with all attachments, must be retained by the applicant. When issued, the license will require, as a condition, that the licensee possess and use radioactive material described in all schedules of the license in accordance with statements, representations and procedures contained in, or enclosed with, the application form and supporting documentation. The regulations contained in 32 Ill. Adm. Code: Chapter II, Subchapters b and d shall govern unless the statements, representations and procedures set forth in the licensee's application and correspondence are more restrictive than the regulations.

Unless the applicant is exempt, an application fee is required for a radioactive material license. Refer to 32 Ill. Adm. Code 331 to determine the appropriate fee that shall



accompany the application. Review of the application will not begin until the proper fee is received by the Agency. Also, please note that 32 Ill. Adm. Code 330.320(c) requires licensees to submit either a renewal application or a termination request no less than 30 days before the expiration date of an existing license.

### III. CONTENTS OF AN APPLICATION

The following paragraphs explain the information requested on the "Application Form for a Radioactive Material License Authorizing the Use of Sealed Sources in Fixed Gauges" (Exhibit A):

#### Item 1 - Type of Application

Indicate, by checking the appropriate box, if the application is for a new license, an amendment to an existing license or a renewal of an existing license. If the application is for an amendment to or a renewal of an existing license, please specify the existing Illinois Radioactive Material License Number in the space provided. Simple amendments may be requested by letter without using the application form. The letter must be signed by either a member of management, the Radiation Safety Officer or an individual who is authorized by management to sign on behalf of the licensee. A statement signed by facility management granting authority to sign license requests and related documents is required for applications not signed by an officer or the administrator of the facility.

#### Item 2 - Applicant's Name and Mailing Address

The "applicant" is the organization or person(s) legally responsible for possession and use of the licensed radioactive material specified in the application. The applicant's mailing address may or may not be the same as the address where radioactive material will be used. An individual should be designated as the applicant only if that individual is acting in a private capacity and the use of radioactive material is not connected with his or her employment with a corporation or other legal entity. Enter the name, mailing address (including ZIP code), telephone number (including area code) and telefacsimile number of the applicant in the space provided.

### Item 3 - Person to Contact Regarding this Application

The applicant should name a qualified individual who is authorized by the applicant's management to answer questions and make commitments regarding this application and the radiation safety program. This individual, usually the Radiation Safety Officer (RSO) or a principal radioactive material user, will serve as the point of contact during the application's review. In the space provided, enter the name, address, telephone number (including area code) and telefacsimile number of the individual to be contacted regarding this application.

### Item 4 - Address(es) Where Radioactive Material will be Used and/or Stored

Specify all of the addresses and physical locations where licensed radioactive material will be used and/or stored. Each location description should include the street address, city and other descriptive information (e.g., building name/number, suite, room or floor number) to allow specific facility identification. If multiple facilities will be used, specify the extent of use, storage or both at each location. Do not specify a post office box number as a use or storage location. Additionally, if more than one permanent facility is used, specify where records will be maintained for each facility.

### Item 5 - Individual(s) Who Will Use Radioactive Material

List the full name of at least one individual who will use or directly supervise the use of radioactive material in fixed gauges and submit evidence of their training and experience. All personnel who will independently use fixed gauges containing radioactive material do not have to be designated by name. However, if the applicant does not specifically identify all individuals who should be authorized to use radioactive materials independently and include training and experience for each individual identified, then the applicant must provide a commitment that all authorized users will complete either:

- A. An approved fixed gauge manufacturer's training program, or
- B. An approved training program equivalent to the fixed gauge manufacturer's training program. If this option is chosen, the information specified in Item 11 of these instructions must be submitted.

The following three levels of training exist for individuals working with or in the vicinity of a fixed gauge(s):

1. Individuals who work in the vicinity of the gauge(s), but do not operate or handle the gauge(s) in any way should complete a 1 to 2-hour orientation training course.

2. Individuals who handle and operate the fixed gauge(s), but do not perform installation, initial radiation monitoring, relocation, removal, maintenance or repair should complete an 8-hour training course.
3. Individuals who handle and operate the fixed gauge(s) and perform installation, initial radiation monitoring, relocation, removal, maintenance or repair should complete a 40-hour training course.

Regardless of which of the above options is chosen, the applicant must include a commitment that training records will be maintained (e.g., copies of training course certificates issued to each authorized user) for all personnel authorized to use the fixed gauges independently and for those individuals working in the vicinity of the fixed gauges who receive the orientation training.

A person specifically listed as an authorized user on an existing radioactive material license authorizing use of radioactive material in a similar fixed gauge may submit a copy of that license (or reference an Illinois Radioactive Material License Number) as evidence of training and experience. If the individual has completed the fixed gauge manufacturer's training program, enclose a copy of the completion certificate. Additionally, submit the information specified in Item 11 of these instructions.

Specify on the application if individuals will complete the manufacturer's training course or a Agency approved training course or submit the training and experience of all authorized users. See Item 11 of this instructional set for additional training requirements for all authorized users. Appendix G contains a listing of basic subjects to be covered for various levels of training.

#### Item 6 - Radiation Safety Officer (RSO)

State the name and job title of the RSO. This person is designated by, and responsible to, the applicant's management for the coordination of the applicant's radiation safety program and for ensuring compliance with the applicable regulations and license provisions. For smaller companies the RSO may be the management.

The individual responsible for the radiation safety program should, at a minimum, have completed the highest level of training requirements listed in Item 5 and Item 11 of this Instructional Set. The RSO should be an on-site individual designated for each installation to assume the responsibilities of the office, to advise on the establishment of safe working conditions and to assure that the installation is in compliance with all pertinent federal, State and local regulations. The RSO should be familiar with the basic principles of radiation protection in order to properly fulfill the responsibilities, although for details the RSO may consult with appropriate qualified experts.

In addition, the RSO's duties and responsibilities must be defined. Appendix C contains a sample listing of these duties and responsibilities. Either indicate that the RSO will

commit to these duties and responsibilities or submit an alternate program for Agency review.

### Item 7 - Radioactive Material

Submit a detailed description of the radioactive material for which a license is requested. This description should include all of the items listed in column one of the following example for each particular make and model of fixed gauge:

Information	Fixed Gauge
Element and Mass Number	Cs-137
Chemical and Physical Form	Sealed Source
Source Manufacturer and Model	ABC Company, Model 111
Maximum Activity per Source	X MBq or Y mCi
Number of Sources Requested	2
Device Manufacturer and Model	DEF Company, Model 222
Intended Use	Level/Density Measurements

### Item 8 - Instrumentation

Radiation monitoring instruments are not normally required for most licensees if the fixed gauges are used for their intended purpose, transported in U.S. Agency of Transportation (USDOT) approved containers and installation, relocation, removal, repair or maintenance procedures involving access to the sources or source holders are not performed. There are situations (e.g., receipt of damaged packages, an incident involving a fixed gauge, installation, etc.) where a monitoring instrument is needed to determine whether the radioactive source has been breached or to perform radiation monitoring (i.e., surveys).

In most cases during an incident the fixed gauge is damaged, but the source remains intact. Accordingly, the licensee should implement their emergency procedures and obtain technical assistance from the Agency, other qualified specific licensee or the manufacturer and arrange for a timely evaluation of the source integrity following receipt of a damaged package or an incident.

If the applicant requests to perform maintenance or repair involving access to the sources and source holders, or perform installation, removal or relocation of the fixed gauges, these procedures must be submitted (i.e., as part of Item 14 of this Instructional Set) for Agency approval. The licensee must have at least one low range beta-gamma (0-50 mR/hr or 0-200 mR/hr) or appropriate neutron monitoring instrument available at each area where these procedures will be performed for monitoring before, during and upon completion of the procedures.

If the licensee requests to analyze samples for leakage and/or contamination (leak/wipe tests), a radiation measurement instrument that is sufficiently sensitive to detect 185 Bq

(0.005 mCi) is also required. The applicant must submit the minimum detectable activity (MDA) calculations for each instrument used for leak/wipe test analysis. Appendix D contains sample MDA calculations.

Exhibit B is a form that may be used to describe the applicant's instrumentation. If this form is not used, then submit equivalent information for Agency review or specify that monitoring instruments are not applicable.

### Item 9 - Instrument Calibration and Operability Checks

If radiation monitoring instruments are required (see Item 8), the licensee must ensure that the monitoring instruments used to demonstrate compliance with 32 Ill. Adm. Code 340 are calibrated prior to first use, at intervals not to exceed 12 months thereafter and also following repair. Specify if monitoring instruments will be calibrated by a service company specifically licensed to perform monitoring instrument calibrations as a customer service or by the applicant using specified procedures.

If monitoring instruments are to be calibrated by the applicant, then the applicant must submit the information requested in Appendix E. Additionally, specify in Item 7. above, the manufacturer, model, radionuclide and activity of the sources and the manufacturer and model of the devices used for performing instrument calibrations. If a consultant or other licensed firm will perform the calibration of the monitoring instruments, then the applicant should maintain a copy of the radioactive material license which authorizes that entity to perform monitoring instrument calibrations as a customer service.

In addition, the Agency requires the licensee to check instrument operability by using a source of radiation and maintain records of these checks. These instrument operability checks are required to be performed on each day the instrument is used; however, a record of these checks is required only after repair, battery change or instrument calibration and at intervals not to exceed three months. If any check source reading varies greater than 20% from the reading measured immediately after calibration, the licensee shall require the instrument be repaired or recalibrated before use for monitoring required to maintain compliance.

### Item 10 - Facilities and Equipment

Fixed gauges must be stored and used in such a manner as to prevent unauthorized removal or unauthorized use as required by 32 Ill. Adm. Code 340.810. Submit diagrams of all areas in which radioactive material will be permanently stored or used (e.g., closets or rooms, etc. for storage; locations within the plant, etc. for use). The submitted diagrams and additional information should include the following:

- a. Specify the diagram scale.
- b. Indicate the direction of north.

- c. Clearly mark or identify all areas adjacent (e.g., beside, above and below) to radioactive material storage/use rooms or areas (e.g., offices, control rooms, work stations, etc.). Specify the distance of the closest occupied work station to the radioactive material storage/use area. Areas where gauges are stored pending installation or disposal should also be included.
- d. Specify the building, floor, room number and principal use (e.g., for storage only or for use of the device) of each room or area.
- e. Indicate all lockable doors and storage containers for all storage/use locations for radioactive material.
- f. Provide a description of the security measures implemented to limit access to the storage/use areas to authorized personnel only (e.g., areas locked when not in use and only accessible by authorized users - for storage areas; fixed gauges are mounted "X" feet above personnel work areas which are inaccessible, etc. - for use areas).
- g. Submit a description of the storage containers (e.g., manufacturer's shipping container, etc.) used for the fixed gauges.
- h. For each storage or use location, if the applicant does not own the use/storage facility/property, submit a letter from the owner of the facility/property verifying the owner is aware of the use/storage of radioactive material on this property. If the facility/property is owned by the applicant, so indicate.

Appendix F contains sample facility diagrams.

#### Item 11 - Personnel Training Program

The applicant may request authorization for individuals to complete the manufacturer's training course, an equivalent Agency approved training course or provide in-house training to authorize new radioactive material users. In addition to the aforementioned training, all individual users whose jobs may require them to access any portion of a restricted area must receive instruction as specified in 32 Ill. Adm. Code 400.120.

Training requirements vary depending on the level of use by personnel. The following describes training requirements for various levels of use:

- 1. Individuals who work in the vicinity of the gauge(s), but do not operate or handle the gauge(s) in any way should complete a 1 to 2-hour orientation training course.

2. Individuals who handle and operate the fixed gauge(s), but do not perform installation, initial radiation monitoring, relocation, removal, maintenance or repair should complete an 8-hour training course.
3. Individuals who handle and operate the fixed gauge(s) and perform installation, initial radiation monitoring, relocation, removal, maintenance or repair should complete a 40-hour training course including the manufacturer's service procedures and on-the-job training in the installation/removal procedures.

In order for Agency staff to evaluate proposals for in-house training programs and programs acceptable to meet 32 Ill. Adm. Code 400.120 requirements, submit a description of the training which includes the following information:

- a. The form of training (e.g., formal course work, lectures, on-the-job training, etc.),
- b. A list of topics covered in the training (See Appendix G),
- c. The means used to evaluate the training [e.g., exam with an answer key (which must be submitted) and the minimum passing criteria],
- d. The frequency and the duration of training (i.e., such training must be provided to personnel before assuming duties in, or performing duties requiring access to, any portion of a restricted area, at intervals not to exceed 12 months as refresher training and whenever there is a significant change in duties, potential radiation hazards, regulations or the terms of the license),
- e. The name and qualifications of the individual providing the training (i.e., the instructor should have completed an approved training course and should have at least one year of experience in the use of fixed gauges) and
- f. A sample of the training record to be maintained (or a description of such records content and the subject matter).

The training program should be of sufficient scope to ensure that all personnel, including technical, clerical, maintenance, security, etc. who have access to the fixed gauges, receive proper instruction regarding the safety of the fixed gauge. These topics may vary depending on staff members job-related duties.

Licenses who request to install, relocate, remove, repair or perform maintenance on fixed gauges, may need to request approval to transport the devices to outside facilities. 32 Ill. Adm. Code 341 requires that no licensees may transport licensed material outside the confines of his plant or other place of use or deliver licensed material to a carrier for transport unless the transport and delivery is in compliance with the regulations of the USDOT, 49 CFR 170-189. Note the training requirements listed in 49 CFR 172 for which you are responsible if transporting the radioactive material. Copies of 49 CFR can

be ordered from the U.S. Government Printing Office (GPO), Superintendent of Documents, P.O. Box 371954, Pittsburgh, Pennsylvania 15250-7954. The GPO's order desk in Washington, DC can be reached at (202) 512-1800. Copies of these rules are also available for inspection at the Agency, 1035 Outer Park Dr., Springfield, IL.

In addition to the initial classroom training listed in Item 11 of these instructions or the initial manufacturer's training course, the responsible individual should have completed the 49 CFR 172 training mentioned above, if applicable, training in the applicant's operating and emergency procedures and the terms and conditions of the license. This training should be performed at frequencies not to exceed 12 months, except the 49 CFR 172 training is only required every three years.

Appendix G contains sample topics for acceptable training programs for all three levels of training. Submit a description of your training program for each level of training requested in Item 5 of this Instructional Set.

### Item 12 - Procedure for Ordering and Receiving Radioactive Material

Submit a description of procedures for ordering and receiving radioactive material, including receipt during off-duty hours and for notification of responsible persons upon receipt of radioactive material. This procedure should be adequate to meet the requirements of 32 Ill. Adm. Code 340.960, to ensure that possession limits are not exceeded, to ensure that radioactive material is secured at all times against unauthorized removal, to ensure that radiation levels in unrestricted areas do not exceed the limits specified in 32 Ill. Adm. Code 340.310 and to ensure that all receipts are properly documented.

If packages are only received during normal working hours, so indicate. Security personnel or any other individuals who receive packages of radioactive material during off-duty hours should be issued written procedures, which detail receipt, examination and security of packages. Procedures should include notification procedures to be followed for packages found or suspected to be damaged and indicate the immediate steps to be taken to prevent the spread of contamination.

Appendix H contains a sample procedure and instructions for ordering and receiving radioactive material packages.

### Item 13 - Procedure for Safely Opening Radioactive Material Packages

Submit procedures for examining the physical condition of incoming packages, for notification of responsible persons upon receipt of radioactive material and for safely opening packages in accordance with 32 Ill. Adm. Code 340.960. This procedure may vary depending on the type and quantity of radioactive material received, but it should include:



- a. Procedures or methods for verifying the contents of packages of radioactive material, not only against the packing slip, but also against the amount, type and form of material ordered and against the license to ensure that possession limits are not exceeded.
- b. Procedures or methods to ensure that radioactive material is secured at all times against unauthorized removal.
- c. Procedures or methods to ensure that receipt of radioactive material is properly documented.

Appendix I contains a sample procedure and instructions for safely opening radioactive material packages. Either indicate that the procedure in Appendix I will be followed or submit an alternate procedure for Agency review.

#### Item 14 - General Rules for the Safe Use of Radioactive Material

Submit the general safety instructions to be followed by all personnel while working with radioactive materials. The instructions should include:

- a. Provisions that only qualified individuals will use the fixed gauges.
- b. Procedures to be followed when performing lock-out procedures of fixed gauges including provisions for when these procedures should be implemented.
- c. Provisions for maintaining doses ALARA.
- d. Procedures to be followed for accountability of radioactive material. Note that a physical inventory of the sealed sources is required to be performed at frequencies not to exceed six months. This inventory is not the same as conducting tests for leakage and/or contamination (leak/wipe tests), but it may coincide with leak/wipe tests as long as the sources are not placed into permanent storage and this is specifically requested in the application and approved by the Agency. A sample physical inventory, inspection and monitoring form is contained in Appendix K. This form may be used for the physical inventory required to be performed at frequencies not to exceed six months.
- e. Provisions for conducting a physical inspection (e.g., labeling, posting, shutter checks, etc.) of each fixed gauge at intervals not to exceed six months. See Appendix K for a sample physical inventory, inspection and monitoring form.
- f. Procedures or methods for preventing unauthorized access, use or removal of the fixed gauge(s) at use and storage locations.

- g. Procedures to be followed for records maintenance regarding receipt, use and transfer of radioactive material. Records of use should be adequate to identify the location of the fixed gauge(s) at all times.
- h. Procedures for use and care of personnel monitoring devices, if used.
- i. Specific instructions to the users and individuals working in the vicinity of the fixed gauges informing them that sealed sources shall not be opened or removed from their source holders.
- j. Procedures for evaluation of the environmental conditions where the fixed gauge is intended for use to ensure the conditions meet those recommended by the manufacturer prior to installing or using a fixed gauge in a particular environment.
- k. Procedures for cleaning fixed gauge(s) including use of remote handling tools and instructions for their use.
- l. Specific instructions to users informing them that any installation, initial radiation monitoring, relocation, removal, maintenance and repair on the fixed gauge(s) is prohibited.

NOTE:

If the applicant desires authorization to perform installation, initial radiation monitoring, relocation, removal, maintenance or repair of fixed gauges involving access to the source or source holders and/or dismantling of the shielding or shutter devices, specific step-by-step procedures, including radiation safety precautions, must be submitted to the Agency for review. In addition, the names and qualifications of personnel who will perform such procedures must be submitted. A commitment must also be made to maintain records of such procedures and monitoring.

- m. Safety measures to be used when transporting the fixed gauge(s) in a vehicle, if applicable. Transportation activities must be carried out in accordance with 32 Ill. Adm. Code 341 and the requirements of the U.S. Department of Transportation regulations.

Appendix J contains a sample set of general rules for the safe use of radioactive material for Items a - j above. Either indicate the procedures covering Items a - j above and contained in Appendix J will be followed or submit an alternate procedure for Agency review.

If the applicant requests authorization to perform procedures listed in Items k - m above, separate procedures, in addition to the information in Appendix J, must be submitted. Information contained in Appendix J.1. lists minimum requirements that must be addressed in your procedures for Items k - m. Additionally, indicate if all or which

portions of the physical inventory, inspection and monitoring form contained in Appendix K will be used or submit alternate form(s) for Agency review.

#### Item 15 - Emergency Procedure

Submit a copy of the procedure to be implemented during an emergency. A copy of this procedure should be posted in all areas where radioactive material is used and/or stored. The procedure should:

- a. Describe immediate action to be taken after an incident in order to prevent contamination/radiation exposure of personnel or members of the public. Actions to be taken for handling injured people who may be contaminated should also be addressed.
- b. List the names and telephone numbers of the responsible person(s) (e.g., RSO) to be notified in case of an emergency. The Agency's 24-hour telephone number should be included in this section (217/785-0600).
- c. Instruct personnel on appropriate methods for re-entering effected areas.
- d. Describe what action is to be taken in the event of fire, theft or loss involving radioactive material. This response must include the notification of this Agency in accordance with 32 Ill. Adm. Code 340.1210 and 340.1220.

Appendix L contains a sample emergency procedure. Either indicate that the procedure in Appendix L will be followed or submit an alternate procedure for Agency review.

#### Item 16 - Monitoring Procedure

For applicants who wish to perform their own installation, initial radiation monitoring, relocation, removal, maintenance or repair of fixed gauges or analysis of test samples for leakage and/or contamination (leak/wipe tests), submit a procedure for performing periodic radiation monitoring and contamination monitoring. The procedure must describe the routine monitoring program, including the areas to be monitored, frequency of the monitoring, action levels initiating decontamination procedures and provisions for maintaining records of monitoring. Otherwise indicate monitoring is not applicable.

### Item 17 - Transfer or Disposal

Describe the specific method(s) to be used to transfer or dispose of the fixed gauge(s) containing radioactive material when the device(s) are no longer usable or wanted [e.g., return to the manufacturer or transfer to a person properly licensed to receive such material. See 32 Ill. Adm. Code 340.1010(a) for authorized recipients.].

### Item 18 - Testing Sealed Sources for Leakage and/or Contamination

Testing of sealed sources for leakage and/or contamination (leak/wipe tests) must be performed only by persons who are specifically licensed by either the Agency, the U.S. Nuclear Regulatory Commission (NRC), another Agreement State or a Licensing State to perform such services. In establishing a program for performing leak/wipe tests in accordance with 32 Ill. Adm. Code 340.410, two alternatives are available from which to choose:

- a. The services of a licensed consultant or commercial organization may be used to obtain test samples, evaluate the samples and report the results back to the applicant. In addition, a commercially available test kit may be used to obtain a test sample for subsequent analysis by a licensed service company. When using a licensed service, please note the licensee should maintain a copy of that company's license which authorizes them to perform leak/wipe tests as a customer service.
- b. The applicant may request authorization to perform leak/wipe tests, including sampling and analysis. If this option is chosen, then submit the information outlined in Appendix M for Agency evaluation.

### Item 19 - Personnel Monitoring

32 Ill. Adm. Code 340.210(a) describes occupational dose limits to adults. 32 Ill. Adm. Code 340.520(a) specifies when personnel monitoring equipment is necessary, unless it can be demonstrated by calculation and/or procedures that the radiation exposure will not exceed 10% of the applicable limits set forth in 32 Ill. Adm. Code 340.210. When applicable, on the application, indicate the type(s) of personnel monitoring device(s) to be used (e.g., whole-body and/or finger device) and the frequency at which the device will be exchanged and evaluated. In addition to whole-body film or thermoluminescent dosimeter (TLD) badges, certain persons must wear a ring film badge or TLD. When used, finger badges should be turned to the inside and worn on the finger most likely to receive the greatest radiation exposure. In addition, each applicant using a film badge or TLD service must ensure that the service meets the requirements of 32 Ill. Adm. Code 340.510(d).

If direct reading dosimeters (pocket ionization chambers) are used in the program, indicate the conditions under which they will be used, each dosimeter's useful range, frequency of reading and recording dosimeter readings, and the procedure for

maintaining and calibrating the dosimeters. In accordance with 32 Ill. Adm. Code 340.510(e) applicants must receive prior Agency approval for use of dosimeters as a means of complying with Section 340.210 or other applicable provisions of 32 Ill. Adm. Code: Chapter II, Subchapters b and d or with conditions specified in a license.

Appendix N contains a sample procedure for use and calibration of direct reading dosimeters. If direct reading dosimeters are used, either indicate that the procedure contained in Appendix N will be followed or submit an alternate procedure for Agency review.

#### Item 20 - License Fee

Refer to 32 Ill. Adm. Code 331 and the appropriate fee schedule to determine the correct fee. Applications will NOT be processed until the correct fee is received by this Agency. Questions concerning fees should be directed to the Radioactive Materials Section Licensing Section staff.

#### Item 21 - Financial Assurance

((COMPLET THIS SECTION))

#### Item 22 - Certification

The application must be signed and dated by the applicant, if acting as an individual or by an individual who is authorized by management to sign on behalf of the licensee. A statement signed by facility management granting authority to sign license requests and related documents is required for applications not signed by an officer or the administrator of the facility. Unsigned applications will be returned for proper signature.

### IV. LICENSE AMENDMENTS

Licensees are required to conduct their programs in accordance with the regulations and statements, representations and procedures contained in the license application and supporting documents. The license must be amended if the licensee plans to make any changes, from previously submitted correspondence, in the facilities, equipment, procedures, RSO, radioactive material used or authorized users (i.e., unless the license authorizes individuals who have completed the manufacturer's training course or equivalent Agency approved training course to use radioactive material).

Applications for license amendments should be filed on the "Application Form for a Radioactive Material License Authorizing the Use of Sealed Sources in Fixed Gauges" or in letter form. The licensee must identify the license by number and clearly describe the exact nature of the changes, additions or deletions requested. References to previously submitted information and documents must be clear and specific and identify the applicable information by date, page and paragraph. This documentation must also

be maintained on file for inspection. An original and two copies of the application for amendment should be prepared. The original and one copy must be submitted and the licensee must retain one copy and all attachments with the license file. Licensees must conduct their program in accordance with their current license until said amendment is issued.

## V. LICENSE RENEWALS

An application for license renewal must be received by the Agency at least 30 days prior to the expiration date. This filing will ensure that the license does not expire until final action on the application has been taken by the Agency as provided by 32 Ill. Adm. Code 330.330.

Renewal applications must be filed on the "Application Form for a Radioactive Material License Authorizing the Use of Sealed Sources in Fixed Gauges" appropriately supplemented, contain complete and up-to-date information about the applicant's program and meet all licensing and regulatory requirements in effect at the time of renewal. Renewal applications should be submitted without reference to documentation and information submitted previously, except for previously approved users. If such references cannot be avoided, they are acceptable provided:

- A. The reference is made in response to a particular item of required information (e.g., radiation instrument calibration procedures);
- B. The reference is clear and specific (e.g., title of document, date of submission, page and paragraph); and
- C. The referenced document contains all information required for a particular item at the time of renewal.

Renewal applications should be submitted in accordance with the procedures outlined in Section II (Filing an Application) of these instructions.

## VI. LICENSE TERMINATIONS

A licensee may request termination of a radioactive material license at any time. To terminate a license, the licensee must meet the requirements of 32 Ill. Adm. Code 330.320(d), which include:

- A. Transfer or disposal of all licensed radioactive material in the licensee's possession in accordance with 32 Ill. Adm. Code 340;
- B. Completion of IEMA form IL 473-00084 (KLM.007), "Certificate - Termination and Disposition of Radioactive Material" (see Exhibit C); and
- C. Performance of radiation monitoring or the equivalent in accordance with 32 Ill. Adm. Code 330.320.(d)(1)(E)

Submit the completed IEMA Form KLM.007 and a copy of any applicable radiation monitoring records to the Agency at least 30 days before the expiration date of the license or upon termination of all licensed activities. The Agency reserves the right to perform confirmatory monitoring of licensed facilities prior to termination.

**(This page is intentionally blank)**



## APPENDIX A

### RETENTION OF DOCUMENTS

<u>Document</u>	<u>Retention Interval</u>
32 Ill. Adm. Code	Until termination of license
License, all active amendments and supporting documents (including the application)	Until termination of license
Annual Radiation Protection Program and ALARA Reviews	5 years
Receipt, Transfer and Disposal	Until disposal is authorized by the Agency
Monitoring Instrument Calibration	5 Years
Tests for Leakage and/or Contamination	5 Years
Inventories and Inspections	5 Years
Utilization Logs	Until disposal is authorized by the Agency
Training and Testing Records	Until disposal is authorized by the Agency or 3 years after termination of employment
Personnel Monitoring Records	Until disposal is authorized by the Agency
Radiation Monitoring Records	5 years or until disposal is authorized by the Agency if monitoring was used to determine an individual's exposure

**(This page is intentionally blank)**

## APPENDIX B GUIDE TO SI UNITS

RADIATION DOSE EQUIVALENT		AMOUNT OF RADIOACTIVE MATERIAL		SURFACE ACTIVITY LEVELS		
OLD ( <i>rem</i> ) 0.1 mrem 0.25 0.5 0.75 1.0 mrem 2.5 10 mrem 100 mrem 500 mrem 1 rem 1.5 rem 5 10 rem 15 rem 50 rem 100 rem	NEW ( <i>sievert</i> ) 1 $\mu$ Sv 2.5 5 7.5 10 $\mu$ Sv 25 100 $\mu$ Sv (0.1 mSv) 1 mSv 5 mSv 10 mSv 15 mSv 50 100 mSv 150 mSv 500 mSv 1 Sv	OLD Ci ( <i>curie</i> ) 1 pCi 27 pCi 1 nCi 27 nCi 1 $\mu$ Ci 27 $\mu$ Ci 1 mCi 27 mCi 1 Ci 27 Ci	NEW Bq ( <i>becquerel</i> ) 37 mBq 1 Bq 37 Bq 1 kBq 37 kBq 1 MBq 37 MBq 1 GBq 37 GBq 1 TBq	$\mu$ Ci/cm <sup>2</sup> 10 <sup>-6</sup> 3 x 10 <sup>-6</sup> 10 <sup>-5</sup> 3 x 10 <sup>-5</sup> 10 <sup>-4</sup> 3 x 10 <sup>-4</sup> 10 <sup>-3</sup> 3 x 10 <sup>-3</sup> 10 <sup>-2</sup>	Bq/cm <sup>2</sup> (kBq/m <sup>2</sup> ) 0.037 0.1 0.37 1 3.7 10 37 100 370 1000 3700	0.37 0.1 3.7 10 37 100 370 1000 3700

(1 m<sup>2</sup> = 10<sup>4</sup> cm<sup>2</sup>)

CONVERSIONS	RADIATION DOSE RATES	DERIVED AIR CONCENTRATION (DAC)	CONCENTRATION IN SOLUTION								
100 rem = 1 Sv 100 rad = 1 Gy (gray) 1 ton = 1 Mg 1 ton = 1000 kg 1 kg = 1000 g 1 MBq/ton = 1 Bq/g	$\mu$ Sv/h, mSv/h e.g., 7.5 $\mu$ Sv/h 25 $\mu$ Sv/h	Units: Bq m <sup>-3</sup> Conversion: $\mu$ Ci cm <sup>-3</sup> x 3.7 x 10 <sup>10</sup> = Bq m <sup>-3</sup> $\frac{\text{dpm m}^{-3}}{60} = \text{Bq m}^{-3}$	<table border="0" style="width: 100%;"> <tr> <td style="text-align: center;"><math>\mu</math>Ci</td> <td style="text-align: center;">kBq/dm<sup>3</sup> (kBq/l)</td> </tr> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">37</td> </tr> <tr> <td style="text-align: center;">10</td> <td style="text-align: center;">370</td> </tr> <tr> <td style="text-align: center;">100</td> <td style="text-align: center;">3700</td> </tr> </table> <hr/> 1 m <sup>3</sup> = 10 <sup>3</sup> dm <sup>3</sup> = 10 <sup>3</sup> l or 10 <sup>3</sup> L 1 mBq/m <sup>3</sup> = 1 kBq/dm <sup>3</sup>	$\mu$ Ci	kBq/dm <sup>3</sup> (kBq/l)	1	37	10	370	100	3700
$\mu$ Ci	kBq/dm <sup>3</sup> (kBq/l)										
1	37										
10	370										
100	3700										

### PREFIXES FOR UNITS:

a	atto	10 <sup>-18</sup>		k	kilo	10 <sup>3</sup>	thousand
f	femto	10 <sup>-15</sup>		M	mega	10 <sup>6</sup>	million
p	pico	10 <sup>-12</sup>	trillionth	G	giga	10 <sup>9</sup>	billion
n	nano	10 <sup>-9</sup>	billionth	T	tera	10 <sup>12</sup>	trillion
$\mu$	micro	10 <sup>-6</sup>	millionth	P	peta	10 <sup>15</sup>	
m	milli	10 <sup>-3</sup>	thousandth	E	exa	10 <sup>18</sup>	

**(This page is intentionally blank)**

## APPENDIX C

### DUTIES AND RESPONSIBILITIES OF THE RADIATION SAFETY OFFICER

Among the specific duties and responsibilities of the RSO are the following:

1. Assure that radioactive material possessed by the licensee conforms to the material authorized by the license.
2. Assure that only individuals authorized by an appropriate license use the radioactive material.
3. Assure personnel are instructed in proper radiation protection practices and maintain training records.
4. For applicants who perform their own installation, initial radiation monitoring, relocation, removal, maintenance, repair or analysis of test samples for leakage and/or contamination (leak/wipe tests), conduct or have conducted radiation monitoring where indicated and keep records of such monitoring, including summaries of corrective measures recommended and/or instituted.
5. Assure that personnel monitoring devices are used where required or indicated, exchanged at required intervals and that records are maintained of the results of such monitoring.
6. Investigate each known or suspected case of excessive or abnormal exposure to determine the cause and take steps to prevent its recurrence.
7. Be immediately available to serve as a point of contact with the Agency and give assistance in case of emergency (e.g., fixed gauge damage, fire, theft, etc.).
8. Assure that the Radiation Protection Program is implemented and reviews are performed in accordance with the regulations.
9. Assure that the proper authorities (e.g., IEMA, local police, U.S. Agency of Transportation, etc.) are notified promptly in case of accident, damage, theft or loss of the fixed gauge(s).
10. Assure that fixed gauge(s) are properly secured against unauthorized removal at all times when they are in use and in storage.
11. Assure that the terms and conditions of the license (e.g., installation, relocation, removal, periodic leak/wipe tests, inventories, etc.) are met and that the required records (e.g., personnel exposure, leak/wipe test, accountability, inventory, etc.) are maintained and periodically reviewed for compliance with the Agency's regulations and license conditions.

12. Assure that the fixed gauges are transported, if applicable, in compliance with all applicable U.S. Department of Transportation regulations (e.g., labeling, marking, shipping papers, container blocking and bracing, etc.).

## APPENDIX C.1

### PROVISION FOR DELEGATING DUTIES TO AUTHORIZED INDIVIDUALS

The Radiation Safety Officer may delegate certain duties to specified individuals provided that:

- A. The licensee maintains, for a period of 5 years, records of all individuals designated by the Radiation Safety Officer to perform duties or meet regulatory requirements that would otherwise be required as a duty of the Radiation Safety Officer. These records shall include:
  1. The name of the individual;
  2. A list of all duties the Radiation Safety Officer's designee is authorized to perform;
  3. The date upon which the designation became effective;
  4. The signature of the Radiation Safety Officer's designee; and
  5. The signature of the Radiation Safety Officer.
  
- B. The Radiation Safety Officer shall review records generated by designees and the performance of designees quarterly. In addition, the licensee shall maintain for departmental inspection for a period of 5 years, records of the quarterly reviews of records generated by designees and quarterly reviews of each designee's performance. These records shall include:
  1. The date of the review;
  2. The records being reviewed and the name of the designee being reviewed;
  3. A list of all duties performed by the designee;
  4. The results of the Radiation Safety Officer's review and any corrective measures taken, if applicable, based on the review; and
  5. The signature of the Radiation Safety Officer.

**(This page is intentionally blank)**



## APPENDIX D

### SAMPLE MINIMUM DETECTABLE ACTIVITY CALCULATIONS

Several references contain discussions of counting statistics for radiation measurements. For purposes of this guide, the discussion contained in NCRP Report No. 58 appears to be the simplest to use. The formula the Agency recommends is the one for determining a measurement at the 95% confidence level. The formula for this level is:

$$LLD = \frac{2.71 + 4.65 \sqrt{B}}{EFF}$$

where:

- LLD = Lower Limit of Detection (dpm, divide by 2.2 E+6 for mCi)
- B = Background counting rate (counts/time) and
- EFF = Counting efficiency (counts/disintegration).

The sample counting time and background counting time must be equal. The counting efficiency must be determined by using a standard source of known activity that emits photons of approximately the same energy as the contaminant to be detected. The counting rate for the standard is divided by the standard activity to determine the counting efficiency. When dividing, the two values must be in compatible units. For example, a standard activity in  $\mu\text{Ci}$  must be converted to dpm by multiplying by a factor of  $2.2\text{E}+6$  dpm/ $\mu\text{Ci}$ .

For a copy of the full discussion of the theory and limitations of this test, refer to pages 307-311 in NCRP Report No. 58, A Handbook of Radioactivity Measurement Procedures, issued February 1, 1985 by the National Council on Radiation Protection and Measurements, 7910 Woodmont Avenue, Bethesda, MD 20814.

**(This page is intentionally blank)**

## APPENDIX E

### METHOD FOR CALIBRATING RADIATION MONITORING INSTRUMENTS

#### 1. Application For a Licensee to Perform Radiation Monitoring Instrument Calibrations

When radioactive material is used to calibrate radiation monitoring instruments, the person or organization performing the calibration must be specifically authorized by the Agency, the U.S. Nuclear Regulatory Commission, an Agreement State, or a Licensing State.

An application for a licensee to perform radiation monitoring instrument calibrations should contain the following information:

- a. The manufacturer's name and model of the source(s) to be used.
- b. The radionuclide and activity of the radioactive material contained in the source(s).
- c. The accuracy of the source(s) activity; documentation that the determination of each source activity is traceable to the National Institute of Standards and Technology - NIST (previously National Bureau of Standards - NBS) or other accepted National Standards organization.
- d. A description of the facilities to be used.
- e. The name and applicable experience of each individual who will perform the calibrations.
- f. Calculations related to the calibration procedures.
- g. The step-by-step calibration procedures, including associated radiation safety procedures.
- h. Copies of records that will be maintained (see Item 4).
- i. Verification that the requirements outlined in this appendix will be followed.

## 2. Recommended Methods For Calibration of Radiation Monitoring Instruments

The calibration of radiation monitoring instruments shall be performed in accordance with the following:

- a. The radionuclide sources used for calibration shall approximate point sources.
- b. The source activities shall be traceable\* within  $\pm 5\%$  accuracy to the NIST (previously NBS) or other accepted National Standards organization calibrations.\*\*
- c. The frequency of calibration shall be at intervals not to exceed one year and after servicing/repair.
- d. Each scale of the radiation monitoring instrument shall be calibrated at least at two points such that: (a) one point is in each half of the scale; and (b) the two points are separated by 50-60% of full scale. Logarithmic and digital readout radiation monitoring instruments with only a single readout scale shall be calibrated, at a minimum, at one point near the midpoint of each decade.

---

\* For purposes of this document, the amount of activity in a source is said to be traceable to a national standard when its activity was determined by comparison with a source of the same radionuclide (or a proper simulated source, isotopically) the activity of which is certified by the NIST or other accepted National Standards organization.

\*\* In lieu of using a traceable radioactive source, a transfer instrument traceable to the NIST or other accepted National Standards organization, within  $\pm 5\%$ , may be used as an alternative standard. For purposes of this document, a transfer instrument shall meet the definition as contained in the American National Standard Institute publication, ANSI N323-1978, "Radiation Protection Instrumentation Test and Calibration."

NOTE: Sources of cobalt-60, cesium-137, or radium-226 are generally appropriate for use in calibrations. The radioactivity of the calibration standard should be sufficient to calibrate the radiation monitoring instruments on all ranges, or at least up to 1 Roentgen per hour on the higher range radiation measurement instruments. If there are higher ranges, they should be checked for operation and approximately correct response to radiation.

- e. The exposure rate measured by the radiation monitoring instrument should not deviate more than  $\pm 10\%$  from the calculated or known value for each point checked. (Read appropriate section of the radiation monitoring instrument manual to determine how to make necessary adjustments to bring the radiation monitoring instrument into calibration.) Readings within  $\pm 20\%$  will be considered acceptable if a calibration chart or graph is prepared and attached to the radiation monitoring instrument. If the radiation monitoring instrument cannot be adjusted so that each reading falls within the  $\pm 20\%$  range, it shall be taken out of service and sent to the manufacturer or to a qualified radiation monitoring instrument firm for repair.
- f. If an electronic device is used to calibrate instruments, the instrument must still be checked for response to a known source of radiation.

### 3. Use of a Reference Check Source for Operational Checks

A reference check source of a long half-life (e.g., greater than five years) shall be used to obtain a radiation monitoring instrument response by the licensee. The gauging device housing may be used as the reference check source. The reading shall be taken with the check source placed in a specific geometry relative to the detector and:

- a. Shall be taken before use on each day the instrument is used;
- b. Shall be taken after calibration by the licensee or after return to the licensee of a radiation monitoring instrument sent for calibration by a specifically licensed firm authorized to perform radiation monitoring instrument calibrations as a customer service;
- c. Shall be taken after maintenance and/or each battery change; and
- d. Shall be taken at least quarterly.

If any operational check reading using the reference check source, with the same geometry, is not within  $\pm 20\%$  of the reading measured immediately after calibration (or upon receipt from a calibration firm), the radiation monitoring instrument shall be removed from service and recalibrated.

#### 4. Records

Records for Items 2, 3.b and 3.d of this procedure shall be maintained.

- a. Records for Item 2 shall include, at a minimum:
  - 1) Radionuclide used;
  - 2) Activity and assay date of source;
  - 3) Present activity;
  - 4) Calculated and measured radiation values, including the percent of difference;
  - 5) Respective distance from source for each calculated and measured radiation value;
  - 6) Necessary scale correction factors (required if calculated and measured radiation values do not agree within  $\pm 10\%$ );
  - 7) Make, model and serial number of radiation monitoring instrument being calibrated;
  - 8) Name of individual performing the calibration; and
  - 9) Date radiation monitoring instrument calibration was performed.
  
- b. Records for Items 3.b and 3.d, of this procedure shall include, at a minimum:
  - 1) Radionuclide used;
  - 2) Activity and assay date of the radionuclide used;
  - 3) Reading of check source at time of calibration;
  - 4) Geometry of check source relative to detector (position);
  - 5) Date of calibration;
  - 6) Make, model and serial number of the radiation monitoring instrument;
  - 7) Date reference check was performed; and
  - 8) Name of individual who performed the reference check.

#### 5. Use of Inverse Square Law and Radioactive Decay Law

- a. A calibrated source will have a calibration certificate giving its output at a given distance measured on a specific date by the manufacturer or National Institute of Standards and Technology (NIST) or other accepted National Standards organization.
  - 1) The Inverse Square Law may be used with any point source to calculate the exposure rate at other distances.
  - 2) The Radioactive Decay Law may be used to calculate the output at other times after the specified date.

b. INVERSE SQUARE LAW:

S (R<sub>1</sub>) (R<sub>2</sub>)

\* ----- P<sub>1</sub>

\* ----- P<sub>2</sub>

Exposure rate at P<sub>2</sub>:

$$R_2 = \frac{(P_1)^2 \times (R_1)}{(P_2)^2}$$

where:

S is the point source

R<sub>1</sub> and R<sub>2</sub> are the exposure rates at points P<sub>1</sub> and P<sub>2</sub> in the same units (e.g., mR/hr, R/hr, mSv/hr or mSv/hr).

P<sub>1</sub> and P<sub>2</sub> are the distances from the point source in the same units (e.g., centimeters, meters, feet, etc.)

c. RADIOACTIVE DECAY LAW:

$$R_t = R_o e^{-(0.693 t / T_{1/2})}$$

where:

R<sub>0</sub> and R<sub>t</sub> are in the same units (e.g., mR/hr, R/hr, mSv/hr or mSv/hr)

R<sub>0</sub> is exposure rate on specified calibration date (i.e., time zero)

R<sub>t</sub> is exposure rate "t" units of time later

T<sub>1/2</sub> and t are in the same units (e.g., years, months, days, etc.)

T<sub>1/2</sub> is the half-life of the radionuclide

t is the time elapsed between the source calibration (assay) date and the radiation monitoring instrument calibration date (i.e., present time)

- d. Example: Source output is given by calibration certificate as 100 mR/hr at 1 foot on March 10, 1985. Radionuclide half-life is 5.27 years.

Question: What is the output at 3 feet on March 10, 1987 (2.0 years later)?

- 1) Output at 1 foot, 2.0 years after calibration date:

$$\begin{aligned}R_{(1 \text{ ft})} &= 100 \text{ mR/hr} [\exp^{-((0.693 \times 2.0)/5.27)}] \\ &= 100 \text{ mR/hr} (0.77) \\ &= 77 \text{ mR/hr at 1 foot on March 10, 1987}\end{aligned}$$

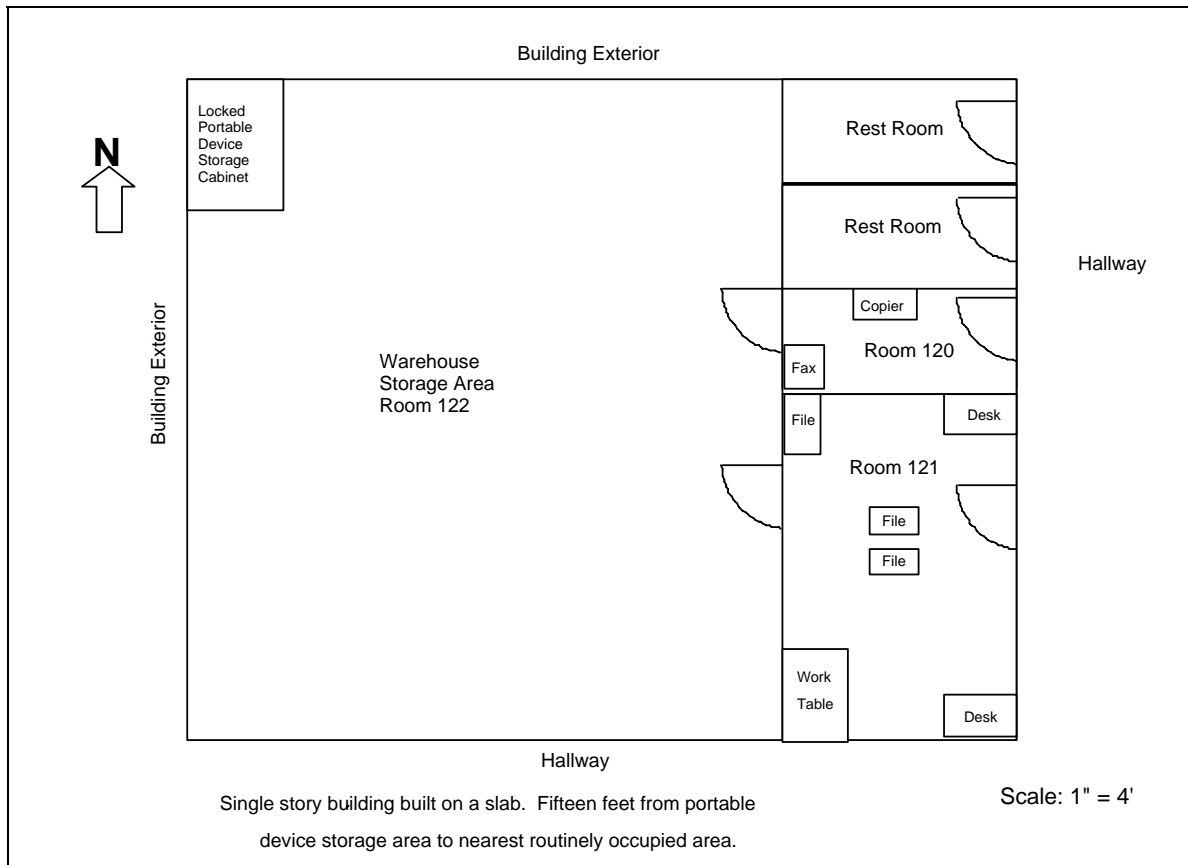
- 2) Output at 3 feet, 2.0 years after calibration date:

$$\begin{aligned}R_{(3 \text{ ft})} &= \frac{(1 \text{ foot})^2}{(3 \text{ feet})^2} (77 \text{ mR/hr}) \\ &= 1/9 (77 \text{ mR/hr})\end{aligned}$$

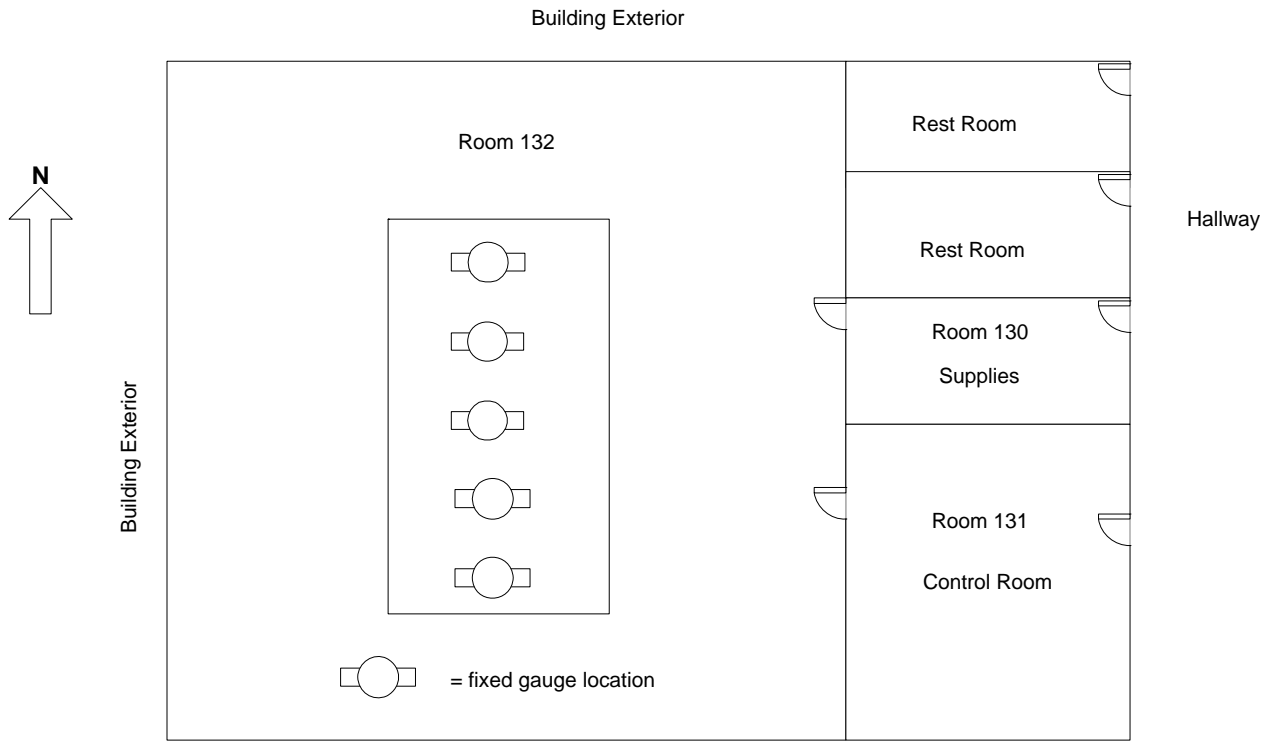


APPENDIX F

SAMPLE FACILITY DIAGRAM FOR FIXED GAUGE STORAGE



# SAMPLE FACILITY DIAGRAM FOR FIXED GAUGE USE



Single story building built on a slab. Minimum of fifteen feet from fixed gauge to closest occupied work station

Scale: 1" = 4'

## APPENDIX G

### BASIC SUBJECTS TO BE COVERED DURING RADIATION SAFETY TRAINING

#### I. BASIC SUBJECTS TO BE COVERED DURING A 1- to 2- HOUR RADIATION SAFETY ORIENTATION TRAINING COURSE

1. A general description and operation of the fixed gauge
2. Topics listed in 32 Ill. Adm. Code 400.120
3. Methods of controlling radiation dose
4. Instructions prohibiting handling of the fixed gauge
5. Instructions prohibiting entry into the vessel on which the fixed gauge is mounted or prohibiting performance of work adjacent to the fixed gauge during periods of shutdown until the shutter is locked-out by an authorized user
6. Emergency procedures

This training should be of sufficient scope to ensure that all participants can identify the gauge and all relative components and safely act/respond within the licensee's radiation protection program.

#### II. BASIC SUBJECTS TO BE COVERED DURING AN 8-HOUR RADIATION SAFETY TRAINING COURSE

##### A. Fundamentals of Radiation Safety

1. Characteristics of radiation
2. Units of radiation dose and activity
3. Math and calculations basic to the use and measurement of activity
4. Significance of radiation dose
  - a. Radiation protection standards
  - b. The ALARA principle
  - c. Biological effects of radiation
5. Levels of radiation from sources of radiation
6. Methods of controlling radiation dose
  - a. Working time
  - b. Working distance
  - c. Shielding

- B. Radiation Monitoring Instrumentation to be Used
  - 1. Use of radiation monitoring instruments
    - a. Operation
    - b. Calibration
    - c. Limitations
  - 2. Monitoring techniques
  - 3. Use of personnel monitoring equipment
    - a. Film badges
    - b. Thermoluminescent dosimeters (TLD's)
- C. Safety Equipment to be Used
  - 1. Remote handling equipment
  - 2. Storage containers
- D. The Requirements of Pertinent Federal and State Regulations (see Section I.D. of this Instructional Set) and Record Maintenance
- E. Terms and Conditions of the License, Active Amendments and Any Correspondence Submitted in Support of the License Application
- F. The Licensee's Written Operating and Emergency Procedures
  - 1. Storage procedures
    - a. Surveillance
    - b. Security
    - c. Inventory
    - d. Records
  - 2. Package receipt procedures
  - 3. Procedures for source/device use
    - a. Limitations regarding repair and maintenance (including cleaning)
    - b. Manufacturer's instruction manual
    - c. Evaluation of environmental conditions for fixed gauge placement
    - d. Lock-out procedures
    - e. Physical inventory and inspection
    - f. Testing for leakage and/or contamination (leak/wipe tests)
    - g. Prevention of accidents
    - h. Notification due to accident
    - i. Emergency procedures
  - 4. Transportation procedures (if applicable)
    - a. Shipping papers
    - b. Labels and markings
    - c. Certification of packaging
    - d. Blocking and bracing
    - e. Security
    - f. Inventory records

- g. Prevention of accidents
- h. Notification due to accident
- i. Emergency procedures
- j. U.S. DOT training requirements

G. Transfer or Disposal of Source/Device

H. Hands-On Training

- 1. Fixed gauge use
- 2. Lock-out procedures
- 3. Use of monitoring instruments
- 4. Testing for leakage and/or contamination (leak/wipe tests) procedures
- 5. Fixed gauge cleaning

III. BASIC SUBJECTS TO BE COVERED DURING A 40-HOUR RADIATION SAFETY TRAINING COURSE

A. Fundamentals of Radiation Safety

- 1. Characteristics of radiation
- 2. Units of radiation dose activity
- 3. Math and calculations basic to the use and measurement of activity
- 4. Significance of radiation dose
  - a. Radiation protection standards
  - b. The ALARA principle
  - c. Biological effects of radiation
- 5. Levels of radiation from sources of radiation
- 6. Methods of controlling radiation dose
  - a. Working time
  - b. Working distance
  - c. Shielding

- B. Radiation Monitoring Instrumentation to be Used
  - 1. Use of radiation monitoring instruments
    - a. Operation
    - b. Calibration
    - c. Limitations
  - 2. Monitoring techniques
  - 3. Use of personnel monitoring equipment
    - a. Film badges
    - b. Thermoluminescent dosimeters (TLD's)
- C. Safety Equipment to be Used
  - 1. Remote handling equipment
  - 2. Storage containers
- D. The Requirements of Pertinent Federal and State Regulations (see Section I.D. of this Instructional Set) and Record Maintenance
- E. Terms and Conditions of the License, Active Amendments and Any Correspondence Submitted in Support of the License Application
- F. The Licensee's Written Operating and Emergency Procedures
  - 1. Storage procedures
    - a. Surveillance
    - b. Security
    - c. Inventory
    - d. Records
  - 2. Package receipt and opening procedures
  - 3. Procedures for source/device use
    - a. Manufacturer's instruction manual
    - b. Evaluation of environmental conditions for fixed gauge placement
    - c. Installation, initial radiation monitoring, relocation, removal, repair and maintenance procedures
    - d. Lock-out procedures
    - e. Physical inventory and inspection
    - f. Testing for leakage and/or contamination (leak/wipe tests) procedures
    - g. Prevention of accidents
    - h. Notification due to accident
    - i. Emergency procedures
    - j. Technical updates from the manufacturer regarding equipment and procedures.
  - 4. Transportation procedures (if applicable)
    - a. Shipping papers
    - b. Labels and markings
    - c. Certification of packaging

- d. Blocking and bracing
- e. Security
- f. Inventory records
- g. Prevention of accidents
- h. Notification due to accident
- i. Emergency procedures
- j. U.S. DOT training requirements

G. Transfer or Disposal of Source/Device

H. Hands-On Training

- 1. Fixed gauge use
- 2. Lock-out procedures
- 3. Installation, initial radiation monitoring, relocation, removal, repair and maintenance procedures
- 4. Use of monitoring instruments
- 5. Testing for leakage and/or contamination (leak/wipe tests) procedures
- 6. Fixed gauge cleaning

**(This page is intentionally blank)**



## APPENDIX H

### SAMPLE PROCEDURE FOR ORDERING AND RECEIVING RADIOACTIVE MATERIAL

1. The Radiation Safety Officer (RSO) must approve or place all orders for radioactive material and must ensure that the requested material, quantities, manufacturer and model are authorized by the license and that possession limits are not exceeded.
2. During normal working hours, carriers must be instructed to deliver radioactive packages directly to the designated fixed gauge storage area.
3. During off-duty hours, security or other designated trained personnel must accept delivery of radioactive packages in accordance with the procedure outlined in the sample memorandum below.

### SAMPLE MEMORANDUM

MEMORANDUM FOR: Security Personnel  
FROM: John Jones, Administrator  
SUBJECT: RECEIPT OF PACKAGES CONTAINING  
RADIOACTIVE MATERIAL

If the package appears to be damaged, immediately contact the facility's RSO. Ask the carrier to remain at the facility until it can be determined that neither the carrier nor the vehicle is contaminated.

Any packages containing radioactive material that arrive between 4:30 P.M. and 7:00 A.M. or on Sundays shall be signed for by the Security guard or other designated trained individual on duty and taken immediately to the designated fixed gauge storage area/room. Unlock the door, place the package in the designated secured storage area and relock the door.

RADIATION SAFETY OFFICER (RSO): \_\_\_\_\_

OFFICE PHONE: \_\_\_\_\_

HOME PHONE: \_\_\_\_\_

THE ILLINOIS EMERGENCY MANAGEMENT AGENCY 24-HOUR PHONE: (217) 785-0600

**(This page is intentionally blank)**

## APPENDIX I

### PROCEDURE FOR SAFELY OPENING RADIOACTIVE MATERIAL PACKAGES

For packages received under the specific license, authorized individuals shall implement procedures for opening each package as follows:

1. a. Visually inspect the package for any sign of damage (e.g., crushed). If damage is noted, stop and notify the Radiation Safety Officer (RSO). Accordingly, the licensee should implement their emergency procedures, obtain technical assistance from the Agency or the fixed gauge manufacturer and arrange for a timely evaluation of the source integrity following receipt of a damaged package.
- b. Make arrangements to have all packages monitored that are known (or suspect) to contain radioactive contamination for radiation levels and for leakage if there is evidence of degradation of package integrity, such as packages that are crushed or damaged.
- c. For receipt of damaged packages, monitor the packing material and packages for contamination before discarding. If contamination is found, treat packaging as radioactive waste. If no contamination is found, obliterate all radiation labels prior to discarding as non-radioactive waste.
2. The monitoring required by Item 1 above shall be performed as soon as practicable after receipt of the package, but not later than three (3) hours after the package is received at the licensee's facility if it is received during the licensee's normal working hours or if there is evidence of degradation of package integrity, such as a package that is crushed or damaged.
3. Open the outer package and verify the contents (compare requisition, packing slip and device label). Check integrity of the final source container (inspecting for damage). Check also that the shipment does not exceed license possession limits or differ in the form, type, manufacturer, model, etc. as that authorized by the radioactive material license. If package received is not damaged, obliterate all radiation labels on packaging prior to discarding as non-radioactive waste. If anything is other than expected, stop and notify the RSO.
4. Place the fixed gauge in the designated secured storage area until it can be inspected and installed by the manufacturer or other person specifically authorized to perform such services by the Agency, U.S. NRC, another Agreement State or Licensing State.
5. Maintain records of receipt.

**(This page is intentionally blank)**

## APPENDIX J

### GENERAL RULES FOR THE SAFE USE OF RADIOACTIVE MATERIAL

1. Each individual using the fixed gauge will complete the training requirements prior to operation of the device.
2. Ensure the device is locked so that the source is in the shielded position before moving the fixed gauge from its place of storage or use; when individuals are working on or adjacent to a density or level gauge during periods of shutdown; and whenever an individual enters a vessel for which such a gauge is located.
3. The fixed gauge must be stored and used in a manner to minimize the amount of radiation exposure to the operator and each individual in its vicinity. Do not touch the source with your fingers, hands, or any part of your body and do not place any part of your body in front of the source when it is in the open or exposed position.
4. The fixed gauge shall not be locked in the open or source exposed position.
5. The sample physical inventory, inspection and monitoring form located in Appendix K of Instructional Set 64.0, Revision 0, February 1997 will be completed at intervals not to exceed six months when the physical inventory and gauge inspection is performed and when the fixed gauge is installed, relocated, removed, repaired or when maintenance is performed on the fixed gauge; or a form containing equivalent information will be used.
6. Only an approved transport container will be used to transport the fixed gauges and it will be properly labeled and marked and containers will be braced, blocked and locked. Shipping papers, a copy of the latest leak test results, a copy of the current radioactive material license and emergency procedures will be transported with the device.
7. When transporting the device, fully secure the fixed gauge within the vehicle and away from the passenger compartment or if transported in an open-bed vehicle, the device must be properly secured/locked to the vehicle.
8. A fixed gauge must not be left unattended unless the device is secured from unauthorized access [e.g., locked within a room or transport vehicle (i.e., when transporting the device)].

9. Personnel monitoring devices, if required by the regulations or the radioactive material license, shall be worn during use of the fixed gauge and shall not be worn during other non-occupational radiation exposure (e.g., medical or dental x-rays, etc.). They must be worn at chest or waist level where the highest exposure is expected. Each personnel monitoring device shall be assigned to only one individual and shall not be shared. They shall be stored in a low background area away from the radioactive material storage/use area. They shall not be stored in areas subject to extreme environmental conditions (e.g., a car during weather extremes).
10. The source holder shall be locked in the "off" or closed position when the device is not in use.
11. Individuals shall not open sealed sources or remove them from their source holders.
12. The licensee shall maintain a copy of the manufacturer's instruction manual at each facility and shall install, if approved to perform these procedures by the Agency, and operate each fixed gauge within the manufacturer's specified temperature and/or environmental limits such that the shielding and shutter mechanism of the source holder are not compromised.
13. Maintenance/repair involving dismantling, removal of sources or source holders, etc., must be performed only by the manufacturer or other persons specifically authorized to perform such services by the Agency, the U.S. Nuclear Regulatory Commission, another Agreement State or a Licensing State.

## APPENDIX J.1

### INFORMATION TO BE SUBMITTED BY APPLICANTS REQUESTING AUTHORIZATION TO PERFORM INSTALLATION, INITIAL RADIATION MONITORING, RELOCATION, REMOVAL, REPAIR OR MAINTENANCE

1. Procedures manual for performing installation, initial radiation monitoring, relocation, removal, repair and maintenance.
2. Lock-out procedures, including means of ensuring source is locked in the stored or closed position during installation, relocation, removal, repair or maintenance.
3. Description of an operable radiation monitoring instrument, which is of an appropriate model for the types of radiation to be measured and the occasions for use.
4. Description of the fixed gauge locking mechanism.
5. Description of personnel monitoring.
6. Procedures for determining when the device can be unlocked and checked for proper operation including notification of personnel in the area.
7. Procedures for monitoring occupied personnel work stations after installation of a gauge to evaluate the need for personnel monitoring for individuals working at those stations; or methods of reducing exposure rates around a device if exposure rates exceed the limits in 32 Ill. Adm. Code 340.310 for individuals working in the vicinity of the fixed gauge.
8. Items reviewed (e.g., labels, caution signs, shutter checks, etc.) when performing installation and inspection procedures of the fixed gauges.
9. Provisions for training individuals working in the vicinity of the fixed gauge when a new or different model device is installed/relocated.

**(This page is intentionally blank)**



APPENDIX K

FIXED GAUGE PHYSICAL INVENTORY, INSPECTION AND MONITORING FORM

DATE:	PERFORMED BY:		
LOCATION OF FIXED GAUGE:	NUCLIDE:		
FIXED GAUGE MAKE AND MODEL:	FIXED GAUGE SERIAL NUMBER:		
MONITORING INSTRUMENT MAKE AND MODEL:	MONITORING INSTRUMENT SERIAL NUMBER:		
MONITORING INSTRUMENT CALIBRATION DATE:			
DESCRIPTION OF DEVICE CONDITION			
INVENTORY/INSPECTION LIST	YES	NO	NA
1. Legible manufacturer's label(s) and required radioactive material labels are affixed to the gauge.			
2. A legible sign bearing the statement "Caution Radioactive Material" is posted in the proximity of the gauge.			
3. Shutter functions properly.			
4. Fixed gauge is not in use and is in secured storage.			

If any responses to Items 1-3 above are "NO", the following action(s) have been implemented prior to using the fixed gauge:

---



---

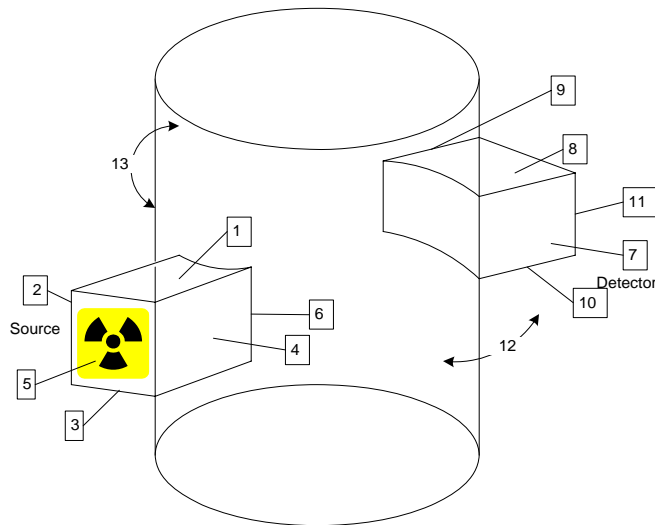


---

TYPE OF MONITORING (Check all that apply)		PIPE/VESSEL ON WHICH FIXED GAUGE IS MOUNTED IS: (Check one)	
Initial Radiation Monitoring		Full	
After Relocation		Partially Full	
After Repair/Maintenance		Empty	

MEASUREMENTS ( mR/hr or $\mu$ Sv/hr)						
SHUTTER OPEN						SHUTTER CLOSED
SURFACE	1 FOOT (30 cm)	3 FEET (1 meter)	SURFACE	1 FOOT (30 cm)	3 FEET (1 meter)	SURFACE
1.			8.			1.
2.			9.			2.
3.			10.			3.
4.			11.			4.
5.			12.			5.
6.			13.			6.
7.						

Attach a diagram if this diagram is not representative of actual gauge set-up.



## APPENDIX L

### EMERGENCY PROCEDURE

1. Implement the following in the event of physical damage to a fixed gauge:
  - a. Evaluate the situation to determine if any individuals have been exposed to radiation. If individuals are suspected to be contaminated, care for life threatening injuries first, then notify emergency personnel and the hospital staff about possible radioactive material contamination/exposure.
  - b. Secure the area around the fixed gauge using a radius of at least 15 feet from the fixed gauge. Maintain direct surveillance to protect against unauthorized entry into the area.
  - c. Limit access to the fixed gauge until the source integrity and the surrounding area has been evaluated for radioactive material leakage/contamination. If the licensee has a radiation monitoring instrument, measure the exposure rate around the fixed gauge to establish the safe distance to maintain the barriers (e.g., 2 mR/hr or 20 mSv/hr).
  - d. As soon as possible, notify the Radiation Safety Officer and The Illinois Emergency Management Agency at (217) 785-0600 in accordance with 32 Ill. Adm. Code 340.1220. The licensee should obtain technical assistance from the Agency, the fixed gauge manufacturer or other qualified specific licensee and arrange for a timely evaluation of the source integrity following an incident.
  - e. For licensees authorized to transport fixed gauges, evaluate the extent of contamination (if any) of any vehicle involved, if the incident occurred during transport. Do not move the vehicle until the extent of contamination has been determined. With technical assistance from the Agency, the manufacturer or other qualified specific licensee, use appropriate precautions and protective clothing/equipment to decontaminate the vehicle prior to moving the vehicle.
  - f. Ensure the shutter or other on-off controls are in the "off" or "closed" position. Visually inspect the fixed gauge to determine whether any damage to the source housing or shield has occurred. Do not move the fixed gauge until the extent of contamination has been determined.
2. Notify the Radiation Safety Officer and The Illinois Emergency Management Agency at (217) 785-0600 in accordance with 32 Ill. Adm. Code 340.1210 in the event of stolen, lost or missing sources of radioactive material.

**(This page is intentionally blank)**

## APPENDIX M

### TESTING SEALED SOURCES FOR LEAKAGE AND/OR CONTAMINATION

Applicants who wish to perform their own tests for leakage and/or contamination (leak/wipe tests), including the collection and the analysis of the test samples, must submit the following descriptive information in support of the application:

1. Describe all instrumentation, which will be used for the analysis of the test samples. The descriptive information should include:
  - a. The manufacturer, model and serial number of each instrument;
  - b. The types and energies of detectable radiation, as applicable to each instrument;
  - c. The efficiency of each instrument, for each type of radioactive material to be tested, including the supportive calculations documenting such efficiency; and
  - d. The minimum sensitivity of each instrument, for each type of radioactive material to be tested, including the supportive calculations documenting such minimum sensitivity. At a minimum, the instrument used must be capable of detecting 185 Bq (0.005  $\mu$ Ci) of the radioactive material being tested. For radium-226, the instrument must be sensitive enough to detect 185 Bq (0.005  $\mu$ Ci) external radon-daughter contamination or the escape of radon at the rate of 37 Bq (0.001  $\mu$ Ci) per 24 hours.
2. Identify the calibration standards to be used in the analysis of each radioactive material to be tested. The identification shall include the manufacturer, model, radionuclide and activity of each standard. Such standards shall be traceable to a national standard.
3. Describe the calibration procedures and the frequency of calibration for each instrument.
4. Describe the material or leak/wipe test kit to be used in collecting the leak/wipe test samples.
5. Describe in detail the procedure for performing the analysis of the leak/wipe test samples.
6. Submit sample calculations showing the conversion of the raw counting data to units of becquerels or microcuries.
7. Describe the method for disposing of contaminated leak/wipe test samples.

8. Describe the applicable training and experience of each person who will analyze and evaluate the results of the leak/wipe test samples.
9. Describe the records to be maintained for each leak/wipe test. These shall include:
  - a. The unique identification of the source tested (e.g., manufacturer, model, serial number, etc.);
  - b. The radionuclide and the activity of the radioactive material contained in the source;
  - c. The results of the test expressed in units of becquerels or microcuries. Actual test results shall be reported unless such results are less than 185 Bq (0.005  $\mu$ Ci);
  - d. The date the sample was collected;
  - e. The date the analysis was performed;
  - f. The identity of the individual collecting the sample; and
  - g. The identity of the person performing the analysis.

## APPENDIX N

### DIRECT READING DOSIMETER USE AND CALIBRATION

#### USE OF DIRECT READING DOSIMETERS

1. Each direct reading dosimeter (dosimeter) used must have been calibrated within one year prior to its use.
2. A dosimeter shall only be assigned to one person at any one time.
3. A log must be made to document the measured exposures of each individual using a dosimeter. This log shall record the date and time of each entry and the name and social security number of the monitored individual.
4. At the beginning of each shift, or prior to entering an area where dosimeters are needed, the dosimeter must be zeroed (charged) to indicate essentially no exposure. If this is not practicable, document the initial exposure reading in the dosimeter log.
5. Enter the exposure reading from the dosimeter in the dosimeter log daily (after all entries into a restricted area have been performed).
6. The Radiation Safety Officer must be notified immediately if a dosimeter is discharged beyond its range.
7. At least once each month, total the exposures in the log for each individual who used a dosimeter during that period. These totals may be kept in the log or with other dosimetry results maintained by the licensee.

#### CALIBRATION OF DIRECT READING DOSIMETERS

1. The calibration of a direct reading dosimeter (dosimeter) shall be performed in accordance with the following:
  - a. The radionuclide sources used for calibration shall be approximate point sources.
  - b. The source activities shall be traceable within 5% accuracy to NIST or other accepted national standard.
  - c. The dosimeter shall be calibrated at two scale readings, separated by at least 50 percent of the full-scale reading.

- d. The exposure measured by the dosimeter shall not differ from the calculated (true) exposure by more than  $\pm 20$  percent of the calculated (true) value.
  - e. Dosimeters shall be charged, placed in a radiation-free environment (excluding background radiation), then read after a minimum of 24 hours has passed. A dosimeter shall be considered defective if the rate of leakage is greater than 5 percent of the dosimeter full-scale reading in 24 hours.
2. Records of calibration shall include:
- a. Radionuclide used,
  - b. Activity and activity assay date of source,
  - c. Date of dosimeter calibration,
  - d. Activity of source at date of dosimeter calibration,
  - e. Calculated (true) and measured radiation values,
  - f. Respective distance from source for each calculated and measured radiation value,
  - g. Elapsed time of exposure for each measured radiation value,
  - h. Necessary scale correction factors (required if calculated and measured radiation values do not agree within  $\pm 20$  percent),
  - i. Make, model, and serial number of dosimeter calibrated, and
  - j. Signature of individual who performed the calibration.





**EXHIBIT A**

**THE ILLINOIS EMERGENCY MANAGEMENT AGENCY**  
 1035 OUTER PARK DRIVE  
 SPRINGFIELD, ILLINOIS 62704

**APPLICATION FOR A RADIOACTIVE MATERIAL LICENSE  
 AUTHORIZING THE USE OF SEALED SOURCES IN FIXED GAUGES**

Complete all items if this is an initial application for renewal of a license. Use supplementary sheets where necessary. Retain one copy and submit the original and one copy of the entire application to The Illinois Emergency Management Agency.

This state agency is requesting disclosure of information that is necessary to accomplish the statutory purpose as outlined under 32 Ill. Adm. Code 330. Disclosure of this information is required. Failure to provide any information may result in denial of a radioactive material license. This form has been approved by the State Forms Management Center.

**ITEM 1. Type of application** (Check one)

NEW LICENSE     RENEWAL     AMENDMENT

Radioactive Material License # \_\_\_\_\_

**ITEM 2. Applicant's Name and Mailing Address**

(Applicant must be the legal entity or individual responsible for the license.)

**ITEM 3. Person to Contact Regarding This Application:**

Phone #:
Fax #:
E-mail:

Phone #:
Fax #:
E-mail:

**ITEM 4. Address(es) Where Radioactive Material Will Be Used**     Stored     Used and Stored   

Phone #:

Phone #:

**ITEM 5. Individual(s) Who Will Use Radioactive Material** (Attach evidence of appropriate training and experience). List names and requested uses of material. (Check all that apply)

- All individuals working in the vicinity of the fixed gauge shall complete a 1 to 2-hour orientation course. Training records shall be maintained for Agency inspection.
- All authorized users for this license shall complete the manufacturer's 8-hour training course or an equivalent, Agency approved training course prior to unsupervised use of radioactive material. Evidence of training and experience for at least one authorized user is attached. Training records for all authorized users shall be maintained for Agency inspection. Description of training program covering items requested in Item 11 of Instructional Set 64.0 dated February 1997 is attached. See Attachment \_\_\_\_\_ of this application.
- All authorized users who will perform installation, initial radiation monitoring, relocation, removal, maintenance or repair shall complete the manufacturer's 40-hour training course or an equivalent, Agency approved training course prior to unsupervised use of radioactive material. Evidence of training and experience for at least one authorized user is attached. Training records for all authorized users shall be maintained for Agency inspection. Description of training program covering items requested in Item 11 of Instructional Set 64.0 dated February 1997 is attached. See Attachment \_\_\_\_\_ of this application.
- The authorized users for this license and evidence of their training and experience relative to radioactive material use are specified in an attachment to this application. See Attachment \_\_\_\_\_ of this application.

**ITEM 6. Radiation Safety Officer (RSO)** (Attach evidence of training and experience)

Name: \_\_\_\_\_ Telephone #: \_\_\_\_\_

- Duties are as stated in Appendix C of Instructional Set 64.0 dated February 1997.
- Duties and responsibilities are attached. See Attachment \_\_\_\_\_ of this application
- We request authorization for the delegation of duties as stated in Appendix C.1 of Instructional Set 64.0 dated February 1997.

**ITEM 7. Radioactive Material**

Element and Mass Number		
Chemical and Physical Form	Sealed Source	Sealed Source
Source Manufacturer and Model		
Maximum Activity per Source		
Number of Sources Requested		
Device Manufacturer and Model		
Intended Use		

**ITEM 8. Instrumentation** (Check one)

- Completed Exhibit B from Instructional Set 64.0 dated February 1997 or equivalent is attached. See Attachment \_\_\_\_\_ of this application.
- Not applicable.

**ITEM 9. Instrument Calibration and Operability Checks** (Check one)

- Radiation monitoring instruments will be calibrated by a service company authorized to perform such services. We will maintain a copy of the company's license authorizing such services.
- We will calibrate radiation monitoring instruments in accordance with the attached procedures, which contain all of the information requested in Appendix E of Instructional Set 64.0 dated February 1997. See Attachment \_\_\_\_\_ of this application.
- Not applicable.

**ITEM 10. Facilities and Equipment** (Check all that apply)

- Diagrams of radioactive material use and storage area are attached. See Attachment \_\_\_\_\_ of this application.
- Letter from the facility/property owner is attached. See Attachment \_\_\_\_\_ of this application.
- The applicant/licensee owns the property/facility.

**ITEM 11. Personnel Training Program**

- Description of training program, including an outline for each level of training and the frequency, form, duration and the means used to evaluate the training is attached. See Attachment \_\_\_\_\_ of this application.

**ITEM 12. Procedure for Ordering and Receiving Radioactive Material**

- Procedure for ordering and receiving radioactive material, including a procedure for receipt of radioactive material during off-duty hours is attached. See Attachment \_\_\_\_\_ of this application.
- Procedure for ordering and receiving radioactive material is attached. Packages **will not** be received after normal working hours. See Attachment \_\_\_\_\_ of this application.

**ITEM 13. Procedure for Safely Opening Radioactive Material Packages** (Check one)

- We will use the procedure identified in Appendix I of Instructional Set 64.0 dated February 1997.
- Procedure for safely opening radioactive material packages is attached. Packages **will not** be received after normal working hours. See Attachment \_\_\_\_\_ of this application.

**ITEM 14. General Rules for the Safe Use of Radioactive Material** (Check all that apply)

- We will use the procedure identified in Appendix J (for items a.- j.) of Item 14 of Instructional Set 64.0 dated February 1997.
- General safety instructions are attached. See Attachment \_\_\_\_\_ of this application.
- We request authorization to perform procedures listed in Items k., l. and m. of Item 14 of Instructional Set 64.0 dated February 1997. Procedures, which contain the information listed in Appendix J.1. are attached. See Attachment \_\_\_\_\_ of this application.
- Items k., l., and m. of Item 14 of Instructional Set 64.0 dated February 1997 will be performed by a commercial service company authorized by the Agency, the U.S.N.R.C., an Agreement State or a Licensing State to perform those services. We will maintain a copy of the commercial service company's license authorizing them to perform such services.
- We will use the physical inventory, inspection and monitoring form identified in Appendix K of Instructional Set 64.0 dated February 1997 for device accountability and the physical inventory/inspection performed at frequencies not to exceed six months.
- Forms for device accountability and the physical inventory/inspection performed at frequencies not to exceed six months are attached. See Attachment \_\_\_\_\_ of this application.
- We will use the physical inventory, inspection and monitoring form identified in Appendix K of Instructional Set 64.0 dated February 1997 for monitoring performed in accordance with procedures described for Items k., l. and m. of this part.
- Form(s) for monitoring performed during procedures described for Items k., l. and m. of this part are attached. See Attachment \_\_\_\_\_ of this application.

**ITEM 15. Emergency Procedure**

- We will use the procedure identified in Appendix L of Instructional Set 64.0 dated February 1997.
- Emergency procedure is attached. See Attachment \_\_\_\_\_ of this application.

**ITEM 16. Monitoring Procedure** (Check one)

- Area/contamination monitoring procedures are attached. See Attachment \_\_\_\_\_ of this application.
- Not applicable.

**ITEM 17. Transfer or Waste Disposal** (Check all that apply)

- Disposal methods are attached. See Attachment \_\_\_\_\_ of this application.
- Fixed gauge and source will be returned to the manufacturer or other specifically licensed firm or low-level radioactive waste disposal company for transfer or disposal.

**ITEM 18. Testing Sealed Sources for Leakage and/or Contamination** (leak/wipe tests) (Check one)

- We will use a commercial service to perform analysis of leakage and/or contamination samples. We will maintain a copy of the commercial service company's license authorizing such services.
- We will perform our own sample analysis for source leakage and/or contamination. Procedure is attached. See Attachment \_\_\_\_\_ of this application.

**ITEM 19. Personnel Monitoring** (Check all that apply)

TYPE	EXCHANGE FREQUENCY	FILM	TLD	OSL
<input type="checkbox"/> Whole body	<input type="checkbox"/> Monthly <input type="checkbox"/> Quarterly	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> Extremity	<input type="checkbox"/> Monthly <input type="checkbox"/> Quarterly		<input type="checkbox"/>	<input type="checkbox"/>

Direct reading dosimeters will be used and calibrated in accordance with Appendix N of Instructional Set 64.0 dated February 1997.

Direct reading dosimeter use and calibration procedures are attached. See Attachment \_\_\_\_\_ of this application.

We will not perform any fixed gauge/source installation, relocation, removal, repair or maintenance. Personnel monitoring is not applicable.

**ITEM 20. License Fees** (Refer to 32 Ill. Adm. Code 331)

Please do not submit your fee payment. New applicants will be billed a prorated fee for the portion of the billing year remaining from the date the application is received. Licensees adding sites or changing fee categories will be billed when the license is amended. Existing licensees and applicants are also subject to annual bills as specified in 32 Ill. Adm. Code 331.

Fee Category: \_\_\_\_\_

**ITEM 21. Financial Assurance**

The applicant must satisfy applicable financial assurance requirements as described in 32 Ill. Adm. Code 326.

**NEW APPLICANT** (Check one)

Exempt  \$25,000 arrangement will be provided at a later date  Reclamation plan/cost estimate attached

**RENEWAL OR AMENDMENT** (Check one)

Exempt  Existing document reviewed – no changes necessary  Limiting condition applies  
 Updated reclamation plan/cost estimate attached

**ITEM 22. Certification**

EACH APPLICANT MUST COMPLETE SECTION A:

A. I have reviewed the above items and hereby certify that my radiation protection program meets the current 32 Ill. Adm. Code, radioactive materials license with active amendments, operating procedures and ALARA Program, and that all information contained herein, including any supplements attached hereto, is true and correct to the best of my knowledge and belief.

SIGNATURE: \_\_\_\_\_ DATE: \_\_\_\_\_

NAME: \_\_\_\_\_ TITLE: \_\_\_\_\_  
(Print or Type)

COMPLETE THIS SECTION IF THE APPLICANT IS AN INDIVIDUAL:

B. If you are applying as an individual, rather than as a corporation or other legal entity, you must provide the following information in order to process your application:

Have you defaulted on an educational loan guaranteed by the Illinois Student Assistance Commission? Yes  No

I certify, under penalty of perjury, that I am not more than 30 days delinquent in complying with a child support order. Failure to certify may result in a denial of the license and making a false statement may subject you to contempt of court. (5 ILCS 100/10-65)

I declare that all information either included with or appearing on this application is accurate and true to the best of my knowledge.

SIGNATURE: \_\_\_\_\_ DATE: \_\_\_\_\_

APPLICANT'S SOCIAL SECURITY NUMBER: \_\_\_\_\_

## EXHIBIT B

### INSTRUMENTATION FORM

1. Portable Radiation Monitoring Instruments

(0.1 mrem/hr to 50 mrem/hr or 1  $\mu$ Sv/hr to 500  $\mu$ Sv/hr):

Manufacturer: \_\_\_\_\_

Model: \_\_\_\_\_

# Available: \_\_\_\_\_

Range: \_\_\_\_\_

Window Thickness:  
( $\text{mg}/\text{cm}^2$ ) \_\_\_\_\_

Detector Type:  
(G-M, Ion Chamber, etc.) \_\_\_\_\_

2. Portable Radiation Monitoring Instruments

(0.1 mrem/hr to 50 mrem/hr or 1  $\mu$ Sv/hr to 500  $\mu$ Sv/hr):

Manufacturer: \_\_\_\_\_

Model: \_\_\_\_\_

# Available: \_\_\_\_\_

Range: \_\_\_\_\_

Window Thickness:  
( $\text{mg}/\text{cm}^2$ ) \_\_\_\_\_

Detector Type:  
(G-M, Ion Chamber, etc.) \_\_\_\_\_

3. Instrument Used for Analysis of Leakage and/or Contamination Samples (leak/wipe tests)\*

(Generic Description) \_\_\_\_\_

Manufacturer: \_\_\_\_\_

Model: \_\_\_\_\_

Minimum Detectable Activity\*: \_\_\_\_\_

\* Submit calculations as described in Appendix D.

**(This page is intentionally blank)**

**EXHIBIT C**



**THE ILLINOIS EMERGENCY MANAGEMENT AGENCY**  
**1035 OUTER PARK DRIVE**  
**SPRINGFIELD, ILLINOIS 62704**

This State agency is requesting disclosure of information that is necessary to accomplish the statutory purpose as outlined under 420 ILCS 40/1-40/44. Disclosure of this information is required. Failure to provide any information will result in this form not being processed. This form has been approved by the Forms Management Center.

**CERTIFICATE**  
**TERMINATION AND DISPOSITION OF RADIOACTIVE MATERIAL**

<b>LICENSEE:</b>	<b>LICENSE NUMBER:</b>
<b>ADDRESS:</b>	<b>TELEPHONE NUMBER:</b>

The following information is provided in accordance with 32 Ill. Adm. Code 330.320, "Expiration and Termination of Licenses." This regulation appears on the back of this form. Check all that apply below.

1. All use of radioactive material authorized under the above referenced license has been terminated.

2. Radioactive contamination has been removed to the level outlined in 32 Ill. Adm. Code 340.Appendix A, to the extent practicable.

3. All radioactive material previously procured and/or possessed under the authorization granted by the above referenced license has been disposed of as follows:

Transferred to (Name and Address): \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

who is authorized to possess such material under License Number \_\_\_\_\_  
 issued by (Licensing Agency): \_\_\_\_\_

Decayed, surveyed and disposed of as non-radioactive waste.

Licensed under License Number: \_\_\_\_\_  
 issued by (Licensing Agency): \_\_\_\_\_

No radioactive material has ever been procured and/or possessed by the licensee under the authorization granted by the above referenced license.

Other (Attach additional pages).

4. Attached are radiation surveys or the equivalent as specified in 32 Ill. Adm. Code 330.320(d)(1)(E).

5. Records required to be maintained for the license requested to be terminated are available at the following location:

Name: \_\_\_\_\_  
 Address: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

Telephone No.: \_\_\_\_\_ Contact Person: \_\_\_\_\_

6. Additional remarks. (Attach additional pages.)

THE UNDERSIGNED, ON BEHALF OF THE LICENSEE, HEREBY CERTIFIES THAT LICENSABLE QUANTITIES OF RADIOACTIVE MATERIAL UNDER THE JURISDICTION OF THE ILLINOIS EMERGENCY MANAGEMENT AGENCY ARE NOT POSSESSED BY THE LICENSEE. IT IS THEREFORE REQUESTED THAT THE ABOVE REFERENCED LICENSE BE TERMINATED.

SIGNATURE: \_\_\_\_\_ DATE: \_\_\_\_\_  
 NAME: \_\_\_\_\_ TITLE: \_\_\_\_\_  
 (print or type)

### Section 330.320 Expiration and Termination of Licenses

- a) Except as provided in Section 330.330(b), the authority to engage in licensed activities as specified in the specific license shall expire at the end of the specified day in the month and year stated therein. Any expiration date on a specific license applies only to the authority to engage in licensed activities. Expiration of a specific license shall not relieve the licensee of responsibility for decommissioning its facility and terminating the specific license.
- b) Each licensee shall notify the Agency immediately, in writing and request termination of the license when the licensee decides to terminate all activities involving radioactive materials authorized under the license. This notification and request for termination shall include the documents required by subsection (d) below and shall otherwise substantiate that the licensee has met all of the requirements in subsection (d) below.
- c) No less than 30 days before the expiration date specified in the license, the licensee shall either:
  - 1) Submit an application for license renewal under Section 330.330; or
  - 2) Notify the Agency, in writing, if the licensee decides not to renew the license. The licensee requesting termination of a license shall comply with the requirements of subsection (d) below.
- d) Termination of Licenses
  - 1) If a licensee does not submit an application for license renewal under Section 330.330, the licensee shall, on or before the expiration date specified in the license:
    - A) Terminate use of radioactive material;
    - B) Remove radioactive contamination to the level outlined in 32 Ill. Adm. Code 340.Appendix A, to the extent practicable;
    - C) Properly dispose of radioactive material;
    - D) Submit a completed Agency Form KLM.007; and
    - E) Submit a radiation survey report to confirm the absence of radioactive materials or to establish the levels of residual radioactive contamination, unless the licensee demonstrates the absence of residual radioactive contamination in some other manner. The radiation survey report shall specify the instrumentation used and certify that each instrument was properly calibrated and tested. The licensee shall, as applicable, report levels or quantities of:
      - i) Beta and gamma radiation at 1 centimeter from surfaces in units, multiples, or subunits of sieverts or rem per hour;
      - ii) Gamma radiation at 1 meter from surfaces in units, multiples, or subunits of sieverts or rem per hour;
      - iii) Removable radioactivity on surfaces in units, multiples, or subunits of becquerels or curies per 100 square centimeters of surface area, or in disintegrations (transformations) per minute per 100 square centimeters of surface area;
      - iv) Fixed radioactivity on surfaces in units, multiples, or subunits of becquerels or curies per 100 square centimeters of surface areas or in

- disintegrations (transformations) per minute per 100 square centimeters of surface area;
        - v) Radioactivity in contaminated liquids such as water, oils or solvents in units, multiples, or subunits of becquerels or curies per milliliter of volume; and
        - vii) Radioactivity in contaminated solids such as soils or concrete in units, multiples, or subunits of becquerels or curies per gram of solid.
  - 2) If no residual radioactive contamination attributable to activities conducted under the license is detected, the licensee shall submit a certification that no detectable radioactive contamination was found. The Agency will notify the licensee, in writing, of the termination of the license.
  - 3) If detectable levels or residual radioactive contamination attributable to activities conducted under the license are found:
    - A) The license continues in effect beyond the expiration date, if necessary, with respect to possession of residual radioactive material present as contamination until the Agency notifies the licensee in writing that the license is terminated. During this time the licensee is subject to the provisions of subsection (e) below.
    - B) In addition to the information submitted under subsections (1)(D) and (1)(E) above, the licensee shall submit a plan for decontamination, if required, as regards residual radioactive contamination remaining at the time the license expires.
- e) Each licensee who possesses residual radioactive material under subsection (d)(3) above, following the expiration date specified in the license, shall:
  - 1) Limit actions involving radioactive material to those related to decontamination and other activities related to preparation for release for unrestricted use; and
  - 2) Continue to control entry to restricted areas until they are suitable for release for unrestricted use and the Agency notifies the licensee in writing that the license is terminated.

(Source: Amended at 18 Ill. Reg. 5553, effective March 29, 1994)