



ILLINOIS EMERGENCY MANAGEMENT AGENCY
Division of Nuclear Safety

INSTRUCTIONAL SET NO. 48.6

REVISION 1
October 1994

Instructions for Preparing Applications
for Radioactive Material Licenses Authorizing the

NON-MEDICAL USE OF RADIOACTIVE MATERIAL

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

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I. INTRODUCTION

A. General

The Illinois Emergency Management Agency, Division of Nuclear Safety (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 non-medical use of radioactive material.

Prior to submitting an application for non-medical 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). 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 assure 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 32 Ill. Adm. Code. 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).

D. Applicable Regulations

The following portions of the regulations are applicable to the non-medical use of radioactive material 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 351 - "Radiation Safety Requirements for Wireline Service Operations and Subsurface Tracer Studies"
7. 32 Ill. Adm. Code 400 - "Notices, Instructions, and Reports to Workers; Inspections"

Persons applying for a license other than that for well logging may disregard 32 Ill. Adm. Code 351. Those applicants interested in applying for well logging licenses should be aware that there are specific requirements in Part 351 that may be more restrictive than other portions of the regulations and this guide. Furthermore, for licensees of broad scope, additional information may be required, particularly regarding the establishment of a Radiation Safety Committee. Additional instructions may be obtained from the Agency by applicants for a broad scope license.

The Agency may amend these regulations periodically to remain compatible with current standards. The licensee will be notified of these changes as they occur and should 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 32 Ill. Adm. Code. Appendix A contains the 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 and 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, the potential for intake of radioactive material, and the physical characteristics of the radionuclides.

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. Système 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 by no means mandatory at this time. The Agency will continue to recognize SI and English units. Appendix B of this guide has been included to assist applicants in the use of SI units.

II. FILING AN APPLICATION

An application for a specific license for the non-medical use of radioactive material should be submitted on the "Application Form for Non-Medical Radioactive Material License" 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 22 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, along with duplicate copies of supporting documents, must be mailed to:

Illinois Emergency Management Agency
Division of Nuclear Safety
Radioactive Materials Section
1035 Outer Park Drive
Springfield, Illinois 62704

At least one copy of the submitted application, 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 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 must accompany the application. Review of the application will not begin until the proper fee is received by the Agency. In addition, applicants may be required to file financial surety arrangements for reclaiming sites. The applicant should refer to 32 Ill. Adm. Code 330.250(c) for details regarding applicability to their program. 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 Non-Medical Radioactive Material License" (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.

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), and telephone number (including area code) of the applicant in the space provided.

Item 3 - Person to Contact Regarding the Application

The applicant should name a qualified individual who is authorized by the applicant's management to answer questions and make commitments regarding the 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, and telephone number (including area code) of the individual to be contacted regarding the application.

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

Specify all 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 addresses will be used, then specify the extent of use at each location. Do not specify a post office box number as a use location. If the applicant does not own the use/storage location(s), written approval from the owner for the use/storage of radioactive material on this property must be submitted with the application.

Use of temporary job sites should be requested by checking off the blank provided under Item 4 on the application. Use of licensed material at temporary job sites will become

part of the license conditions and each separate address does not need to be specified so long as the licensee does not use or store radioactive material at any one site for more than 180 days during any twelve-month period.

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

List the full names of all persons who will use or directly supervise the use of radioactive material, and specify the types of radioactive material for which each person is to be authorized.

Persons who will use or directly supervise the use of radioactive material must have radionuclide training and experience commensurate with the proposed radioactive material use. Evidence of training and experience must be submitted to the Agency. A person specifically listed as an authorized user on an existing radioactive material license may submit a copy of that license (or reference an Illinois Radioactive Material License Number) as evidence of training and experience.

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. In addition, if the RSO is not a proposed authorized user, then submit a complete description of that individual's training and experience relative to the handling of radioactive material requested in the application.

The RSO should be an on-site individual designated for each installation to assume the responsibilities of his 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 may delegate certain duties to qualified individuals provided the terms of said designations are specifically outlined in the facility procedures. The RSO should be familiar with the basic principles of radiation protection in order to properly fulfill his responsibilities, although for details he 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. Either indicate that the RSO will commit to these duties and responsibilities or submit an alternate program for Agency review.

Item 7 - Radioactive Material for Non-Medical Use

For use, possession, and/or storage of materials for non-human use, list, for each radionuclide to be used, the chemical and physical form, the maximum activity desired for possession at any one time, and the intended use of the material. This would include authorization for depleted uranium for linear accelerator shielding, survey instrument calibration sources, etc. In addition, if the applicant wishes to be licensed to possess and use sealed sources or sealed sources in devices, specify the manufacturer's name for both the sealed source and device, radionuclide and source model, device model (if any), the maximum activity per source/device, and the total number of sources/devices.

Item 8 - Instrumentation

Specify by manufacturer and model number, all radiation measuring/monitoring instruments and detectors to be used at the facility. This list shall include, but is not limited to, fixed area monitors, instruments for analysis of wipe tests, and instruments for performing area surveys. The applicant must submit calculations to show that the instrumentation used to analyze wipe test samples is sufficiently sensitive to detect 220 dpm/100 cm², beta/gamma. Appendix D contains information regarding minimum detectable activity 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.

Item 9 - Instrument Calibration and Operability Checks

The licensee must ensure that the survey 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 survey instruments will be calibrated by a service company specifically licensed to perform survey instrument calibrations as a customer service or by the applicant using specified procedures.

If survey instruments are to be calibrated by the applicant, then the applicant must submit the information requested in Appendix E. If a consultant or other licensed firm will perform the calibration of the survey instruments, then the applicant should maintain a copy of the radioactive material license which authorizes that entity to perform survey instrument calibrations as a customer service. If other instrumentation such as area monitors are to be calibrated as well, these should be addressed in this section.

In addition, the Agency requires the licensee to check instrument operability by using a dedicated check source, and maintain records of these checks. These instrument operability checks are required to be performed on each day that 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 that the instrument be repaired or recalibrated before use for compliance surveys.

For these instrument operability checks, the term "dedicated check source" means that:

- a. The sealed source used must contain a radionuclide with a relatively long half-life (e.g., greater than five years).
- b. The sealed source used to check an instrument's operability must remain the same throughout the time period between survey instrument calibrations or repairs (e.g., the source must be the same model and serial number used previously for that particular model and serial number survey instrument).

Note that this does not prohibit the licensee from using the same sealed source as the dedicated check source for more than one survey instrument. It only requires that the sealed source used initially by the licensee upon return of that survey instrument from repair or full calibration must remain the same until that survey instrument is later calibrated.

Item 10 - Facilities and Equipment

Submit annotated diagrams of all areas in which radioactive material will be used or stored (e.g., *in vitro* laboratories, hot laboratories, radioactive waste storage rooms, etc.). A sample diagram can be found in Appendix F. Submitted diagrams should:

- a. Specify the diagram scale and identify areas of interest within each room, such as radioactive material preparation areas, waste storage areas, package receipt areas, hot sinks, etc.
- b. Indicate the direction of north.
- c. Clearly mark or identify all areas adjacent to radioactive material use/storage rooms or areas (e.g., offices, hallways, restrooms, etc.).
- d. Specify the building, floor, room number, and principal use of each room or area.
- e. Note the presence of shielding in rooms or areas on the diagram and indicate thickness and composition.
- f. Specify any available radiation safety equipment for rooms or areas such as fume hoods, L-blocks, remote handling equipment, storage containers, etc.
- g. Clearly identify all area(s) assigned for receipt, storage (including waste), preparation, and measurement of radioactive material.

- h. Specify all pertinent airflow rates, filtration equipment, and monitoring instrumentation available in rooms or areas in which radioactive material could become airborne.
- i. Indicate all lockable doors, storage containers, and security measures for all use/storage locations for radioactive material.

Item 11 - Personnel Training Program

All individuals 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. Submit a description of the training that will be provided to all personnel who work with, or in the vicinity of, radioactive materials. This training description should include the form of training (e.g., formal course work, lectures), a list of topics covered in the training, the means used to evaluate the training (e.g., exam), the frequency of training, the duration of training, the name and qualifications of the individual providing the training, and 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, housekeeping, and security personnel, receive proper instruction in items such as those outlined in Appendix G. These topics may vary depending on staff members' job-related duties.

Regarding the frequency of personnel training, 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.

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.

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 for packages. Procedures should include notification procedures to be followed for packages found or suspected to be leaking 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 incoming packages for leakage, contamination, or damage, and for safely opening packages in accordance with 32 Ill. Adm. Code 340.960. Package monitoring should be performed as soon as practicable after receipt. This procedure may vary depending on the type and quantity of radioactive material received, but it should include instructions for surveying packages, wearing gloves while opening packages, checking packing material for contamination after opening, and 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. Even though 32 Ill. Adm. Code 340.960 exempts certain packages from monitoring, it is necessary that procedures be established for safely opening all radioactive material packages.

Appendix I contains a sample procedure for safely opening packages of radioactive material. Either indicate that the procedures contained 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:

- a. Explain what safety apparel to wear and what equipment to use (e.g., wearing laboratory coats, eye protection and disposable gloves, and using transport carts and shielding).
- b. Indicate what personnel monitoring devices to use when handling radioactive material.
- c. Specify limitations and conditions for handling liquid or unsealed sources of radioactive material and the safety equipment to use when working with them.
- d. Specify the shielding or remote handling equipment to be used when handling beta and/or gamma emitting materials.
- e. Include guidance concerning security of radioactive material.
- f. Provide instructions for movement of radioactive material between rooms, in halls, or in corridors.
- g. Provide guidance on waste disposal requirements.

- h. Describe contamination control procedures including prohibitions against smoking, eating, drinking, or the application of cosmetics, and prohibiting the storage of personal items (food, drink, cosmetics, etc.) in areas where radioactive material is used or stored. In addition, include instructions to individuals for performing radiation surveys of their hands, clothing, etc. after working with radioactive material.

Appendix J contains a sample set of general rules for safe radioactive material use. Either indicate that the procedure contained in Appendix J will be followed or submit an alternate procedure for Agency review.

Item 15 - Emergency Procedure

Submit a copy of emergency procedures. A copy of these procedures should be posted in all areas where radioactive material is used/stored and should:

- a. Describe immediate action to be taken after an incident in order to prevent contamination of personnel and work areas (e.g., turning off the ventilation, area evacuation, and spill containment). Actions to be taken for handling injured personnel who may be contaminated should also be addressed, if applicable.
- b. List the names and telephone numbers of the responsible persons (e.g., RSO) to be notified in case of an emergency. The Agency's 24-hour number should be included in this section (217/785-0600).
- c. Instruct personnel on appropriate methods for re-entering and decontaminating contaminated 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 K contains a sample emergency procedure. Either indicate that the procedure in Appendix K will be followed or submit an alternate procedure for Agency review.

Item 16 - Area Survey Procedure

The licensee must establish and agree to implement written procedures for performing periodic radiation surveys and contamination monitoring. The procedures must describe the routine survey program, including the areas to be surveyed, frequency of the surveys, action levels initiating decontamination procedures, and provisions for maintaining records of surveys.

If the application is to cover multiple users and areas of use, the individual user should perform surveys of his own work areas in addition to those performed by the radiation safety staff.

Appendix L contains sample area survey procedures for use of unsealed radionuclides. Either indicate that the area survey procedures described in Appendix L of this guide have been adopted or submit an alternate procedure for performing routine radiation surveys and contamination monitoring for Agency review.

Item 17 - Waste Disposal

Radioactive material licensees are authorized for the following methods of disposal of radioactive waste:

- a. Transfer to a person properly licensed to receive such waste (e.g., commercial waste disposal firms). See 32 Ill. Adm. Code 340.1010.
- b. Release into the sanitary sewerage system in conformance with 32 Ill. Adm. Code 340.1030. Calculations for concentration of releases made must be submitted.
- c. Release into the air in conformance with 32 Ill. Adm. Code 340.320. Calculations for concentration of releases made must be submitted.
- d. Disposal of scintillation fluid and animal tissue in conformance with 32 Ill. Adm. Code 340.1050.

Applicants may also be authorized to store waste containing, or comprised of, radioactive material with a physical half-life of less than 90 days for "decay-in-storage" before disposal with the following provisions:

- a. Radioactive waste to be disposed of shall be held for decay a minimum of ten half-lives.
- b. Pursuant to 32 Ill. Adm. Code 340.510(a) and (b), radiation surveys shall be performed prior to disposal of the waste to ensure that the waste's radioactivity cannot be distinguished from background radiation levels. The package/container surface shall be surveyed with a radiation detection survey instrument set on its most sensitive scale, with no interposed shielding between the detector and the waste, in a low background radiation environment. Records of monitoring, which include: date of disposal, date placed in storage, specific survey instrument used, background radiation levels, measured radiation levels, and identity of the individual performing the surveys, shall be maintained. All radiation labels shall be removed or obliterated.

- c. Nothing in this condition relieves the licensee from complying with other applicable federal, state, and local regulations governing any other toxic or hazardous property of these materials.

If authorization to dispose of radioactive materials by decay-in-storage is desired or a method different than those identified above (i.e., incineration) is to be used, detailed information regarding facilities, equipment, and handling procedures must be submitted. In addition, if the licensee plans to perform any treatment of radioactive waste (i.e., compaction) prior to transfer, detailed procedures should be submitted describing those operations.

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

Testing of sealed sources for leakage and/or contamination shall be performed only by persons who are specifically licensed by either the Agency, another Agreement State, a Licensing State, or the U.S. Nuclear Regulatory Commission (NRC) to perform such services. In establishing a program for testing for leakage and/or contamination in accordance with 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 tests for leakage and/or contamination as a customer service.
- b. The applicant may request authorization to perform tests for leakage and/or contamination, including sampling and analysis. If this option is chosen, then submit the information outlined in Appendix M for Agency evaluation.

Item 19 - Bioassays

Bioassays are required by 340.520 when individuals are likely to receive an intake in excess of 10% of the annual limit on intake. Bioassays are normally performed when individuals work with millicurie quantities of unsealed hydrogen-3, iodine-125, or iodine-131, depending on the chemical and physical form, the procedures followed and the equipment used to make it possible for radioactive materials to be ingested, inhaled, or absorbed into the body. The applicant should indicate the need for bioassays has been thoroughly considered and should describe his proposed bioassay program, if applicable. U.S. NRC Regulatory Guide 8.9, "Acceptable Concepts, Models, Equations and Assumptions for a Bioassay Program" may be of assistance in preparing these descriptions.

Appendix N contains a sample procedure to be followed when performing radioiodine bioassays. If radioiodine is to be used, verify that procedures contained in Appendix N will be followed or submit an alternate procedure for Agency review.

Item 20 - Procedure for Use of Radioactive Gases/Volatile Material

The use of radioactive gases and volatile materials requires attention not only to the standard radiation safety considerations but also to an evaluation of expected air concentrations of the radioactive material in restricted and unrestricted areas, including effluents released to the atmosphere. Each applicant who wishes to use these forms of material must submit unrestricted area concentration calculations to the Agency in support of that request as well as document personnel exposures as a result of restricted area releases in accordance with 340.230 and 340.240. If ventilation systems are used in conjunction with radioactive gases/volatile material, procedures for use and maintenance of these systems should be included in the application.

Appendix O contains sample calculations. The applicant should refer to the sample calculations in Appendix O to compile information in support of a request to use radioactive gases or volatile material.

Item 21 - Procedure for the Use of Radioactive Material in Animals

The licensee should submit specific procedures to be followed if radio-nuclides will be used in animals. These should include: (1) a description of the dedicated animal housing facilities, (2) a copy of instructions provided to animal caretakers for handling animals, animal wastes, and carcasses, (3) instructions for cleaning and decontaminating animal cages, (4) procedures for ensuring that animal rooms will be locked or otherwise secured unless attended by authorized users of radioactive material, and (5) procedures for disposal of animal carcasses and associated waste in compliance with 32 Ill. Adm. Code 340.1010. If radioactive material will not be used in animals, please so indicate.

Item 22 - Personnel Monitoring

32 Ill. Adm. Code 340.520(a) specifies when personnel monitoring equipment is necessary. 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. Normally, in addition to whole-body film or thermoluminescent dosimeter (TLD) badges, certain persons must wear a ring film badge or TLD 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. 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(c).

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. Information from this section, Item 19, Item 20, and 32 Ill. Adm. Code 340.220 should be considered in determining requirements for summation of doses.

Appendix P 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 P will be followed or submit an alternate procedure for Agency review.

Item 23 - License Fees

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 staff.

Item 24 – Financial Assurance

((((THIS NEEDS TO BE COMPLETED)))

Item 25 - 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 facility. 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 in the facilities, equipment, procedures, authorized users, RSO, or radioactive material used.

Applications for license amendments should be filed on the "Application Form for Non-Medical Radioactive Material License" or in letter form. The application 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 for by 32 Ill. Adm. Code 330.330.

Renewal applications must be filed on the "Application Form for Non-Medical Radioactive Material License," 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 KLM.007, "Certificate - Termination and Disposition of Radioactive Material" (see Exhibit C); and

- C. Performance of radiation surveys 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 surveys 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 surveys of licensed facilities prior to termination.

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APPENDIX A

RETENTION OF DOCUMENTS

I. PERMANENT JOB SITES

<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
Survey Instrument Calibration	5 Years
Leak Tests	5 Years
Inventories	5 Years
Utilization Logs	Until disposal is authorized by the Agency
High Radiation Area Control Devices or Alarm Systems	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 and Pocket Dosimeter Readings	Until disposal is authorized by the Agency
Pocket Dosimeter Calibrations	5 Years
Alarm Ratemeter Function Checks	5 Years

APPENDIX A (continued)

I. PERMANENT JOB SITES (continued)

<u>Document</u>	<u>Retention Interval</u>
Alarm Ratemeter Calibrations	5 Years
Radiation Surveys	5 years or until disposal is authorized by the Agency if a survey was used to determine an individual's exposure

II. TEMPORARY JOB SITES

<u>Document</u>	<u>Retention Interval</u>
License and Active Amendments	Until termination of job
Operating/Emergency Procedures	Until termination of job
Latest Leak Test Result	Until termination of job

GUIDE TO SI UNITS

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

(1 m² = 10⁴ cm²)

CONVERSIONS	RADIATION DOSE RATES	DERIVED AIR CONCENTRATION (DAC)	CONCENTRATION IN SOLUTION
100 rem = 1 Sv		Units: Bq m ⁻³	μCi kBq/dm ³ (kBq/l)
100 rad = 1 Gy (gray)	$\mu\text{Sv}/\text{h}$, mSv/h		1 37
1 ton = 1 Mg	e.g.,	Conversion:	10 370
1 ton = 1000 kg	7.5 $\mu\text{Sv}/\text{h}$	$\mu\text{Ci cm}^{-3} \times 3.7 \times 10^{10} = \text{Bq m}^{-3}$	100 3700
1 kg = 1000 g	25 $\mu\text{Sv}/\text{h}$	$\frac{\text{dpm m}^{-3}}{60} = \text{Bq m}^{-3}$	
1 MBq/ton = 1 Bq/g			1 m ³ = 10 ³ dm ³ = 10 ³ l or 10 ³ L 1 mBq/m ³ = 1 kBq/dm ³

PREFIXES FOR UNITS:

a	atto	10 ⁻¹⁸		k	kilo	10 ³	thousand
f	femto	10 ⁻¹⁵		M	mega	10 ⁶	million
p	pico	10 ⁻¹²	trillionth	G	giga	10 ⁹	billion
n	nano	10 ⁻⁹	billionth	T	tera	10 ¹²	trillion
μ	micro	10 ⁻⁶	millionth	P	peta	10 ¹⁵	
m	milli	10 ⁻³	thousandth	E	exa	10 ¹⁸	

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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 the license use the radioactive material.
3. Instruct personnel in proper radiation protection practices.
4. Conduct or have conducted radiation surveys where indicated and keep records of such surveys, including summaries of corrective measures recommended and/or instituted.
5. Assure that personnel monitoring devices are used where indicated, exchanged at required intervals and that records are kept of the results of such monitoring.
6. Assure that interlock switches and warning signals are functioning and that postings are properly located.
7. Investigate each known or suspected case of excessive or abnormal exposure to determine the cause and take steps to prevent its recurrence.
8. Be immediately available to serve as a point of contact with the Agency and give assistance in case of emergency (e.g., damage, fire, theft, etc.);
9. Assure that the Radiation Protection Program is implemented and reviews are performed in accordance with the regulations.
10. Assure that the proper authorities (i.e., the Agency, local police, U.S. Department of Transportation, etc.) are notified promptly in case of accident, damage, theft, or loss of radioactive material; and
11. Assure that the terms and conditions of the license (such as periodic leak tests) are met and that the required records (such as personnel exposure, leak test, accountability, etc.) are maintained and reviewed for compliance with Agency regulations and license conditions.

12. Maintain, for a period of five 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:
 - A. The name of the designated individual;
 - B. A list of all duties the Radiation Safety Officer's designee is authorized to perform;
 - C. The date upon which the designation became effective;
 - D. The signature of the Radiation Safety Officer's designee; and
 - E. The signature of the Radiation Safety Officer.

13. The Radiation Safety Officer shall review records generated by designees and the performance of designees at least once in each calendar quarter. In addition, the licensee shall maintain records, for a period of five years, of these quarterly reviews and Radiation Safety Officer's designee reviews for Agency inspection. These records shall include:
 - A. The date of the review;
 - B. The records being reviewed or the name of the designee being reviewed;
 - C. A list of all duties reviewed by the Radiation Safety Officer for the designee review;
 - D. The results of the Radiation Safety Officer's review and any corrective measures taken, if applicable, based on the review; and
 - E. The signature of the Radiation Safety Officer.

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 we recommend 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 μ Ci)
- B = Background counting rate (counts/time) and
- EFF = Counting efficiency.

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 μ Ci must be converted to dpm by multiplying by a factor of 2.2E+6.

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.

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APPENDIX E

METHOD FOR CALIBRATING RADIATION SURVEY INSTRUMENTS

1. Application For a Licensee to Perform Radiation Survey Instrument Calibrations

When radioactive material is used to calibrate radiation survey 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 survey 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).
- 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 Survey Instruments

The calibration of radiation survey 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) 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 survey 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 survey instruments with only a single readout scale shall be calibrated, at a minimum, at one point near the midpoint of each decade.
- e. The exposure rate measured by the radiation survey instrument should not deviate more than $\pm 10\%$ from the calculated or known value for each point checked. (Read appropriate section of the radiation survey instrument manual to determine how to make necessary adjustments to bring the radiation survey instrument into calibration.) Readings within $\pm 20\%$ will be considered acceptable if a calibration chart or graph is prepared and attached to the radiation survey instrument. If the radiation survey 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 survey instrument laboratory 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.

NOTE: Sources of cobalt-60, cesium-137, or radium-226 are appropriate for use in calibrations. The radioactivity of the calibration standard should be sufficient to calibrate the radiation survey 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.

* For purposes of this document, the amount of radioactivity in a source is said to be traceable to a national standard when its radioactivity 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.

** In lieu of using a traceable radioactive source, a transfer instrument traceable to the NIST, 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."

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 survey instrument response by the licensee. 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 survey instrument sent for calibration by a specifically licensed firm authorized to perform radiation survey 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 survey instrument shall be removed from service and recalibrated.

4. Records

Records for Items 2, 3.b, 3.c, 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 percentage 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 survey instrument being calibrated;
 - 8) Name of individual performing the calibration; and
 - 9) Date radiation survey instrument calibration was performed.

b. Records for Items 3.b, 3.c, 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 survey 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).

- 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:

$$S \quad (R_1) \quad (R_2)$$

$$* \text{-----} P_1$$

$$* \text{-----} P_2$$

Exposure rate at P_2 :

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

where:

S is the point source

R_1 and R_2 are the exposure rates at P_1 and P_2 in the same units
(e.g., mR/hr or R/hr).

P_1 and P_2 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_o and R_t are in the same units (e.g., mR/hr or R/hr)

R_o is exposure rate on specified calibration date (i.e., time zero)

R_t is exposure rate "t" units of time later

$T_{1/2}$ and t are in the same units (e.g., years, months, days, etc.)

$T_{1/2}$ is the half-life of the radionuclide

t is the time elapsed between the source calibration (assay) date and the radiation detection/measurement 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:

$$\begin{aligned} R_{(3 \text{ ft})} &= \frac{(1 \text{ foot})^2}{(3 \text{ feet})^2} (77 \text{ mR/hr}) \\ &= 1/9 (77 \text{ mR/hr}) \\ &= 8.6 \text{ mR/hr at 3 feet on March 10, 1987} \end{aligned}$$

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APPENDIX F

SAMPLE FACILITY DIAGRAMS

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APPENDIX G

BASIC SUBJECTS TO BE COVERED DURING RADIATION SAFETY TRAINING

- I. Fundamentals of Radiation Safety
 - A. Characteristics of radiation
 - B. Units of radiation dose and quantity of radioactivity
 - C. Math and calculations basic to the use and measurement of radioactivity.
 - D. Significance of radiation dose
 - 1. Radiation protection standards
 - 2. The ALARA principle
 - 3. Biological effects of radiation
 - E. Levels of radiation from sources of radiation
 - F. Methods of controlling radiation dose
 - 1. Working time
 - 2. Working distance
 - 3. Shielding
- II. Radiation Detection Instrumentation to be Used
 - A. Use of radiation survey instruments
 - 1. Operation
 - 2. Calibration
 - 3. Limitations
 - B. Survey techniques
 - C. Use of personnel monitoring equipment
 - 1. Film badges
 - 2. Thermoluminescent dosimeters (TLD's)
 - 3. Pocket dosimeters
- III. Safety Equipment to be Used
 - A. Remote handling equipment
 - B. Fume Hoods
 - C. Storage containers
 - D. Personnel protective equipment (i.e., gloves, lab coats, respirators)
- IV. The Requirements of Pertinent Federal and State Regulations (see Section I.D. of guide)
- V. Terms and Conditions of the License, Active Amendments, and Any Correspondence Submitted in Support of the License Application
- VI. The Licensee's Written Operating and Emergency Procedures
- VII. Manufacturer's Instruction Manuals for Sources/Devices
- VIII. On-the-job Training

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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 and quantities 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 Radiation Safety Department.
3. During off-duty hours, security 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 is wet or appears to be damaged, immediately contact the hospital's RSO. Ask the carrier to remain at the hospital 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 on duty or other designated trained personnel and taken immediately to the Nuclear Medicine Department. Unlock the door, place the package in the hot lab (or designated secured area) and relock the door.

RADIATION SAFETY OFFICER (RSO): _____

OFFICE PHONE: _____

HOME PHONE: _____

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

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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. Put on gloves to prevent hand contamination;
 - b. Visually inspect the package for any sign of damage (e.g., wetness, crushed). If damage is noted, stop and notify the Radiation Safety Officer (RSO);
 - c. Monitor the external surfaces of a labeled package for radioactive contamination unless the package contains only radioactive material in the form of a gas or in special form radioactive material as defined in 32 Ill. Adm. Code 310.20;

AGENCY NOTE: Labeled means labeled with a Radioactive White I, Yellow II or Yellow III label as specified in U.S. Department of Transportation regulations, 49 CFR 172.403 and 172.436-440.
 - d. Monitor the external surfaces of a labeled package for radiation levels unless the package contains quantities of radioactive material that are less than or equal to the Type A quantity, as defined in 32 Ill. Adm. Code 341.20, as listed in 49 CFR 173.435; and
 - e. Monitor all packages known to contain radioactive contamination and radiation levels if there is evidence of degradation of package integrity, such as packages that are crushed, wet or damaged.
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, wet or damaged. If a package is received after working hours and has no evidence of degradation of package integrity, the package shall be monitored no later than three (3) hours from the beginning of the next working day.
3. Open the outer package (following supplier's directions if provided) and remove packing slip. Open inner package to verify contents (compare requisition, packing slip and label on bottle or syringe holder). Check integrity of the final source container (inspecting for breakage of seals or vials, loss of liquid, discoloration of packaging material). Check also that the shipment does not exceed license possession limits. If anything is other than expected, stop and notify the RSO.

4. Survey the packing material and packages for contamination before discarding. If contamination is found, treat as radioactive waste. If no contamination is found, obliterate all radiation labels prior to discarding in regular trash.
5. Maintain records of receipt, package survey and wipe test results.
6. The final carrier and the Agency shall be immediately notified by telephone and shall confirm the initial contact within 24 hours by overnight letter or telefacsimile to the Agency, when:
 - a. Removable radioactive surface contamination exceeds the limits of 32 Ill. Adm. Code 341.150(h); or
 - b. External radiation levels exceed the limits of 32 Ill. Adm. Code 341.150(i) and (j).

APPENDIX J

GENERAL RULES FOR THE SAFE USE OF RADIOACTIVE MATERIAL

1. Wear laboratory coats or other protective clothing at all times in areas where radioactive material is used.
2. Wear disposable gloves at all times while handling radioactive material or potentially contaminated items.
3. Monitor hands and clothing, with a low-level monitoring instrument (e.g., G-M survey meter), for contamination after each procedure or before leaving the area.
4. Use syringe shields for preparation of patient doses and administration to patients except in circumstances when their use would compromise the patient's well-being (such as some pediatric cases).
5. Do not eat, drink, smoke or apply cosmetics in any area where radioactive material is stored or used.
6. Do not store food, drink or personal items in any area where radioactive material is stored or used.
7.
 - a. Assay each patient dose in the dose calibrator prior to administration. Notify the authorized user if any doses differ from the prescribed dose by more than $\pm 10\%$ and do not use unless an authorized user grants written approval.
 - b. For therapeutic doses, also check the patient's name, the radionuclide, the chemical form and the activity vs. the order written by the physician who will perform the procedure.
8. Secure all areas where radionuclides are stored when unattended.
9. Wear whole-body personnel monitoring devices (film badge or TLD) at all times while in areas where radioactive material is used or stored. These must be worn at chest or waist level where the highest exposure is expected.
10. Wear film or TLD finger badges, turned inward towards material, during elution of generator and preparation, assay and injection of radiopharmaceuticals. Finger badges are worn on the finger likely to receive the most dose.
11. Dispose of radioactive waste only in specially designated receptacles.
12. Never pipette by mouth.

13. Survey generator, kit preparation and injection areas for contamination after each procedure or at the end of the day. Decontaminate if necessary.
14. Confine radioactive solutions in covered containers plainly identified and labeled with name of compound, radionuclide, date, activity and radiation level if applicable.
15. Always transport radioactive material in shielded containers.
16. Use suitable ventilation systems when handling gases or volatile material.

APPENDIX K

EMERGENCY PROCEDURE

1. **MINOR SPILLS:**

- a. NOTIFY: Notify persons in the area that a spill has occurred.
- b. PREVENT THE SPREAD: Cover the spill with absorbent material and prevent access to the area by unauthorized personnel.
- c. CLEAN UP: Use disposable gloves and remote handling tongs. Carefully fold the absorbent material. Insert into a plastic bag and dispose of in the radioactive waste container. Also insert into the plastic bag all other contaminated materials such as disposable gloves.
- d. SURVEY: With a low range monitoring instrument (e.g., thin window, G-M survey meter) check the area around the spill, hands and clothing for contamination.
- e. REPORT: Report incident to the Radiation Safety Officer (RSO).

2. **MAJOR SPILLS:**

- a. CLEAR THE AREA: Notify all persons not involved in the spill to vacate the room.
- b. PREVENT THE SPREAD: Cover the spill with absorbent material, but do not attempt to clean it up. Confine the movement of all personnel potentially contaminated to prevent the spread.
- c. SHIELD THE SOURCE: If possible, the spill should be shielded, but only if it can be done without further contamination or without significantly increasing your radiation exposure.
- d. CLOSE THE ROOM: Leave the room and lock the door(s) to prevent entry.
- e. CALL FOR HELP: Notify the RSO immediately.

- f. **PERSONNEL DECONTAMINATION:** Contaminated clothing should be removed and stored for further evaluation by the RSO. If the spill is on the skin, flush thoroughly and then wash with mild soap and lukewarm water. Injured persons should be decontaminated and first aid performed as necessary. If life threatening injuries are present, the individual should be given immediate life-saving first aid and transported to a hospital for further medical treatment regardless of any contamination present. The hospital should be given prior notification that the patient is contaminated so that the appropriate controls can be implemented.

3. **EXPOSURE TO SOURCES OF RADIATION**

Terminate the source of exposure and prevent others from being exposed. Use additional shielding as needed. Notify the RSO so the nature and extent of exposure can be determined. Seek medical attention if severe exposure is suspected.

4. **LOSS, THEFT OR DAMAGE TO A SOURCE OF RADIOACTIVE MATERIAL**

In addition to following the applicable procedures outlined above, notify the RSO immediately and the Illinois Emergency Management Agency (217) 785-0600.

RADIATION SAFETY OFFICER (RSO): _____

OFFICE PHONE: _____ HOME PHONE: _____

ALTERNATE NAMES AND TELEPHONE NUMBERS DESIGNATED BY RSO:

APPENDIX L

AREA SURVEY PROCEDURE

1. All preparation and use areas will be surveyed each day of use with a low-range survey instrument (as appropriate for radionuclides used) and decontaminated if necessary.
2. Individuals shall monitor hands, shoes, clothing, and work surfaces with a low-range survey instrument (as appropriate for radionuclides used) for contamination after each use of radioactive material or before leaving the restricted area and decontaminate as necessary.
3. Laboratory areas where only small quantities of radioactive material are used [less than 7.4 MBq (200 μ Ci)] or areas where material is in storage only will be surveyed monthly.
4. Waste storage areas and all other laboratory areas [those using greater than or equal to 7.4 MBq (200 μ Ci)] will be surveyed weekly.
5. The weekly and monthly surveys will consist of:
 - a. A measurement of radiation levels with a survey meter sufficiently sensitive to detect 1.0 uSv (0.1 mrem) per hour for the radionuclide involved.
 - b. A series of wipe tests to measure contamination levels. The method for performing wipe tests will be sufficiently sensitive to detect 3.7 Bq (220 dpm) per 100 cm², beta/gamma, for the contaminant involved. Wipes for areas of use or other high-background areas will be removed to a low-background area for measurement.
6. If contamination is detected, the area will:
 - a. Be cleaned or posted and restricted from use if the contamination level exceeds 37 Bq (2,200 dpm) per 100 cm², beta/gamma; or
 - b. Be covered, cleaned, or identified to all employees if the contamination level exceeds 3.7 Bq (220 dpm) per 100 cm² but is less than 37 Bq (2,200 dpm) per 100 cm², beta/gamma.
7. Records of all area survey results, including negative results, will be kept for five (5) years after each survey. The record will include:
 - a. Manufacturer, model, and serial number of the instruments used to perform surveys and analyze wipe tests.
 - b. Date of the survey.

- c. A drawing of the area surveyed identifying relevant features such as active storage areas, active waste areas, etc.
- d. Measured dose rates (in units of sieverts or mrem per hour) keyed to locations on the drawing.
- e. Detected contamination levels (in units of Bq/100 cm², dpm/100 cm² or microcuries/100 cm²) keyed to locations on the drawing.
- f. Corrective action taken in the case of contamination or exposure rates in excess of action levels or the regulations, reduced contamination levels or dose rates after corrective action, and any appropriate comments.
- g. The identification of the individual performing the survey.

NOTE: For the surveys referenced in Items 1. and 2. above, only the date and the identification of the person performing the survey need to be recorded when no abnormal radiation levels are identified. If abnormal radiation levels or personnel contamination are noted, survey results should be documented as per Item 7 above.

APPENDIX M

TESTING SEALED SOURCES FOR LEAKAGE AND/OR CONTAMINATION

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

1. Describe all instrumentation that 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 μ Ci) of the radioactive material being tested. For radium-226, the instrument must be sensitive enough to detect 185 Bq (0.005 μ Ci) external radon-daughter contamination or the escape of radon at the rate of 37 Bq (0.001 μ 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 test kit to be used in collecting the leak test samples.
5. Describe in detail the procedure for performing the analysis of the leak 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 test samples.
8. Describe the training and experience of each person who will analyze and evaluate the results of the leak test samples.

9. Describe the records to be maintained for each leak test. These shall include:
 - a. The location of the source which was leak tested;
 - b. The date the sample was collected;
 - c. The individual collecting the sample;
 - d. The person performing the analysis;
 - e. The date the analysis was performed;
 - f. The unique identification of the source tested; e.g., manufacture, model number, serial number, etc.
 - g. The radionuclide and the activity of radioactive material contained in the source;
and
 - h. 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 μ Ci).

APPENDIX N

RADIOIODINE BIOASSAY PROCEDURE

Calibration

This bioassay procedure uses a sodium iodide crystal and single channel analyzer (such as an uptake probe) to determine thyroid burden. Calibration of the system will be performed annually.

A. Set Window or Region of Interest

The window or region of interest must be set to detect emissions for the radionuclide you are trying to detect. In the case of I-131, the region of interest must be in the area of 364 keV.

Using the minimum detectable activity calculations described in Appendix D, demonstrate that the system you are using can detect 1.48 kBq (0.04 μ Ci) of I-131. (Submit these calculations with Exhibit B.)

B. Establish Background

Hold probe on thigh (ensure thigh and/or lab coat are not contaminated) for a 1 minute count. Record results.

C. Count Standard

A known (measured) amount of radioactivity must be used as the standard. When assaying for I-131, an I-131 standard (or a standard source of known activity that emits photons of approximately the same energy as I-131, e.g., Ba-133) must be used. I-131 liquid or capsule may be used, and must be measured and corrected for decay. Place the standard in a thyroid phantom*. Hold probe against the phantom in an established geometry, similar to the geometry to be used when performing a bioassay on an individual, for required amount of time (1 min.). Record results.

(*Note: Specifications for design of a neck phantom can be found in American National Standard ANSI N44.3-1973, "Thyroid Radioiodine Uptake Measurements Using a Neck Phantom.")

D. Establish System Efficiency

Standard CPM - Background CPM = Net Standard CPM

$$\frac{\text{Net Standard CPM}}{\text{Standard Activity}(\mu\text{Ci})} \times \frac{100}{2.2 \times 10^6 \text{ DPM}/\mu\text{Ci}} = \% \text{ Efficiency}$$

Investigation Limits

E. Establish In-House Investigation Limits

1. The Radiation Safety Officer (RSO) shall be notified whenever the thyroid burden at the time of measurement exceeds 37 kBq (1.0 μCi) of I-131. The RSO shall perform an investigation into the cause of the exposure and the potential for further exposure, and develop corrective actions to prevent recurrence.

2. The RSO shall be notified immediately whenever the thyroid burden at the time of measurement exceeds 185 kBq (5.0 μCi) of I-131. The RSO must perform an investigation, as described above, and must perform weekly bioassays on the individual until the individual's thyroid burden is less than 37 kBq (1.0 μCi) of I-131.

(Note: In-house investigation limits are adopted from U. S. Nuclear Regulatory Guide 8.9, "Acceptable Concepts, Models, Equations and Assumptions for a Bioassay Program.")

MEASUREMENT

F. Measure Thyroid Gland

1. Perform measurements in a low-background area.
2. Hold probe on thigh (ensure thigh and/or lab coat are not contaminated) for a 1 minute count. Record results.
3. Hold probe in the center of neck near Adam's apple for required amount of time (1 min). Record results.
4. Subtract background from thyroid gland count to obtain net counts. Record results.

5. Calculate and record the amount of radioactivity in thyroid by using the equation below:

A.
$$\frac{\text{Net counts (CPM)} \times 100}{\% \text{ Efficiency} \times 2.2 \times 10^6 \text{ dpm}/\mu\text{Ci}} = X \mu\text{Ci}$$

B. The intake retention fraction (t = 24 hours) for I-131 is 0.133.

$$\frac{X \mu\text{Ci}}{0.133} = X(i) \mu\text{Ci} \text{ (estimate of intake)}$$

C. The inhalation ALI for I-131 is 50 μCi

$$\frac{X(i)}{50 \mu\text{Ci}} = \% \text{ of CEDE}$$

6. If results are less than the investigation limits established in E.1. above, you are finished with this procedure.
7. If results are more than the investigation limits established in E.1. above, notify the RSO immediately. The RSO may restrict the employee's further handling of I-131 until the thyroid burden is measured to be below the reporting limits established in E above.

NOTE: For other radioisotopes of iodine, corrections for effective half-life, inhalation ALI, instrument efficiency, intake retention factors and action levels must be made.

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APPENDIX O

SAMPLE CALCULATIONS FOR RADIOACTIVE GASES/VOLATILE MATERIAL

The following information must be submitted in support of requests to use radioactive gases:

1. CALCULATIONS OF MINIMUM VENTILATION RATES FOR RESTRICTED AREAS REQUIRED BY PART 340
 - a. Determine the highest dose to an individual from all external radiation for the previous 12-month period by reviewing personnel monitoring records (film, TLD, etc.) or based on activity, distance and duration of handling. If necessary, modify the dose to account for an anticipated increase or decrease in potential exposure.
 - b. Modify the DAC value to allow for the estimated annual external exposure.

A simplified method is to subtract the estimated external dose from the occupational dose limit of 50 mSv (5 rems) and divide this number by 50 mSv (5 rems). This yields the fraction of the dose limit of 5 rems that would still be permitted from internal sources. Multiplying this fraction times the DAC value yields a modified DAC. These DAC values are provided in Appendix B to 10 CFR § 20.1001-20.2401 in Table 1, Column 3.

Example:

A new room is being designed where Kr-85 will be used. If the annual external dose is 2 rems, the modified DAC value should be based on 3 rems that could still be incurred from internal exposure. The listed DAC value for Kr-85 is $1E-4 \mu\text{Ci/ml}$.

$$\begin{aligned} \text{DAC(modified)} &= \frac{3\text{rems}}{5\text{rems}} \times 1E-4 \mu\text{Ci/ml} \\ &= 6E-5 \mu \end{aligned}$$

If the facility in question plans to use $5.2 \times 10^6 \mu\text{Ci}$ of Kr-85 per year. What ventilation rate is required to ensure compliance with 32 Ill. Adm. Code 340.210?

Maximum Activity:

$$A_0 = 5.2 \times 10^6 \mu\text{Ci/year}$$

Assume a loss rate (f) of 20%

$$A = A_0 \times f$$

$$A = (5.2 \times 10^6 \mu\text{Ci/year}) \times 0.2$$

$$A = 1 \times 10^6 \mu\text{Ci/year}$$

Required Ventilation Rate:

$$V = \frac{A}{C} \text{ where } C = \text{DAC} = 6 \times 10^{-5} \mu\text{Ci/ml}$$

$$V = \frac{1 \times 10^6 \mu\text{Ci/year}}{6 \times 10^{-5} \mu\text{Ci/ml}}$$

$$V = 1.7 \times 10^{10} \text{ ml/yr}$$

$$V = \frac{1.7 \times 10^{10} \text{ ml}}{\text{year}} \times \frac{1 \text{ year}}{52 \text{ weeks}} \times \frac{1 \text{ week}}{40 \text{ hours}} \times \frac{1 \text{ hour}}{60 \text{ minutes}} \times \frac{1 \text{ ft}^3}{2.832 \times 10^4 \text{ ml}}$$

$$V = 4.8 \text{ ft}^3/\text{min}$$

The answer shows that, in order to meet the requirements of 32 Ill. Adm. Code 340.210, the nuclear medicine laboratory (RESTRICTED AREA) must have a ventilation rate of at least 5.0 ft³/min with no recirculation of air. Where practicable, the ventilation rate should be greater than that shown necessary by the calculations. Consider every alternative in order to maintain the air concentration of Xe-133 as low as is reasonably achievable.

If the ventilation rate is inadequate to meet the requirements of 32 Ill. Adm. Code 340.210, methods of increasing ventilation or reducing the activity must be implemented.

2. AIR CONCENTRATIONS OF RADIOACTIVE GASES/VOLATILE MATERIAL IN UNRESTRICTED AREAS

Licenses who make releases of radioactive gases/volatile material to unrestricted areas during use, storage, and disposal are required to perform surveys (measurements or calculations) to ensure that they are in compliance with 32 Ill. Adm. Code 340.210. Many facilities do not have sufficient air flow to achieve the necessary dilution to unrestricted areas. The following procedure may be used to estimate the concentrations of radioactive gases in effluents to unrestricted areas:

- a. Estimate the maximum amount of radioactive gas/volatile material to be released per year (A). This should include all anticipated losses during use, storage and disposal.
- b. Determine the flow rate of the exhaust system, and calculate the air flow per year (V).

- c. For unrestricted areas, 32 Ill. Adm. Code 340.1030 requires that the air concentration (C):

$$C = \frac{A}{V} \leq \begin{array}{l} \text{Maximum concentration as listed in Table II,} \\ \text{Column I of 10 CFR 20 Appendix A.} \end{array}$$

- d. Sample Problem:

A laboratory plans to use 5×10^6 μCi of Kr-85 per year. A fume hood is available for the release of Kr-85, and has a measured airflow of 168 ft/min. with an opening of 8 ft². What is the average concentration of Kr-85 at the point of release from the fume hood exhaust (assuming all Kr-85 from collection bags, filters, etc. has been released)?

Volume:

$$(1 \text{ ft}^3/\text{min} = 1.7 \times 10^6 \text{ ml/hr} = 6.8 \times 10^7 \text{ ml/40-hr wk} = 1.5 \times 10^{10} \text{ ml/yr})$$

$$V = 168 \frac{\text{ft}}{\text{min}} \times 8 \text{ ft}^2 \times 1.5 \times 10^{10} \frac{\text{ml/yr}}{\text{ft}^3/\text{min}}$$

$$V = 1344 \frac{\text{ft}^3}{\text{min}} \times 1.5 \times 10^{10} \frac{\text{ml/yr}}{\text{ft}^3/\text{min}}$$

$$V = 2.02 \times 10^{13} \text{ ml/yr}$$

Concentration:

$$C = \frac{5.2 \times 10^6 \mu\text{Ci/year}}{2.02 \times 10^{13} \text{ ml/yr}}$$

$$C = 2.6 \times 10^{-7} \mu\text{Ci/ml}$$

The concentration of radioactive gas vented to the atmosphere is less than the maximum concentration of 7×10^{-7} $\mu\text{Ci/ml}$ listed in Table II, Column I of 10 CFR 20 Appendix A.

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APPENDIX P

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. Only one person shall be assigned to a dosimeter 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 (immediately before the end of a shift, or 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.
 - 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 ± 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.
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 ± 20 percent),
 - i. Make, model, and serial number of dosimeter calibrated, and
 - j. Signature of individual who performed the calibration.

EXHIBIT A



ILLINOIS EMERGENCY MANAGEMENT AGENCY
 DIVISION OF NUCLEAR SAFETY
 1035 OUTER PARK DRIVE
 SPRINGFIELD, ILLINOIS 62704

APPLICATION FORM FOR NON-MEDICAL RADIOACTIVE MATERIAL LICENSE

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 #:	Phone #:
Fax #:	Fax #:
E-mail:	E-mail:

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

Phone #:	Phone #:

Request for TEMPORARY JOB SITES (≤ 180 days during any consecutive twelve-month period): Yes No

ITEM 5. Individual(s) Who Will Use Radioactive Material

List names and requested uses of material. (Attach evidence of appropriate Training and Experience).

Name: _____	Subparts: _____
Name: _____	Subparts: _____
Name: _____	Subparts: _____
Name: _____	Subparts: _____
Name: _____	Subparts: _____
Name: _____	Subparts: _____
Name: _____	Subparts: _____

ITEM 6. Radiation Safety Officer (RSO) (Attach evidence of Training and Experience)

Name: _____ Phone #: _____

- Duties are as stated in Appendix C of Instructional Set 48.6 dated October 1994.
- Duties and responsibilities are attached.

ITEM 7. Radioactive Material for Non-Medical Use

RADIONUCLIDE	CHEMICAL and/or PHYSICAL FORM	MAXIMUM ACTIVITY PER SOURCE	MAXIMUM POSSESSION LIMIT
<input type="checkbox"/>			
<input type="checkbox"/>			
<input type="checkbox"/>			
<input type="checkbox"/>			
<input type="checkbox"/>			

Authorized Use: _____

ITEM 8. Instrumentation

- Complete Exhibit B from Instructional Set 48.6 dated October 1994 or equivalent is attached.

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

- Radiation survey 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 survey instruments in accordance with the attached procedures, which contain all information requested in Appendix E of Instructional Set 48.6 dated October 1994.

ITEM 10. Facilities and Equipment

- Diagrams of radioactive material use and storage area are attached.

ITEM 11. Personnel Training Program

- Description of training program, including frequency, form, and duration is attached.

ITEM 12. Procedure for Ordering and Receiving Radioactive Material

- Description for ordering and receiving radioactive material is attached.

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

- We will use the procedure identified in Appendix I of Instructional Set 48.6 dated October 1994.
- Procedure is attached.

ITEM 14. General Rules for the Safe Use of Radioactive Material (Check one)

- We will use the procedure identified in Appendix J of Instructional Set 48.6 dated October 1994.
- Procedure is attached.

ITEM 15. Emergency Procedure (Check one)

- We will use the procedure identified in Appendix K of Instructional Set 48.6 dated October 1994.
- Procedure is attached.

ITEM 16. Area Survey Procedure (Check one)

- We will use the procedure identified in Appendix L of Instructional Set 48.6 dated October 1994.
- Procedure is attached.

ITEM 17. Waste Disposal (Check one)

- We do not wish authorization for alternate disposal methods.
- Alternate disposal methods are detailed in an Attachment to this application. (This includes Decay-in-Storage procedures for isotopes with $T_{1/2} < 90$ days.)

ITEM 18. Testing Sealed Sources for Leakage and/or Contamination (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's license authorizing such services.
- We will perform our own sample analysis for source leakage and/or contamination. Procedure is attached.

ITEM 19. Bioassays (Check one)

- Not applicable.
- We will use the procedure for radioactive bioassays identified in Appendix N of Instructional Set 48.6 dated October 1994.
- Procedure is attached.

ITEM 20. Procedure for Use of Radioactive Gases/Volatile Material (Check one)

- Not applicable.
- Occupational dose limit/ventilation calculations are attached.

ITEM 21. Procedure for Use of Radioactive in Animals (Check one)

- Not applicable.
- Procedure is attached.

ITEM 22. Personnel Monitoring (Check all that apply)

- | TYPE | EXCHANGE FREQUENCY | FILM | TLD | OSL |
|-------------------------------------|--------------------|--------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> Whole body | _____ | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <input type="checkbox"/> Extremity | _____ | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
- Direct reading dosimeters will be used and calibrated in accordance with Appendix P of Instructional Set 48.6 dated October 1994.
 - Direct reading dosimeter use and calibration procedures are attached.

ITEM 23. 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 24. 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 25. 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 Detection Survey Instruments

(0.1 mrem/hr to 50 mrem/hr or 1 uSv/hr to 500 uSv/hr):

Manufacturer: _____

Model: _____

Available: _____

Range: _____

Window Thickness: _____
(mg/cm²)

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

2. Portable Radiation Measurement Survey Instruments

(1 mrem/hr to 1000 mrem/hr or 10 uSv/hr to 10 mSv/hr):

Manufacturer: _____

Model: _____

Available: _____

Range: _____

Window Thickness: _____
(mg/cm²)

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

3. Fixed Area Monitor

Manufacturer: _____

Model: _____

Available: _____

Range: _____

4. Liquid Scintillation Counter (If used to analyze wipes*)

Manufacturer: _____

Model: _____

*Minimum Detectable Activity: _____

5. Well Counter (If used to analyze wipes*)

Manufacturer: _____

Model: _____

*Minimum Detectable Activity: _____

6. Instrument Used for Analysis of Wipe Tests

(Generic Description) _____

Manufacturer: _____

Model: _____

*Minimum Detectable Activity: _____

7. Thyroid Bioassay Probe

Manufacturer: _____

Model: _____

Range/*Minimum Detectable Activity: _____

8. Other Instruments (Continue on separate sheet if necessary.)

(Generic Description) _____

Manufacturer: _____

Model: _____

Range: _____

* Submit calculations as described in Appendix D.



EXHIBIT C

CERTIFICATION OF TERMINATION
Illinois Emergency Management Agency
Division of Nuclear Safety -- Radioactive Materials Section
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

LICENSEE: ADDRESS: LICENSE NUMBER: TELEPHONE NUMBER:

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:
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:
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)