# MINNESOTA DEPARTMENT OF HEALTH

# REGULATORY GUIDE FOR CALIBRATING RADIATION SURVEY AND MONITORING INSTRUMENTS


**Division of Environmental Health**
**Indoor Environments & Radiation Section**
**Radiation Control**

**625 Robert Street North**
**P.O. Box 64975**
**St. Paul, Minnesota 55164-0975**
**(651) 201-4545**


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**REGULATORY GUIDE FOR CALIBRATING**
**RADIATION SURVEY AND MONITORING INSTRUMENTS**

**MDH REGULATORY GUIDE FOR**
**CALIBRATING RADIATION SURVEY AND MONITORING INSTRUMENTS**

## PURPOSE

This guide identifies the information needed by the MDH to evaluate an application for a "Calibrating Radiation Survey and Monitoring Instruments" license and to describe the radioactive material regulations.

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

## AS LOW AS REASONABLY ACHIEVABLE (ALARA) PHILOSOPHY

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

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

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

## FILING AN APPLICATION

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

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

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

Submit one copy of your application to:

Radiation Control
Minnesota Department of Health
625 Robert St. N
PO Box 64975
St. Paul, MN 55164-0975

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

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

**Item 1: License Action Type**

Check box A for a new license request.

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

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

**Item 2: Name and Mailing Address of Applicant**

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

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

- Radioactive materials are possessed, used, or controlled only by persons who have valid MDH licenses.
- Materials are properly handled and secured.
- Persons using these materials are competent and committed to implementing appropriate radiological controls.
- A clear chain of custody is established to identify who is responsible for final disposal of radiography devices.
- Public health and safety are not compromised by the use of such materials.

**Item 3: Address(es) At Which Licensed Material Will Be Used or Possessed**

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

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

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

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

**Item 4: Person to be Contacted About This Application**

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

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

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

**Item 5: Radioactive Material**

Describe the radioactive material by isotope, chemical and/or physical form, and activity, in millicuries or microcuries. Possession limits requested should cover the total anticipated inventory, including stored materials (but not decay-in-storage), and should be based on the applicant's needs and abilities for safe handling.

If the use of sealed or plated sources is being considered, specify the isotope, manufacturer, and model number of each sealed source or plated source. You should consult with your proposed supplier for information to be sure that your sources and devices conform to the sealed source and device designations registered with the US Nuclear Regulatory Commission (NRC) or an Agreement State.

Also list any survey meter or calibration source not exempted under 4731.3040.

Example:

| | | |
|---|---|---|
| Cesium-137 | Sealed rod source<br>XYZ Inc. Model 10 | Not to exceed 250<br>microcuries/source |
| Cobalt-60 | Sealed source<br>XYZ, Inc. Model 351 | Not to exceed 20<br>millicuries/source |

NOTE: It is the practice of MDH to provide flexibility in the number of identical sealed source/device combinations you may want to possess at any one time. Therefore, it is not necessary for you to specify the number of identical source/device combinations. You will need to amend your license before you obtain any source other than those listed in Item 6.

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

Specify the purpose for which each type of source listed in Item 6 will be used. If a source is contained in a device, you need to specify the manufacturer and model number of each device (calibrator). For example:

1. To be used for low-range (.01 to 2 mr/hr) calibration of portable survey meters.

2. To be used for medium (1 to 500 m/R/hr) and low-range calibration of survey meters.

3. To be used in a Nuclides, Inc. Model 100 shielded calibrator for the high-range (>1 R/hr) calibration of radiation measuring meters and devices.

4. To be used for calibration of medium- and low-range portable survey meters.

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

Submit a description or chart of the overall organization pertaining to the radioactive materials program that specifies the name and title of each individual who has responsibility for management or supervision of the program.

***Radiation Safety Officer (RSO)***

The person responsible for the radiation protection program is called the Radiation Safety Officer (RSO). The RSO needs independent authority to stop operations that he or she considers unsafe. He or she must have sufficient time and commitment from management to fulfill certain duties and responsibilities to ensure that radioactive materials are used in a safe manner. MDH requires the name of the RSO on the license to ensure that licensee management has always identified a responsible, qualified person and that the named individual knows of his or her designation as RSO[1]. The duties of the RSO are outlined in Appendix B.

Radiation Safety Officers (RSOs) must have adequate training and experience. The licensee should provide the name of the proposed RSO and information demonstrating that the proposed RSO is qualified by training and experience.

Additional training is required for RSOs of programs that perform non-routine operations. This includes repairs involving or potentially affecting components related to the radiological safety of the calibration equipment (e.g., the source, source holder, source drive mechanism, shutter, shutter control, or shielding)

[1] It is important to notify MDH, as soon as possible, of changes in the designation of the RSO.

and any other activities during which personnel could receive radiation doses exceeding MDH limits (e.g., installation, initial radiation survey, or relocation).

As an alternative, the licensee should state that:

a. Before obtaining licensed materials, the proposed RSO will have successfully completed training. Provide an outline of the course content or describe the training.
b. The new RSO will receive training within a specified time after being appointed. Provide an outline of the course content or describe the training.

***Authorized Users***

An authorized user (AU) is a person whose training and experience meet MDH criteria and who uses or directly supervises the use of licensed material. Authorized users must ensure the proper use, security, and routine maintenance of devices containing licensed material. Therefore, they must attend the formal training and instruction or receive equivalent training and instruction.

An AU is considered to be supervising the use of licensed material when he or she directs personnel in operations involving the material. Although the AU may delegate specific tasks to supervised users (e.g., maintaining records), he or she is still responsible for safe use of licensed material.

Before allowing an individual to perform survey instrument calibrations, the RSO will ensure that the AU has sufficient training and experience to perform independent survey instrument calibrations. Classroom training may be in the form of lecture, videotape, or self-study and will cover the following subject areas:

- Principles and practices of radiation protection
- Radioactivity measurements, monitoring techniques, and instrument use
- Mathematics and calculations basic to using and measuring radioactivity
- Biological effects of radiation

Appropriate on-the-job-training consists of the following:

- Observing authorized personnel performing survey instrument calibration.
- Conducting survey meter calibrations under the supervision and in the physical presence of an individual authorized to perform calibrations.

**Item 8: Training for Individuals Working In or Frequenting Restricted Areas**

Individuals who, in the course of employment, are likely to receive occupational doses of radiation in excess of 100 mrem (1 mSv) in a year must receive training. The extent of this training must be commensurate with potential radiological health protection problems present in the work place. A model training program is included in Appendix C.

Licensee personnel who work in the vicinity of a device but do not use equipment containing sources (ancillary staff) are not required to have radiation safety training as long as they are not likely to receive 100 mrem (1 mSv) in a year. However, to minimize potential radiation exposure when ancillary staff are working in the vicinity of a device, it is prudent for them to work under the supervision and in the physical presence of an AU or to be provided some basic radiation safety training. Such ancillary staff should be informed of the nature and location of the device and the meaning of the radiation symbol. They should be instructed not to touch the equipment and to keep away from it as much as their work permits.

Some ancillary staff, although not likely to receive doses over 100 mrem, should receive training to ensure adequate security and control of licensed material. Licensees may provide these individuals with training commensurate with their assignments near the equipment, to ensure the control and security of licensed material.

Submit the training program for individuals who in the course of employment are likely to receive occupational doses of radiation in excess of 100 mrem (1 mSv) in a year (occupationally exposed workers) and ancillary personnel.

**Item 9: Facilities and Equipment**

Calibration equipment normally has engineering features to protect the user from unnecessary radiation exposure. An application will be approved if, among other things, the applicant has equipment and facilities that are adequate to protect health and to minimize danger to life or property. Therefore, you should provide a sketch or description of the proposed location of each device containing radioactive equipment within your facility. Note the following:

1. The scale. Use the same scale (preferably 1/4 inch = 1 foot) for all drawings.

2. The direction of north.

3. Room numbers and principal use of each room or area (for example, in vitro, hot lab, office, file, fresh materials storage, radioactive waste storage, hallway).

4. Any shielding available, auxiliary shielding and description of use.

5. Additional safety equipment (for example, fume hoods, L-blocks, or fixed area monitors) including manufacturer and model or serial numbers where appropriate.

6. Restricted areas within calibration labs.

7. Location of any beam calibrators and calibration range facilities, including a description of the range facility.

8. Means of minimizing scatter.

9. Location of any self-contained calibration facilities.

10. Source storage facilities.

11. Source handling equipment.

12. Means of preventing entry into high radiation areas.

13. Means of preventing unauthorized use or removal of licensed material.

Sketches and descriptions should show the relationship of material use areas to any adjoining unrestricted areas (e.g., offices, rest rooms, or cafeterias).

In addition, the following precautions should be observed:

- To reduce doses received by individuals not calibrating instruments, calibrations will be conducted in an isolated area of the facility or at times when no one else is present.

- Individuals conducting calibrations will wear assigned dosimetry. Additional information on monitoring is in Appendix D.

- Individuals conducting calibrations will use a calibrated and operable survey instrument to ensure that unexpected changes in exposure rates are identified and corrected.

**Item 10: Radiation Safety Program**

***Surveys***

Each licensee must make surveys as necessary to evaluate the extent of radiation hazards that may be present during the possession and use of licensed material. List the radiation detection (survey or monitoring) instruments that you will have available for your own use in manipulating the requested sealed sources and in performing your calibration services. Your list must specify both the number of instruments and the following information for each instrument:

(1) type of instrument
(2) type of radiation detected
(3) sensitivity range
(4) specific use
(5) calibration interval

Survey instruments should be calibrated at least annually and following servicing.

The following is an example:

Portable thin-window GM survey meter
2 units are available
Radiation detected is beta and gamma
Sensitivity range is 0-500 mR/hr
Used for survey and monitoring

***Operating and Emergency Procedures***

Each individual who will perform calibration on customers' radiation survey and monitoring instruments should have a set of operating and emergency procedures. You should state in your application that personnel will be provided with operating and emergency procedures. Submit a copy of the procedures listed below.

1. Systematic instructions for performing calibrations of survey and monitoring instruments (including pocket dosimeters, if applicable). For acceptable criteria, see Appendix F as a guide. You should also consider "Radiation Protection Instrumentation Test and Calibration," ANSI N323-1978. Copies are available from the American National Standards Institute, 1430 Broadway, New York, NY 10018.

2. A program for routine area survey. See Appendix J for guidance.

3. The procedures for use of shielding and remote handling equipment when handling hard (high energy) beta- or gamma-emitting materials.

4. Special precautions to be used when handling large sealed calibration sources.

5. Your program for routine personnel monitoring. See Appendix D for guidance.

6. Emergency procedures to be followed in case of fires, equipment malfunction, etc., including notification procedures to the MDH.

7. Leak test procedures.

8. A copy or description of the certificate of instrument calibration that you will provide to customers with each calibrated instrument as part of your documentation of the elements of the radiation protection program and instrument calibration procedure. See Appendix G for guidance.

***Annual Audit of Radiation Safety Program***

Annually licensees must review the content and implementation of their radiation protection programs at intervals not to exceed 12 months to ensure the following:

- Compliance with MDH and DOT regulations (as applicable), and the terms and conditions of the license.
- Occupational doses and doses to members of the public are ALARA.
- Records of audits and other reviews of program content are maintained for three years.

Currently the MDH's emphasis in inspections is to perform actual observations of work in progress. As a part of their audit programs, applicants should consider performing unannounced audits of calibration equipment users to determine if, for example, Operating and Emergency Procedures are available and are being followed, etc. It is essential that once identified, problems are corrected comprehensively and in a timely manner.

MDH will review the licensee's audit results and determine if corrective actions are thorough, timely, and sufficient to prevent recurrence. If the licensee identifies violations and these steps are taken, the MDH will normally exercise discretion and may elect not to cite a violation. MDH's goal is to encourage prompt identification and prompt, comprehensive correction of violations and deficiencies.

Licensees must maintain records of audits and other reviews of program content and implementation for three years from the date of the record. These audit records should include the following:

- date of audit
- name of person(s) who conducted the audit
- persons contacted by the auditor(s)
- areas audited
- audit findings
- corrective actions
- follow-up

The applicant's program for reviewing the content and implementation of its radiation protection program will be examined during inspections, and should not be submitted in the license application.

***Leak Testing of Sealed Sources***

As a licensee, you must perform leak tests to ensure that sources are not leaking. MDH requires tests to determine if there is any leakage from the sealed sources in the devices. Normally, leak tests should be performed at six-month intervals. Some sealed source/device combinations have been authorized for a leak test interval of three years. Information about sealed source/device combinations that have three-year leak test intervals may be obtained from suppliers and manufacturers.

The following options are available for leak testing:

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

2. Use a commercial leak test kit. You take the smears and send them to the kit supplier, who will report the results to you.

3. Perform the entire leak test sequence yourself, including taking the smears and their measurements.

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

For Option 2, specify the name, address, and license number of the leak test kit supplier. You should state that the test samples will be taken by the individual specified in Item 4 who is responsible for the program. Commit to the procedures in Appendix E.1 or submit your own procedures.

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

***Inventories***

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

***Appendices***

In addition to Appendix A, review each of the following appendices carefully. Commit to the specific appendix, submit your own procedures using the appendix as a guide, or indicate "not applicable."

| | |
|---|---|
| Appendix B | Duties and Responsibilities of the RSO |
| Appendix C | Model Training Program |
| Appendix D | Personnel Exposure Monitoring Program |
| Appendix E | Leak Testing Sealed Sources |
| Appendix F | Calibrating Survey Instruments |
| Appendix G | Certificate of Instrument Calibration |
| Appendix H | Guidance for Ordering and Receiving Radioactive Material |
| Appendix I | Safely Opening Packages Containing Radioactive Material |
| Appendix J | Area Surveys |
| Appendix K | Waste Disposal |
| Appendix L | Calibration Equipment Required |
| Appendix M | Maintenance of Quality of Calibration |

**Item 11: Waste Management**

Submit your procedures for waste disposal. See Appendix K. Be sure to include a procedure for each material listed in Item 6.

**Item 12: License Fees**

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

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

**Item 13: Certification**

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

## AMENDMENTS TO LICENSE

A licensee must receive a license amendment before changing the scope of the program, such as changing the Radiation Safety Officer or adding to the staff of authorized users. An application for an amendment must be signed by the delegated person and must include the appropriate amendment fee.

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

## RENEWAL OF LICENSE

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

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

## IMPLEMENTATION

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

## INSPECTIONS

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

## APPENDIX A
## MODEL PROGRAM FOR MAINTAINING OCCUPATIONAL RADIATION EXPOSURE ALARA

You may use the text as it appears here, stating on your application, "We will establish and implement the model ALARA program published in Appendix A to the MDH Regulatory Guide for Calibrating Radiation Survey and Monitoring Instruments." Submit the signed commitment in Section 6 of this appendix.

If you prefer, you may develop your own ALARA program for MDH review. If you do so, you should consider for inclusion all the features in the model. State on your application, "We have developed an ALARA program for your review that is appended as Appendix A," and submit your program along with the signed commitment in Section 6 of this appendix.

### ALARA PROGRAM

**1. Management Commitment**

a. We, the management of this facility, are committed to the program described herein for keeping individual and collective doses as low as is reasonably achievable (ALARA). In accord with this commitment, we hereby describe an administrative organization for radiation safety and will develop the necessary written policy, procedures, and instructions to foster the ALARA concept within our institution. The organization will include a Radiation Safety Officer (RSO).

b. We will perform a formal annual review of the radiation safety program, including ALARA considerations. This will include reviews of operating procedures and past dose records, inspections, etc., and consultations with the radiation safety staff or outside consultants.

c. Modifications to operating and maintenance procedures and to equipment and facilities will be made if they will reduce exposures unless the cost, in our judgment, is considered unjustified. We will be able to demonstrate, if necessary, that improvements have been sought, that modifications have been considered, and that they have been recommended but not implemented, and we will be prepared to describe the reasons for not implementing the changes.

d. In addition to maintaining doses to individuals as far below the limits as is reasonably achievable, the sum of the doses received by all exposed individuals will also be maintained at the lowest practicable level. It would not be desirable, for example, to hold the highest doses to individuals to some fraction of the applicable limit if this involved exposing additional people and significantly increasing the sum of radiation doses received by all involved individuals.

**2. Review of Proposed Users and Uses**

a. The RSO will thoroughly review the qualifications of each applicant. To ensure that the applicant will be able to maintain ALARA, the review should include the types and quantities of materials used and methods of use.

b. When considering the use of radioactive material, the RSO will review efforts of the applicant to maintain exposure ALARA.

c. The RSO will ensure that the users justify their procedures and that individual and collective doses will be ALARA.

d. The RSO will encourage all users to review current procedures and develop new procedures as appropriate to implement the ALARA concept.

e. The RSO will perform a quarterly review of occupational radiation exposure with particular attention to instances in which the investigational levels in Table A-1 are exceeded. The principal purpose of this review is to assess trends in occupational exposure as an index of the ALARA program quality and to decide if action is warranted when investigational levels are exceeded.

**Table A-1 – Investigational Levels**

| | Investigational Levels (mrem per year) | |
|---|---|---|
| | Level I | Level II |
| Total Dose Equivalent: whole body; head and trunk; active blood-forming organs; or gonads | 500 | 1500 |
| Skin of whole body, extremities | 5,000 | 15,000 |
| Lens of eye | 1,500 | 4,500 |

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

### *3. RADIATION SAFETY OFFICER COMMITMENT*

a. Annual and Quarterly Review

- The RSO will perform an annual review of the radiation safety program for adherence to ALARA concepts. Reviews of specific methods of use may be conducted on a more frequent basis.

- The RSO will review at least quarterly the external radiation doses of authorized users and workers to determine that their doses are ALARA in accordance with the provisions of Section 5 of this appendix.

b. Education Responsibilities for ALARA Program

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

c. Cooperative Efforts for Development of ALARA Procedures

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

- The RSO will be in close contact with all users and workers in order to develop ALARA procedures for working with radioactive materials.

- The RSO will establish procedures for receiving and evaluating the suggestions of individual workers for improving health physics practices and will encourage the use of those programs.

- Workers will be instructed in recourses available if they feel that ALARA is not being promoted on the job.

d. Reviewing Instances of Deviation from Good ALARA Practices:

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

### *4. AUTHORIZED USERS COMMITMENT*

a. New methods of Use Involving Potential Radiation Doses

- The authorized user will consult the RSO during the planning stage before using radioactive materials for new uses.

- The authorized user will review each planned use of radioactive materials to ensure that doses will be kept ALARA. Trial runs may be helpful.

b. Authorized User's Responsibility to Supervised Individuals

- The authorized user will explain the ALARA concept and the need to maintain exposures ALARA to all supervised individuals.

- The authorized user will ensure that supervised individuals who are subject to occupational radiation exposure are trained and educated in health physics practices and in maintaining exposures ALARA.

### *5. ESTABLISHMENT OF INVESTIGATIONAL LEVELS IN ORDER TO MONITOR INDIVIDUAL OCCUPATIONAL EXTERNAL RADIATION DOSES[1]*

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

The RSO will review and record on MDH Form, "Current Occupational External Radiation Exposures," or an equivalent form (e.g., dosimeter processor's report) results of personnel monitoring not less than once in any calendar quarter. The following actions will be taken at the investigational levels as stated in Table A-1:

a. Personnel dose less than Investigational Level I

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

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

- The RSO will review the dose of each individual whose quarterly dose equals or exceeds Investigational Level I. If the dose does not equal or exceed Investigational Level II, no action related specifically to the exposure is required unless deemed appropriate. However, the RSO will review each such dose in comparison with those of others performing similar tasks as an index of ALARA program quality.

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

c. Personnel dose equal to or greater than Investigational Level II
   - The RSO will investigate in a timely manner the causes of all personnel doses equaling or exceeding Investigational Level II and, if warranted, will take action. The licensee will maintain a report of the investigation and any actions taken. The report should include a copy of the individual's "Occupational Exposure Record for Monitoring Period" and "Cumulative Occupational Exposure History," or its equivalent.

d. Re-establishment of investigational levels to levels above those listed in Table I
   - In cases where a worker's or a group of workers' doses need to exceed an investigation level, a new, higher investigational level may be established with good ALARA practices. Justification for new investigational level will be documented.

***6. SIGNATURE OF CERTIFYING OFFICIAL[1]*** Sign and submit as part of Appendix A.

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

_____
Signature

_____
Name (Print or type)

_____
Title

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

## APPENDIX B
## DUTIES AND RESPONSIBILITIES OF THE RADIATION SAFETY OFFICER (RSO)

You may use the following model procedure to make commitments for your RSO. If you follow the model procedure, you may state on your application, "We will establish and implement the model procedure for RSO published in Appendix B to the MDH Regulatory Guide for Calibrating Radiation Survey and Monitoring Instruments."

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

### MODEL PROCEDURE

The RSO is responsible for implementing the radiation safety program and ensuring that radiation safety activities are performed in accordance with approved procedures and regulatory requirements. The RSO's duties and responsibilities include but are not limited to the following:

1. Ensure that licensed material possessed by the licensee is limited to the types, quantities and forms listed on the license.

2. Ensure that individuals using the material are properly trained, are designated by the RSO, have received refresher training at least annually, and are informed of all changes in regulatory requirements and deficiencies identified during annual audits or MDH inspections.

3. Ensure that personnel monitoring devices are used as required, and reports of personnel exposure are reviewed in a timely manner.

4. Ensure that material is properly secured against unauthorized removal at all times when material is not in use.

5. Ensure that proper authorities are notified in case of accident, damage, fire, or theft.

6. Ensure that audits are performed at least annually to make certain that
   a. The licensee is abiding by MDH and DOT regulations and the terms and conditions of the license (e.g., periodic leak tests, inventories, use limited to trained, approved users).

   b. The licensee's radiation protection program content and implementation achieve occupational doses and doses to members of the public that are ALARA.

   c. The licensee maintains required records with all required information (e.g., records of personnel exposure; receipt, transfer, and disposal of licensed material; user training) sufficient to comply with MDH requirements.

7. Ensure that results of audits, identification of deficiencies, and recommendations for change are documented, provided to management for review, and maintained for at least three years. Ensure prompt action is taken to correct deficiencies.

8. Ensure that audit results and corrective actions are communicated to all personnel who use licensed material (regardless of their location or the license under which they normally work).

9. Ensure that all incidents, accidents, and personnel exposure to radiation more than ALARA levels or 4731 limits are investigated and reported to MDH within the required time limits.

10. Ensure that licensed material is transported in accordance with all applicable DOT requirements.

11. Ensure that licensed material is disposed of properly.

12. Ensure that the facility has up-to-date copies of MDH regulations, completes a review of new or amended MDH regulations, and revises licensee procedures to comply with MDH regulations.

13. Ensure that the license is amended whenever there are changes in licensed activities, responsible individuals, or information or commitments provided to MDH in the licensing process.

**APPENDIX C**
**MODEL TRAINING PROGRAM**
In addition to 4731.1020

The following guidance may be used to develop a training program. If you use the frequency and subject listings to develop your training program, you may state on your application, "We will establish and implement the model training program published as Appendix C to the MDH Regulatory Guide for Calibrating Radiation Survey and Monitoring Instruments." You may use methods of training that best suit your facility's needs, such as lectures, video presentations, or demonstrations.

If you prefer, you may develop your own training program for review. If you do so, you should consider for inclusion all the features in the model program and carefully review the requirements of 4731.1020. State on your application, "We have developed a training program for your review that is appended as Appendix C." Be sure to include the groups of workers, the method of their training, and the frequency of training.

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

**MODEL PROGRAM**

Personnel to be instructed:

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

Frequency of instruction:

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

Instruction for individuals will include the following subjects in addition to 4731.1020:

1. Applicable regulations and license conditions.
2. Licensee's in-house work rules.
3. Locations where the licensees have posted or made available notices, copies of pertinent regulations, and copies of pertinent licenses and license conditions (including applications and applicable correspondence), as required by 4731.1010.

Training will also include a question and answer period. Records will be kept with information regarding the date of the program, subjects covered, and attendees.

## APPENDIX D
## MODEL PERSONNEL EXPOSURE MONITORING PROGRAM

You may use the following model program to monitor personnel external exposure. If you follow the guidance in the program, you may state on your application. "We will establish and implement the model personnel exposure monitoring program published in Appendix D to the MDH Regulatory Guide for Calibrating Radiation Survey and Monitoring Instruments."

If you prefer, you may develop your own program for review. If you do, you should consider for inclusion all the features in the model program and carefully review the requirements of 4731.2020. State on your application, "We have developed an exposure monitoring program for your review that is appended as Appendix D," and submit your monitoring program.

If personnel monitoring will not be used, you should submit calculations or documentation from radiation surveys that demonstrate that it is unlikely that any individual will receive a dose equal to or greater than that indicated in 4731.2020.

### MODEL PROGRAM FOR EXTERNAL EXPOSURE

1. The RSO will promptly review all exposure records to look for workers or groups of workers whose exposure is unexpectedly high or low. This procedure does not apply to backup monitor records, for example, pocket ionization chambers, when the monitor of record is a film badge, thermoluminescent dosimeter (TLD), or optically stimulated dosimeter (OSD).

2. All individuals who are occupationally exposed to ionizing radiation on a regular basis will be issued a film badge, TLD, or OSD whole body monitor that will be processed by a contract service on a (specify time period) basis.

3. All individuals who, on a regular basis, handle radioactive material that emits ionizing radiation will be issued a film or TLD finger monitor that will be processed by a contract service on a (specify time period) basis.

4. All individuals who are exposed to radiation on an occasional basis such as secretarial personnel and service personnel who deliver packages will not normally be issued exposure monitors.

5. Submit the name, address, and license number of the company who will process the personnel monitoring as part of this procedure.

6. Monitoring devices should be stored in a cool, dry place away from possibility of accidental exposure.

7. Working conditions shall not cause excessive radiation exposure of personnel. Personnel shielding, remote instrument reading and positioning facilities, automatic source handling mechanisms, and other mechanical or remote operations will be used.

## APPENDIX E
## LEAK TESTING SEALED SOURCES

You may use the following model procedure to leak test sealed sources. If you or a contractor follow the model procedure you may state on your application, "We will establish and implement the model procedure for leak testing sealed sources published in Appendix E to the MDH Regulatory Guide for Calibrating Radiation Survey and Monitoring Instruments."

You may provide leak test analysis as a service. If you wish to analyze leak tests for other licensees, you should indicate in your application that you will be doing so. You may use the model procedure to analyze test samples. If you follow the model procedure, you may state on your application, "We will establish and implement the model procedure for leak testing sealed sources published in Appendix E to the MDH Regulatory Guide for Calibrating Radiation Survey and Monitoring Instruments."

You may develop your own procedure for review. If you do so, you should consider for inclusion all the features in the model and carefully review the requirements of Minnesota rules. State on your application, "We have developed a leak test procedure for your review that is appended as Appendix (E.1 and/or E.2)," and submit your leak test procedure.

### E.1 MODEL PROCEDURE FOR TAKING TEST SAMPLES

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

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

3. Prepare a separate wipe sample for each source. A cotton swab, injection prep pad, filter paper, or tissue paper is suitable. Number each wipe so you will know for which source it is to be used. Samples should be taken as follows:
   a. For small sealed sources, it may be easier to wipe the entire accessible surface area. Pay particular attention to seams and joints. However, do not wipe the port of beta applicators.

   b. For larger sealed sources and devices (survey meter calibrator), take the wipe near the radiation port and on the activating mechanism.

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

### E.2 MODEL PROCEDURE FOR ANALYZING TEST SAMPLES

The samples will be analyzed as follows:

1. Select an instrument that is sufficiently sensitive to detect 0.005 microcuries (185 Bq) for beta or gamma emitting radionuclides. For alpha emitting radionuclides, select an instrument that is sufficiently sensitive to detect 0.001 microcuries (37 Bq). For beta sources, a proportional flow counter, liquid scintillation counter, or thin-end-window GM survey meter may be appropriate. For gamma sources, a GM instrument or a sodium-iodide crystal with a ratemeter or scaler may be appropriate. Dose calibrators used in nuclear medicine are not sufficiently sensitive. For alpha emitting radionuclides, a zinc-sulfide scintillation detector with a ratemeter or scaler is appropriate.

2. To estimate the detection efficiency of the analyzer used to assay the wipe samples, assay a certified check source that has the same isotope as the sealed source. If one is not available, it will be necessary to use a certified check source with a different isotope that has a similar spectrum. If calculations demonstrate that the instrument is not sufficiently sensitive to detect 0.005 microcuries for beta or gamma emitters or 0.001 microcuries for alpha emitters, a different instrument must be used.

3. Assay the wipe sample. It must be in the same geometry relative to the detector as was the certified check source. Wipes of alpha emitting radionuclides should be dry and the exposed, single layer of the wipe material should face the detector.

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

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

6. If the wipe sample activity is 0.005 microcuries or greater for beta or gamma emitting radionuclides or 0.001 microcuries for alpha emitting radionuclides, notify the RSO. The source must be withdrawn from use to be repaired or disposed in accordance with MDH rules.

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

## APPENDIX F
## CALIBRATING SURVEY INSTRUMENTS

You may use the following guidance to calibrate survey instruments. If you follow all the guidance, you may state on your application, "We will establish and implement the model procedure for calibrating survey instruments published in Appendix F to the MDH Regulatory Guide for Calibrating Radiation Survey and Monitoring Instruments."

If your procedure does not follow the guidance in the model, you may develop your own procedure for review. If you do so, you should consider for inclusion all the features in the model and carefully review the requirements of the Minnesota rules. State on your application, "We have developed a survey instrument calibration procedure for your review that is appended as Appendix F," and append your survey instrument calibration procedure.

Radiation survey meters should be calibrated with a radioactive source. Electronic calibrations alone are not acceptable. Survey meters must be calibrated at least annually and after servicing. (Battery changes are not considered "servicing.")

### PRE-CALIBRATION

The following conditions should be established before exposing the instrument to a source for adjustment and calibration:

1. The instrument should be free of significant radioactive contamination.

2. The meter shall be adjusted to zero or the point specified by the manufacturer using the adjustment or adjustments provided.

3. The batteries or power supply should comply with the instrument manufacturer’s specification.

4. The instrument shall be turned on and allowed to warm up for the period specified by the manufacturer.

5. Electronic adjustments such as high voltage should be set, as applicable, to the manufacturer’s specifications.

6. Geotropism should be known for orientation of the instrument in the three mutually perpendicular planes, and this effect should be taken into account during calibration and performance testing.

7. The performance of any internal sampling time base in digital readout instruments should be verified as being within the manufacturer’s specifications.

### MODEL PROCEDURE FOR PRIMARY CALIBRATION

1. The source must be approximately a point source.

2. Either the apparent source activity or the exposure rate at a given distance must be traceable by documented measurements to a standard certified within 5 percent accuracy by the National Bureau of Standards.

3. A source that has approximately the same photon energy as the environment in which the calibrated device will be employed should be used for the calibration.
4. The source should be of sufficient strength to give an exposure rate of about 30 mr/hr at 100 cm. Minimum activities of typical sources are 85 millicuries of Cesium-137 or 21 millicuries of Cobalt-60.

5. The inverse square law and the radioactive decay law must be used to correct for change in exposure rate due to changes in distance or source decay.

6. A record must be made of each survey meter calibration.

7. A single point on a survey meter scale may be considered satisfactorily calibrated if the indicated exposure rate differs from the calculated exposure rate by less than ten percent. A correction chart or graph must be conspicuously attached to the instrument if the difference is greater than ten percent. Any instrument with an exposure rate that differs from the calculated exposure rate by more than 20 percent must be repaired and cannot be considered calibrated.

8. Three kinds of scales are frequently used on survey meters:
   a. Meters on which the user selects a linear scale must be calibrated at no less than two points on each scale. The points should be separated by at least 50 percent of scale rating.

   b. Meters that have a multi-decade logarithmic scale must be calibrated at no less than one point on each decade and no less than two points on one of the decades. Those points should be separated by at least 50 percent of the decade.

   c. Meters that have an automatically ranging digital display device for indicating rates must be calibrated at no less than one point on each decade and at no less than two points on one of the decades. Those points should be separated by at least 50 percent of the decade.

9. Readings above 1,000 mr/hr need not be calibrated. However, such scales should be checked for operation and approximately correct response.

10. At the time of calibration, the apparent exposure rate from a built-in or owner-supplied check source must be determined and recorded.

11. The report of a survey meter calibration should indicate the procedure used and the data obtained and should be retained for three years. The description of the calibration will include the following:
    a. The owner or user of the instrument.

    b. A description of the instrument that includes
       - manufacturer
       - model number
       - serial number
       - type of detector
       -
    c. A description of the calibration source, including exposure rate at a specified distance on a specified date, and the calibration procedure.

d. For each calibration point, the calculated exposure rate, the indicated exposure rate, the deduced correction factor (the calculated exposure rate divided by the indicated exposure rate), and the scale selected on the instrument.

e. The reading indicated with the instrument in the "battery check" mode (if available on the instrument).

f. The angle between the radiation flux field and the detector. For external cylindrical GM or ionization-type detectors, this will usually be parallel or perpendicular indicating photons traveling either parallel or perpendicular to the central axis of the detector. For instruments with internal detectors, this should be the angle between the flux field and a specified surface of the instrument.

g. For detectors with removable shielding, an indication of whether the shielding was in place or removed during the calibration procedure.

h. The apparent exposure rate from the check source.

i. The name of the person who performed the calibration and the date on which the calibration was performed.

12. The following information will be attached to the instrument as a calibration sticker or tag:
    a. The proper deflection in the battery check mode (unless this is clearly indicated on the instrument).

    b. The apparent exposure rate from the check source.

    c. The name of the person who performed the calibration and the date on which the calibration was performed.

    d. For each scale or decade, one of the following *as appropriate*:
        (1) The average correction factor;

        (2) A graph or graphs from which the correction factor for each scale or decade may be deduced; or

        (3) An indication that the scale was checked for function but not calibrated or an indication that the scale was inoperative;

13. To check reproducibility, the instrument should be exposed to a radiation field three or more times under identical conditions. The readings obtained should normally not deviate from the mean value by more than $\pm$10 percent.

14. The response of an instrument may vary as a function of such parameters as energy, temperature, pressure, humidity, and source/detector geometry. Primary calibration should be accomplished with known values of these parameters and under the conditions specified by the manufacturer. Any of these parameters may be fixed to the condition in which the instrument is to be used routinely, and notation will be made of these values.

15. Readout Scale and Linearity Calibration and Adjustment:
    a. Linear Readout Instruments
        (1) Linear instruments usually have a scale selection switch. If controls are provided for each scale, adjustment of each shall be made according to the manufacturer's

specifications or at the midpoint of each scale. If only one control is provided, adjustment shall be made

- at the point specified by the manufacturer,
- near the midpoint of the middle scale, or
- near the midpoint of a scale that is particularly important to the user's requirements.
-

(2) After adjustment, calibration shall be checked near the ends of each scale (approximately 20 percent and 80 percent of full scale). After an adjustment has been completed, instrument readings shall be within ±10 percent of known radiation values at these two points. However, readings between 10 and 20 percent are acceptable if a calibration chart or graph is prepared and attached to the instrument.

b. Logarithmic readout instruments

(1) These instruments commonly have a single readout scale spanning several decades with two or more adjustments. The instrument should be adjusted for each scale according to the manufacturer's specifications, or, alternatively, at points of particular importance to the user.

(2) As a minimum, calibration shall be performed at one point near the midpoint of each decade after adjustment. Instrument readings shall be within ±10 percent of known radiation values at these points. Readings between 10 and 20 percent are acceptable if a calibration chart or graph is prepared and attached to the instrument.

c. Digital readout instruments

These may have manual scale switching (auto ranging) or no scale switching. For instruments with either manual or automatic scale switching, the calibration shall be performed according to 15.a. above. For instruments without scale switching, the calibration shall be performed as in 15.b. above.

**MODEL PROCEDURES FOR SPECIAL CONDITIONS**

1. If the instrument is to be used under conditions that vary significantly from those for which the instrument is designed, the instrument should be adjusted, calibrated, and used only for the special conditions. (Examples of such conditions are radiation energy, temperature and pressure, and source/detector geometry). When an instrument is calibrated for special conditions, an identification label shall be attached, in addition to any required calibration labels, to indicate its restriction to the special use. If the instrument is also to be used within its design limits, the adjustments made during primary calibration shall remain the same and instrument readings for the special conditions shall be corrected using correction factors obtained from appropriate tables or graphs. Only one parameter should be varied at a time during calibration for the special conditions, but the interrelationships of the variables should be known.

2. Radiation Energy

a. Calibration shall be performed with a standard source or source-providing radiation fields similar to those in which the instrument will be used. Where instruments will be used in radiation fields of widely differing energies, the response of the instrument at several energies over the energy range shall be determined.

b. The response of the instrument to various energies of radiation shall be
(1) plotted as a function of energy, or otherwise called out;

(2) normalized to the response to a specific energy obtained during primary calibration; and

(3) provided with the instrument.

This type of graph is commonly called an energy dependence or spectral sensitivity curve.

3. Temperature, Pressure, and Humidity
   a. Instruments to be used outside the manufacturer's recommended temperature range or at temperatures that differ by more than 30 degrees from the calibration temperature shall be calibrated over the temperature range at which they will be used. Care should be taken to ensure that instruments are not exposed to temperatures that will damage the detector or electronic components.

   b. If the manufacturer has not stated operating limits for humidity or atmospheric pressures, the instruments shall be calibrated at the approximate humidity or pressure expected to be encountered in use. Care should be taken to ensure that an instrument is not damaged by exceeding its pressure or humidity limits.

4. Detector Directional Dependence
   If an instrument is to be used in a detector orientation relative to the source that is different from that used during primary calibration, correction factors should be developed.

**DISCRIMINATION AGAINST UNWANTED RADIATION**

If adjustments or changes are made which might alter the instrument response to unwanted ionizing and non-ionizing radiation, the discrimination against unwanted radiation should be determined for all unwanted radiation that may be encountered.

**PERIODIC PERFORMANCE TEST**

To assure proper operation of the instrument between calibrations, the instrument shall be tested with the check source during operation and before each intermittent use.

Reference readings shall be obtained on each instrument when exposed to a check source in a constant and reproducible manner at the time of, or promptly after, primary calibration. If at any time the instrument response to the check source differs from the reference reading by more than $\pm$20 percent, the instrument shall be returned to the calibration facility for calibration or for maintenance, repair, and re-calibration, as required. Reference readings should be obtained for one point on each scale or decade normally used. The check source should accompany the instrument if it is specific to that instrument.

**PRIMARY CALIBRATION FREQUENCY**

All instruments shall receive a pre-calibration inspection and the primary calibration prior to first use. Primary calibration will be required at least annually even when the performance test requirements outlined above are met. Where instruments are subjected to extreme operational conditions, hard usage, or corrosive environments, calibration should be scheduled more frequently.

Re-calibration shall be scheduled after any maintenance or adjustment of any kind has been performed on the instrument. For this requirement, battery change is not normally considered maintenance.

## CALIBRATION FREQUENCY FOR SPECIAL CONDITIONS

Calibration for special conditions need be performed only once unless
(1) the instrument is modified or physically altered,
(2) the special conditions are changed, or
(3) the primary calibration is altered, providing that the conditions above are met.

## PERFORMANCE TEST FREQUENCY

A performance check shall be made prior to each use, during intermittent use conditions, and several times a day during continuous use.

NOTE: One-word reminders or symbols that are explained on the Survey Meter Calibration Report may be used on the calibration sticker.

## APPENDIX G
## CERTIFICATE OF INSTRUMENT CALIBRATION

The following guidance may be used to develop a procedure for the certificate of instrument calibration to be given to the customer with each calibrated instrument. If you use this procedure, you may state on your application, "We will establish and implement the model procedure for instrument calibration certificates as published in Appendix G to the MDH Regulatory Guide for Calibrating Radiation Survey and Monitoring Instruments."

If you prefer, you may develop your own procedures for review. If you do so, you should consider for inclusion all the feature in the model procedure. State on your application, "We have developed a procedure that is appended as Appendix G," and submit your procedures.

### MODEL PROCEDURE

Certificates to be issued to the customer with a calibrated instrument will include the following information:

1. The customer's name, address, and person to be contacted.
2. Identification of the instrument by manufacturer, type, and model and serial number.
3. Calibration data, such as instrument readings at a point on a given scale.
4. Any specific comments on the calibration or calibration data.
5. Identification of the calibration source or sources used in calibrating nuclide and exposure rates at specified distances (include calibration accuracy).
6. Identification of the individual performing the calibration.
7. The date of the calibration.
8. Energy correction factors, where required.
9. Unusual or special use conditions or limitations.
10. Date that primary calibration is again required.
11. Special condition identification label, if applicable. See special condition model procedures in Appendix F.

## APPENDIX H
## GUIDANCE FOR ORDERING AND RECEIVING RADIOACTIVE MATERIAL

In addition to 4731.2350

You may want to use the following guidance to control the ordering and receipt of radioactive material. If you follow all the guidance, you may state on your application, "We will establish and implement the model guidance for ordering and receiving radioactive material published in Appendix H to the MDH Regulatory Guide for Calibrating Radiation Survey and Monitoring Instruments."

If your procedure does not follow all the guidance in the model, you may develop your own procedure for review. If you do so, you should include 4731.2350. State on your application, "We have developed a procedure for ordering and receiving radioactive material that is appended as Appendix H," and submit your procedure.

### MODEL GUIDANCE

1. The Radiation Safety Officer (RSO) or a designee must ensure that the requested materials and quantities are authorized on the license. The material and quantity must also be approved for the requesting authorized user. Checks should be made to ensure that possession limits are not exceeded.

2. The RSO will establish and maintain a system for ordering and receiving radioactive material. The system must contain the following information:

    a. For routinely used materials:
        (1) Written records identifying the authorized user or department, isotope, chemical form, activity, and supplier

        (2) Verification that material received was ordered by an authorized user.

    b. For occasionally used materials (e.g., therapeutic dosages):
        (1) The authorized user who will perform the procedure will make a written request to confirm that the material received is what was ordered.

        (2) The person who receives the material will check the physician's request to confirm that the material received is what was ordered.

3. For deliveries during normal working hours, the RSO shall instruct carriers to deliver radioactive packages directly to specified areas.

4. For deliveries during off-duty hours, the RSO shall instruct security personnel or other designated persons to accept delivery of radioactive packages in accordance with procedures outlined in the sample memorandum below.

**SAMPLE MEMORANDUM**

MEMO TO: Chief of Security

FROM: Radiation Safety Officer

SUBJECT: Receipt of Packages Containing Radioactive Material

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

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

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

_____, at _____.
Name Home Telephone

## APPENDIX I
## SAFELY OPENING PACKAGES CONTAINING RADIOACTIVE MATERIAL

You may use the following model procedure for opening packages. If you follow the model procedure, you may indicate on your application, "We will establish and implement the model procedure for opening packages that was published in Appendix I to the MDH Regulatory Guide for Calibrating Radiation Survey and Monitoring Instruments."

If your procedure does not follow all the guidance in the model, you may develop your own procedure for review. Indicate on your application, “We have developed a procedure for safely opening packages containing radioactive material that is appended as Appendix I,” and submit your procedure. The response should address the requirements of 4731.2350.

### MODEL PROCEDURE

1. All shipping packages received and known to contain radioactive material must be monitored for radiation levels and radioactive surface contamination in accordance with 4731.2350.

2. The following procedures for opening each package will be followed:

    a. Put on gloves to prevent hand contamination.

    b. Visually inspect the package for any sign of damage (e.g., wet or crushed). If damage is noted, stop the procedure and notify the Radiation Safety Officer (RSO).

    c. Measure the exposure rate from the package at one (1) meter and at the package surface. If it is more than 10 millirem per hour at three (3) feet (1 meter), stop and notify the RSO. (The transport index noted on packages with Yellow II or Yellow III labels is the approximate dose rate, in millirem per hour, at one (1) meter from the package surface).

    d. Measure the dose rate on the surface of the package. The surface dose rate for such packages should not exceed 200 millirem per hour at any point on the package. The dose rate from packages with White I labels should be less than 0.5 millirem per hour on the external surface of the package.

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

        Beta-gamma-emitting radionuclides; all radionuclides with half-lives less than ten days..... 22 dpm/$cm^2$
        All other alpha-emitting radionuclides ..... 2.2 dpm/$cm^2$

    f. Open the package with the following precautionary steps:

        (1) Remove packing slip.

        (2) Open outer package following the supplier's instructions, if provided.

        (3) Verify that the contents match the packing slip.

(4) Check the integrity of the final source container. Look for broken seals or vials, loss of liquid, condensation, or discoloration of the packing material.

(5) If anything is other than expected, stop and notify the RSO.

g. If there is any reason to suspect contamination, wipe the external surface of the final source container and remove the wipe sample to a low-background area. Assay the wipe sample to determine if there is any removable radioactivity. (The licensee should specify in the procedure manual which instrument [for example, a thin-end-window GM survey meter, a NaI(TI) crystal and ratemeter, a liquid scintillation counter, or a proportional flow counter] should be used for these assays. The detection efficiency must be determined to convert wipe samples counts per minute to disintegrations per minute. Note that a dose calibrator is not sufficiently sensitive for this measurement.) Take precautions against the potential spread of contamination.

h. Check the user request to ensure that the material received is the material that was ordered.

i. Monitor the packing material and the empty packages for contamination with a survey meter before discarding.
(1) If contaminated, treat this material as radioactive waste.

(2) If not contaminated, remove or obliterate the radiation labels before discarding it.

j. Make a record of the receipt.

3. For packages received under the general license, the following procedure for opening each package will be followed:
a. Visually inspect the package for any sign of damage (e.g., wet or crushed). If damage is noted, stop the procedure and notify the RSO.

b. Check to ensure that the material received is the material that was ordered.

## APPENDIX J
## AREA SURVEYS

You may use the following procedure to perform area surveys. If you follow this procedure, you may state on your application, "We will establish and implement the model procedure for area surveys that was published in Appendix J to the MDH Regulatory Guide for Calibrating Radiation Survey and Monitoring Instruments."

You may develop your own procedure for review. State on your application, "We have developed survey procedures for your review that are appended as Appendix J" and submit your survey procedures.

### MODEL PROCEDURE

Surveys will be repeated when quantity or type of radioactive material changes or changes occur in containment systems or methods of use.

### *AMBIENT DOSE RATE SURVEYS*

1. Survey Areas: restricted areas

    a. In areas where only small quantities of gamma-emitting radioactive material are processed (less than 200 microcuries at a time), survey monthly with a radiation detection survey meter.

    b. In sealed source storage areas, survey quarterly with a radiation survey meter.

    c. Protective clothing should be surveyed by the wearer after use if significant contamination is possible. Contaminated clothing should be removed before leaving a restricted work area. Hands should be washed and surveyed. Personal clothing should also be surveyed before leaving the restricted areas. Any contamination above expected levels should be reported to the RSO.

2. Survey areas: unrestricted

    Quarterly surveys should be completed in areas

    - adjacent to restricted areas,
    - through which radioactive materials are transferred, and
    - where radioactive material is temporarily stored before shipment.

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

### *REMOVABLE CONTAMINATION SURVEYS*

1. Survey Areas: unrestricted

    In any area where the potential for spreading contamination is likely to occur, (in cafeterias and snack bars, or on furniture and equipment), survey at least quarterly. Random wipe testing of floors alone is acceptable for most unrestricted areas. If such surveys reveal that radioactive contamination is being transferred out of restricted areas, immediate corrective action should be

taken to eliminate such transfers. Surveys that are more frequent should be conducted until a trend of negative results is again established.

2. The wipe sample assay procedure should be sufficiently sensitive to detect the presence of 2000 dpm/100 $cm^2$ of removable contamination (200 dpm/100 $cm^2$ for isotopes of iodine). You must use a radioactive source with a known amount of activity to convert sample measurements (usually in counts per minute to disintegrations per minute).

3. Immediately notify the RSO if you find levels that exceed the established action levels. See Table J-1 below for guidance in establishing your action levels.

**RECORDS**

1. Records must include the information in required for normal package receipt as well as actions taken in the case of excessive dose rates or contamination and follow-up survey information.

2. The RSO will review and initial the record at least monthly and promptly in those cases in which action levels were exceeded.

**Table J-1**

| **RECOMMENDED ACTION LEVELS IN DPM/100 $CM^2$ FOR SURFACE CONTAMINATION** | | |
|---|---|---|
| | P-32, Co-58, Fe-59, Co-60, Se-75, Sr-85, In-111, I-123, I-125, I-131, Yb-169, Au-198 | Cr-51, Co-57, Ga-67, $Tc-99^m$, Hg-197, Tl-201 |
| 1. Unrestricted areas, personal clothing | 200 | 2,000 |
| 2. Restricted areas, protective clothing used only in restricted areas, skin | 2,000 | 20,000 |

## APPENDIX K
## WASTE DISPOSAL

The following general guidance and procedure may be used for disposal of radioactive waste. If you follow all the general guidance and procedures, you may state on your application, "We will establish and implement the general guidance and model procedures for waste disposal published in Appendix K to the MDH Regulatory Guide for Calibrating Radiation Survey and Monitoring Instruments."

If you prefer, you may develop your own procedure for review. If you do so, you should consider for inclusion all the features in the general guidance and models, and carefully review requirements for waste disposal. State on your application, "We have developed a procedure for waste disposal for your review that is appended as Appendix K," and attach your procedure.

### OVERVIEW

There are four commonly used methods of waste disposal: release to the environment through the sanitary sewer or by evaporative release; decay-in-storage (DIS); transfer to a burial site or back to the manufacturer; and release to in-house waste. Nothing in these guidelines relieves the licensee from maintaining records of the disposal of licensed material. (See 4731.2410 through 4731.2450.)

### GENERAL GUIDANCE

1. All radioactivity labels must be defaced or removed from containers and packages prior to disposal. If waste is compacted, all labels that are visible in the compacted mass must be defaced or removed.

2. Remind employees that non-radioactive waste, such as leftover reagents, boxes, and packing material, should not be mixed with radioactive waste.

3. Occasionally monitor all procedures to ensure that unnecessary radioactive waste is not created. Review all new procedures to ensure that waste is handled in a manner consistent with established procedures.

4. In all cases, consider the entire impact of various available disposal routes. Consider occupational and public exposure to radiation, other hazards associated with the material and routes of disposal (e.g., toxicity, carcinogenicity, pathogenicity), and expense.

### MODEL PROCEDURE FOR DISPOSAL OF LIQUIDS AND GASES

Liquids may be disposed of by release to the sanitary sewer or evaporative release to the atmosphere. This does not relieve licensees from complying with other regulations regarding toxic or hazardous properties of these materials.

1. Regulations for disposal in the sanitary sewer appear in 4731.2420. There are monthly limits based on the total sanitary sewerage release of your facility. Make a record of the date, radionuclide, estimated activity that was released (in millicuries or microcuries), and the sink or toilet at which the material was released.

2. Limits on permissible concentrations in effluents to unrestricted areas are enumerated in 4731.2750(4). These limits normally apply at the boundary of the restricted area. Make a

record of the date, radionuclide, estimated activity that was released (in millicuries or microcuries) and estimated concentration, and the vent site at which the material was released.

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

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

Short-lived material (with physical half-life less than 120 days) may be disposed of by decay-in-storage. If you use this procedure, keep material separated according to half-life.

1. Consider using separate containers for different types of waste (e.g., capped needles and syringes in one container, other injection paraphernalia such as swabs and gauze in another, and unused dosages in a third container). Smaller departments may find it easier to use just one container for all decay-in-storage waste. Because the waste will be surveyed with all shielding removed, the containers in which waste will be disposed of must not provide any radiation shielding for material.

2. When the container is full, seal it with string or tape and attach an identification tag that includes the date sealed, the longest-lived radioisotope in the container, and the initials of the person sealing the container. The container may then be transferred to the decay-in-storage area.

3. Decay the material for at least ten half-lives. If the material is not segregated by isotope, decay the material for at least ten half-lives of the longest-lived radionuclide.

4. Before disposal as in-house waste, monitor each container as follows:
   a. Check your radiation detection survey meter for proper operation.

   b. Plan to monitor in a low-level (less than 0.05 millirem per hour) area.

   c. Remove any shielding from around the container.

   d. Monitor all surfaces of each container.

   e. Discard as in-house waste only those containers with radiation levels that cannot be distinguished from background. Record the date on which the container was sealed, the disposal date, and the type of material (e.g., paraphernalia, unused dosages). Check to be that sure no radiation labels are visible.

   f. Containers that can be distinguished from background radiation levels must be returned to the storage area for further decay or transferred for burial.

5. If possible, Mo-99/Tc-$99^{m}$ generators should be held 60 days before being dismantled because of the occasional presence of a long-lived contaminant. When dismantling generators, keep a radiation detection survey meter (preferably with a speaker) at the work area. Dismantle the oldest generator first, then work forward chronologically. Hold each column in contact with the radiation detection survey meter in a low-background (less than 0.05 mr/hr) area. Record the generator date and disposal date for your waste disposal records. Remove or deface the radiation labels on the generator shield.

**MODEL PROCEDURE FOR TRANSFER FOR BURIAL**

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

**MODEL PROCEDURE FOR RELEASE TO IN-HOUSE WASTE**

Waste from in vitro kits that are generally licensed pursuant to 4731.3245 is exempt from waste disposal regulations. Radioactive labels should be defaced or removed. There is no need to keep any record of release or make any measurement.

## APPENDIX L
## REQUIRED CALIBRATION EQUIPMENT

The following general guidance and procedure may be used for the requirements for calibration equipment. If you follow all the general guidance and procedures, you may state on your application, "We will establish and implement the general guidance and model procedures for the requirements for calibration equipment published in Appendix L to the MDH Regulatory Guide for Calibrating Radiation Survey and Monitoring Instruments."

If you prefer, you may develop your own procedure for review. If you do so, you should consider for inclusion all the features in the general guidance and models and carefully review requirements of the Minnesota rules. State on your application, "We have developed a procedure for the requirements for calibration equipment for your review that is appended as Appendix L," and attach your procedure.

### MODEL PROCEDURE

*Calibration Standards*. Instruments should be calibrated either against National Standards or with Derived Standards. If National or Derived Standards are not available, Laboratory Standards may be used. Procedures for Laboratory Standards are demonstrated in ANSI N323-1978.

*Calibration Assemblies*. Instrument calibration assemblies shall be mechanically precise to ensure that positioning errors of either instruments or radiation sources do not affect the radiation field values by more than $\pm$ 2 percent. A sufficient range of radiation fields shall be available to satisfy calibration requirements.

*Standard Instruments*. An instrument used as a Derived Standard shall have an uncertainty no greater than $\pm$ 10 percent. Calibration shall be reestablished after maintenance or repair, or at intervals specified by the manufacturer, but in no case at intervals greater than three years.

A periodic instrument check procedure shall be established by the licensee to assure proper operation.

*Check Sources.* Check sources should provide radiation of the same type or types as provided by those sources used in instrument calibration. Check sources may provide radiation different than that used for calibration if:

1. the source instrument geometry is well understood and easily reproduced, or

2. the instrument response to this radiation is well understood and is not critically dependent on instrument adjustment. For example, the use of a photon source to check instruments sensitive to beta radiation may be acceptable; the use of a photon source to check a detector utilizing a $BF_3$ response to neutrons is not acceptable.

A reproducible source detector geometry shall be established and used for all performance test measurements.

## APPENDIX M
## MAINTAINING QUALITY OF CALIBRATION

The following general guidance and procedures may be used for the maintaining quality of calibration. If you follow all the general guidance and procedures, you may state on your application, "We will establish and implement the general guidance and model procedures for the maintenance of quality of calibration published in Appendix M to the MDH Regulatory Guide for Calibrating Radiation Survey and Monitoring Instruments."

If you prefer, you may develop your own procedure for review. If you do so, you should consider for inclusion all the features in the general guidance and models and carefully review requirements of the Minnesota rules. State on your application, "We have developed a procedure for the maintenance of quality of calibration for your review that is appended as Appendix M" and attach your procedure.

### MODEL PROCEDURE

*Radiation Field*

Either narrow or broad beam geometry may be used to compare the response of similar instruments with that of a standardized instrument.

For calibration of X-ray machines or particle accelerators, a calibrated instrument shall be used. If a continuous monitor is available, it can be calibrated simultaneously and used in subsequent work with periodic checks on its constancy.

Alpha radiation sources shall be standardized in terms of activity per unit area of the source, or both. The reference geometry $2\pi$ or $4\pi$ shall be stated.

Beta radiation sources shall be standardized in terms of air or soft tissue absorbed dose rate at the surface or specified distance from the source, or in terms of activity.

Photon-emitting radionuclide sources shall be standardized in terms of exposure rate (roentgens per hour) at a specified distance from the source.

Neutron sources shall be standardized in terms of (1) the number of neutrons emitted per unit time and (2) the effective or average neutron energy. The concomitant photon exposure-rate should be known and stated.

For photon and neutron monitoring instrument calibrations, the source-to-detector distance shall be the distance measured between the effective center of the radioactive source and the effective center of the radiation detector. Either this distance shall be greater than seven times the maximum dimension of the source or detector, whichever is larger, or suitable corrections shall be used.

*Calibration Facility*

Free-space geometry should be achieved for photon and neutron instrument calibration. The distance to scattering objects from the source and from the detector should be at least twice the distance between the detector and the source. Where scattering contributions to instrument readings are significant, they shall be included in stating the value of the radiation field for all detector positions used for calibration purposes.

The radiation background at the calibration facility shall be low, known, and stable, and shall be accounted for during calibration.

Temperature, relative humidity, and atmospheric pressure shall be noted at the time of instrument calibrations. Calibrations should be performed within the temperature range 25 $\pm$10°C, except when the instrument is to be used outside this temperature range.

*Other*

If an instrument may exhibit an incremental response, the entire instrument should be placed in the radiation field during calibration and the results compared to calibration with just the detector in the field. The fractional contribution, if any, to the instrument reading due to an incremental response should be determined and noted on the instrument.

A reasonable delay should occur before reading to allow warm-up, and to accommodate switching transients and the time constant of the instrument.

## ATTACHMENT I

## US DEPARTMENT OF TRANSPORTATION REQUIREMENTS FOR THE SAFE TRANSPORTATION OF HAZARDOUS MATERIALS

The Federal hazardous materials transportation law (49 U.S.C. 5101 et seq.) is the basic statute pertaining to the transportation of hazardous materials (HAZMAT) in the United States. This law requires the training of all HAZMAT employees. The purposes are to increase a HAZMAT employee's safety awareness and to be an essential element in reducing HAZMAT incidents. The Hazardous Materials Regulations (HMR) include training requirements in several sections of Title 49 Code of Federal Regulations (CFR) as follows:

| | |
|---|---|
| General | § 173.1 |
| Specific | § 172.704 |
| Modal | |
| Air | § 175.20 |
| Vessel | § 176.13 |
| Highway | §§ 177.800, 177.816 |

**Each HAZMAT employer must:**

- train and test,
- certify; and
- develop and retain records of current training (inclusive of preceding three years) for each HAZMAT employee (during the period of employment and 90 days thereafter).

**HAZMAT training must include:**

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

**Initial training**

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

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

**Recurrent Training**

Training is required at least once every three years. The three-year period begins on the actual date of training.

Relevant training received from a previous employer or source may be used to satisfy the requirements provided a current record of training is obtained from the previous employer or other sources. Training conducted by OSHA, EPA and other Federal or international agencies, may be used to satisfy the training requirements in 172.704(a) to the extent that such training addresses the training components specified in paragraph (a) of this section.

**Training records must include:**

- HAZMAT employee's name;
- completion date of most recent training;
- training materials (copy, description, or location);
- name and address of HAZMAT training; and
- certification that the HAZMAT employee has been trained and tested.

**DEFINITIONS**

***Hazardous Material*** means a substance or material capable of posing an unreasonable risk to health, safety, or property when transported in commerce.

***HAZMAT Employer*** means a person who uses one or more employees in connection with:

- transporting HAZMAT in commerce;
- causing HAZMAT to be transported or shipped in commerce; or
- representing, marking, certifying, selling, offering, reconditioning, testing, repairing, or modifying packagings as qualified for use in the transportation of HAZMAT.

The term "HAZMAT employer" also includes any department, agency or instrumentality of the United States, a State, a political subdivision of a State, or an Indian tribe engaged in offering or transporting HAZMAT in commerce. This term includes an owner-operator of a motor vehicle, which transports hazardous materials in commerce.

***HAZMAT Employee*** means a person who is employed by a HAZMAT employer and who directly affects HAZMAT transportation safety including;

- an owner-operator of a motor vehicle which transports HAZMAT;
- a person (including a self-employed person) who:
    - loads, unloads, or handles HAZMAT;
    - tests, reconditions, repairs, modifies, marks, or otherwise represents packagings as qualified for use in the transportation HAZMAT;
    - prepares HAZMAT for transportation;
    - is responsible for safety of transporting HAZMAT; or
    - operates a vehicle used to transport HAZMAT.

***Training*** means a systematic program (consistent approach, testing, and documentation) that ensures that a HAZMAT employee has knowledge of hazardous materials and the HMR, and can perform assigned HAZMAT functions properly. See §172.700 through §172.704.

## ATTACHMENT II

## US DEPARTMENT OF TRANSPORTATION ADVISORY NOTICE

## ENHANCED SECURITY MEASURES

Shippers and carriers can do a lot to enhance the security of hazardous materials shipments during transportation. The Department of Transportation and other federal agencies can provide timely and accurate information to assist you with your personnel, facility, and en route security issues.

In the wrong hands, hazardous materials pose a significant security threat, particularly those that may be used as weapons of mass destruction. If you offer, transport, or store hazardous materials in transit, you should review your security measures and make any necessary adjustments to improve the secure transport and storage of hazardous materials and shipments.

This brochure identifies several voluntary security measures you may wish to consider. It also addresses personnel, facility, and en route security issues and includes contact points for obtaining additional, more detailed information.

We encourage you to consider implementation of the following measures as appropriate to your industry and operations. You should consider actions commensurate with the level of threat posed by the specific hazardous materials you handle.

In addition, you should be aware that there are security requirements that may apply to your operations.

### Security Plan

The most important action a shipper or carrier should consider is the development and implementation of a security plan. You can use a risk management model to assess security risks and develop appropriate measures to reduce or eliminate risk. Most risk management models utilize the following steps.

- Identify areas of concern and partners that may be affected or with whom coordination may be appropriate;
- Assemble detailed information on system operations;
- Identify control points where intervention can reduce or eliminate risk;
- Select and prioritize options to meet identified security goals;
- Take action to implement the strategy;
- Verify implementation of the strategy; and
- Evaluate the effectiveness of the strategy to determine whether additional actions are necessary.

*Begin with a list*

You may first want to list materials you handle, and identify those materials with the potential for use as weapons of mass destruction or targets of opportunity. Then, consider a review of your current activities and operations from a transportation security perspective. Ask yourself, “What are we doing now? What could be wrong? What can we do differently?” The next step is to consider how to reduce the risks you have identified. For hazardous materials transportation, a security plan likely will focus on personnel, facility and en route security issues. To assist you in performing appropriate risk assessments, we have posted a Risk Management Self-Evaluation Framework on our website http://hazmat.dot.gov

### Personnel Security

Your employees can be one of your most critical assets as you endeavor to improve the security of your shipping or transportation operations. You should consider taking one of more of the following actions:

- Ensure your employees are familiar with your security plan and properly trained in its implementation. Training should include company security objectives, specific security procedures employee responsibilities, and organizational security structure.
- Encourage your employees to report suspicious incidents or events.
- Implement routine security inspections.
- Convene regular employee/management meetings on security measures and awareness.
- Communicate with your staff using an internal communication system to provide information on facts, trends, updates, and the like. Because others may access Internet communications, consider alternative methods for communicating sensitive information.

*Employees as a security risk*

You should be aware of the possibility that someone you hire may pose a potential security risk. You should consider establishing a process to verify the information provided by applicants on application forms or resumes, including checking with former and current employers and personal references provided by job applicants.

**Facility Security**

Access to your facility should be another security concern and you should consider taking one or more of the following steps to prevent unauthorized access to your facility.

*Actions you should take*

- Establish partnership with local law enforcement officials, emergency responders and other public safety agencies with jurisdiction over your facility. Through such relationships, you can learn about threats, trends, and unsuccessful security programs.
- Request a review of your facility and security program by local law enforcement officials.
- Restrict availability of information related to your facility and the materials you handle. Encourage authorities in possession of information about your facility to limit disclosure of that information on a need-to-know basis.
- Add security guards and increase off-hours patrols by security or law enforcement personnel.
- Improve fencing around your facility. Check the adequacy of locks and other protective equipment. Consider equipping access gates with timed closure devices. Conduct frequent inspections.
- Install additional lights, alarm systems, or surveillance cameras.
- Restrict access to a single entry or gate.
- Place limits on visitor access; require visitors to register and show photo identification and have someone accompany visitors at all times.
- Require employees to display identification cards or badges.
- Conduct security spot checks of personnel and vehicles.
- Upgrade security procedures for handling pick-ups and deliveries at your facilities. Verify all paperwork and require pick-ups and deliveries be handled only by appointment with known vendors. Require vendors to call before a delivery and to provide the driver's name vehicle number. Accept packages and deliveries only at the facility front gate.
- Secure hazardous materials in locked buildings or fenced areas. Have a sign-out system for keys.
- Secure valves, man ways, and other fixtures on transportation equipment when not in use. Lock all vehicle and delivery trailer doors when not in use. Secure all rail, truck, and barge containers when stored at your location.
- Use tamper-resistant or tamper-evident seals and locks on cargo compartment openings.

- Periodically inventory the quantity of hazardous materials you have on site in order to recognize if a theft has occurred.
- Keep records of security incidents. Review records to identify trends and potential vulnerabilities.
- Report any suspicious incidents or individuals to your local Federal Bureau of Investigation (FBI) office and to local law enforcement officials.

**En Route**

Shippers and carriers can work together to assure the security of hazardous materials shipments en route from origin to destination.

Shippers should assess the transportation modes or combinations of modes-available for transporting specific materials and select the most appropriate method of transportation to ensure efficient and secure movement of product from origin to destination.

*Know your carriers*

Yes, know your carrier and have a system for qualifying the carriers used to transport hazardous materials.

- Use carrier safety ratings, assessments, safety surveys, or audits and ask the carrier to provide information on security measures it has implemented.
- Verify the carrier has an appropriate employee hiring and review process, including background checks, and an on-going security training program.
- Verify the identity of the carrier and/or driver prior to loading a hazardous material.
- Ask the driver for photo identification and commercial drivers license for comparison with information provided by the carrier.
- Ask the driver to tell you the name of the consignee and the destination for the material and confirm with your records before releasing shipments.
- Identify preferred and alternative routing, including acceptable deviations.
- Strive to minimize product exposures to communities or populated areas, including downtown areas; avoid tunnels and bridges where possible; and expedite transportation of the shipment to its final destination.
- Minimize stops en route; if you must stop, select locations with adequate lighting on well-traveled roads and check your vehicle after each stop to make sure nothing has been tampered with.
- Consider using two drivers or driver relays to minimize stops during the trip. Avoid layovers, particularly for high hazard materials.
- Shippers and rail carriers should cooperate to assure the security of rail cars stored temporarily on leased tracks.
- If materials must be stored during transportation, make sure they are stored in secure facilities.
- Train drivers in how to avoid highjacking or stolen cargo-keep vehicles locked when parked and avoid casual conversations with strangers about cargoes and routes.
- Consider whether a guard or escort for a specific shipment of hazardous material is appropriate.
- Consider using advanced technology to track or protect shipments en route to their destinations. For example, you may wish to install tractor and trailer anti-theft devices or use satellite tracking or surveillance systems. As an alternative, consider frequent checks with drivers by cell phone to ensure everything is in order.
- Install tamper-proof seals on all valves and package or container openings.
- Establish a communication system with transport vehicles and operators, including a crisis communication system with primary and back-up means of communication among the shipper, carrier, and law enforcement and emergency response officials.
- Implement a system for a customer to alert the shipper if a hazardous materials shipment is not received when expected.

- When products are delivered, check the carrier's identity with shipping documents provided by the shipper.
- Get to know your customers and their hazardous materials programs. If you suspect you shipped or delivered a hazardous material to someone who may intend to use it for a criminal purpose, notify your local FBI office or local law enforcement officials.
- Report any suspicious incidents or individuals to your local FBI office and to local law enforcement officials.

**Additional Information**

Up-to-date information is a key element of any security plan. You should consider methods to:

- Gather as much data as you can about your own operations and those of other businesses with similar product lines and transportation patterns;
- Develop a communications network to share best practices and lessons learned;
- Share information on security incidents to determine if there is a pattern of activities that, when considered in isolation are not significant, but when taken as a whole generate concern; and
- Revise your security plans as necessary to take account of changed circumstances and new information.

## SUMMARY OF REVISIONS

| REVISION | SECTION | DESCRIPTION |
|---|---|---|
| 9/16/05 | Title page and filing an application | Address and section name changes |
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