Commonwealth of Virginia
Radiation Protection Regulatory Guide

Guidance for Uses of Sealed Sources

ORH-720 K

Virginia Department of Health
Radioactive Materials Program
109 Governor Street, Room 730
Richmond, VA 23219

Revision 1

EXECUTIVE SUMMARY

Virginia Regulatory Guides (**VAREGS**) are issued to describe and make available to the applicant or licensee, acceptable methods of implementing specific parts of **12VAC5- 481, 'Virginia Radiation Protection Regulations',** to delineate techniques used by the staff in evaluating past specific problems or postulated accidents, and to provide guidance to applicants or licensees. VAREGS are not substitutes for **12VAC5-481, 'Virginia Radiation Protection Regulations'**, therefore compliance with them is not required. Methods and solutions different from those set forth in this guide will be acceptable if they provide a basis for the Virginia Department of Health (VDH), Radioactive Materials Program to determine if a radiation protection program meets the current rule and protects health and safety.

Comments and suggestions for improvements in this VAREG are encouraged and it will be revised, as appropriate, to accommodate comments and to reflect new information or experience. Comments should be sent to: **Virginia Department of Health, Radioactive Materials Program, 109 Governor Street, Room 730, Richmond, VA 23219.**

Requests for single copies of this guide (which may be reproduced) can be made in writing to: Virginia Department of Health, Radioactive Materials Program, 109 Governor Street, Room 730, Richmond, VA 23219. This guide is also available on our website: http://www.vdh.virginia.gov/Epidemiology/RadiologicalHealth/.

This VAREG, 'Guidance for Uses of Sealed Sources' has been developed to streamline the application process for a Sealed Source license. A copy of the application VDH form, 'Application for a Radioactive Material License Authorizing the Use of Sealed Sources' is located in **Appendix A** of this guide.

Appendixes C through **K** provide examples, models and additional information that can be used when completing the application.

It typically takes 60-90 days for a license to be processed and issued if the application is complete. When submitting the application be sure to include the appropriate application fee listed in **12VAC5-490**.

In summary, the applicant will need to do the following to submit an application for a Sealed Source license:

- Use this regulatory guide to prepare the application, VDH form, 'Application for a Radioactive Material License Authorizing the Use of Sealed Sources' (**Appendix A**).
- Complete the application, VDH form, 'Application for a Radioactive Material License Authorizing the Use of Sealed Sources' (**Appendix A**). See 'Contents of Application' of the guide for additional information.
- Include any additional attachments.

  All supplemental pages should be on 8 ½" x 11" paper.

  Please identify all attachments with the applicant's name and license number (if a renewal).
- Avoid submitting proprietary information unless it is absolutely necessary. If submitted, proprietary information and other sensitive information should be clearly identified and a request made to withhold from public disclosure.
- Submit an original signed application along with attachments (if any). This submission can be made via scanned copies forwarded via facsimile or electronic mail or via postal mail of the documents.
- Submit the application fee (for new licenses only).
- Retain one copy of the licensee application and attachments (if any) for your future reference. You will need this information because the license will require that radioactive material be possessed and used in accordance with statements, representation, and procedures provided in the application and supporting documentation.

If you have any questions about the application process, please contact this office at (804) 864-8150.

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ABBREVIATIONS

ALARA	As low as reasonably achievable
ALI	annual limit on intake
AU	Authorized User
bkg	Background
Bq	Becquerel
cc	centimeter cubed
CDE	Committed Dose Equivalent
CEDE	Committed Effective Dose Equivalent
Ci	Curie
CFR	Code of Federal Regulations
cc	centimeter cubed
cm^2	centimeter squared
cpm	counts per minute
C/kg	Coulombs/Kilogram
cpm	Counts Per Minute
DFP	Decommissioning Funding Plan
DIS	Decay-In-Storage
DOE	United States Department of Energy
DOT	United States Department of Transportation
dpm	Disintegrations Per Minute
EDE	Effective Dose Equivalent
EPA	United States Environmental Protection Agency
F/A	Financial Assurance
FDA	United States Food and Drug Administration
FR	Federal Register
GM	Geiger-Mueller
GBq	Gigabecquerel
IN	Information Notice
LLW	Low Level Waste
GPO	Government Printing Office
IN	Information Notice
MBq	Megabecquerel
mCi	millicurie
mGy	Milligray
mR	Milliroentgen
mrem	millirem
mSv	millisievert
NIST	National Institute of Standards and Technology
NRC	United States Nuclear Regulatory Commission
NVLAP	National Voluntary Laboratory Accreditation Program
OSL	Optical Stimulated Luminescent Dosimeters
R	Roentgen
RG	Regulatory Guide
RQ	Reportable Quantities
RQ	Reportable Quantities
RSO	Radiation Safety Officer
SDE	Shallow Dose Equivalent
SI	International System of Units (abbreviated SI from the French Le Systeme Internationale d'Unites)

SS&D	Sealed Source and Devices Bulletin Board System (BBS)
SSDR	Sealed Source and Device Registration
Sv	Sievert
T1/2	Half-life
TEDE	Total effective dose equivalent
TI	Transportation Index
TLD	Thermoluminescent dosimeters
VDH	Virginia Department of Health
μCi	microcurie
%	percent

PURPOSE OF GUIDE

This document provides guidance to an applicant in preparing a sealed source license application for sources other than portable gauges, XRFs, or fixed gauges. It also provides on VDH's criteria for evaluating a sealed source license application. It is not intended to address the commercial aspects of manufacturing, distribution, and service of devices containing sealed sources. It does addresses radiation safety issues associated with sealed sources such as calibration and reference sources. If higher activity sources are being requested, consult with VDH staff for the appropriate guidance and application form.

This guide identifies information needed to complete VDH form, 'Application for a Radioactive Material License Authorizing the Use of Sealed Sources.' (**Appendix A**).

The format within this document for each item of technical information is as follows:

- **Rule**--references the requirements from **12VAC5-481 'Virginia Radiation Protection Regulations'** applicable to the item;
- **Criteria**--outlines the criteria used to judge the adequacy of the applicant's response;
- **Discussion**--provides additional information on the topic sufficient to meet the needs of most readers.

The information submitted in the application must be sufficient to demonstrate that proposed equipment, facilities, personnel, and procedures are adequate to protect the health and safety of the citizens of Commonwealth of Virginia according with the agency's guidelines. Submission of incomplete or inadequate information will result in delays in the approval process for the license. Additional information will be requested when necessary to ensure that an adequate radiation safety program has been established. Such requests for additional information will be requested when necessary. Such requests for additional information will delay completion of the application's review and may be avoided by a thorough study of the rule(s) and these instructions prior to submitting the application.

12VAC5-481 'Virginia Radiation Protection Regulations' requires the applicant and/or licensee to develop, document, and implement procedures that will ensure compliance with the rule. The appendices describe radiation protection procedures. Each applicant should read the rule and procedures carefully and then decide if the procedure addresses specific radiation protection program needs at the applicant's

facility. Applicants may adopt a procedure included in this VAREG or they may develop their own procedures to comply with the applicable rule.

In this guide, “dose” or “radiation dose” means absorbed dose, dose equivalent, effective dose equivalent, committed dose equivalent, committed effective dose equivalent, or total effective dose equivalent (TEDE). These terms are defined in the **12VAC5-481-10.** Rem and Sievert (Sv), its SI equivalent (1 rem = 0.01 Sv), are used to describe units of radiation exposure or dose. These units are used because **12VAC5-481 ‘Virginia Radiation Protection Regulations’, Part IV ‘Standards for Protection Against Radiation’,** sets dose limits in terms of rem, not rad or roentgen. Furthermore, radioactive materials commonly used in medicine emit beta and photon radiation, for which the quality factor is 1; a useful rule of thumb is an exposure of 1 roentgen is equivalent to an absorbed dose of 1 rad and dose equivalent of 1 rem.

This VAREG provides the latest guidance, shows the requirements in terms of the **12VAC5-481,** and provides a user-friendly format to assist with the preparation of a license application.

LICENSES

Applicants should study this document, related guidance, and all applicable regulations carefully before completing the VDH form 'Application for a Radioactive Material License Authorizing the Use of Sealed Sources'. VDH expects licensees to provide requested information on specific aspects of their proposed radiation protection program in attachments to the application. When necessary, VDH may ask the applicant for additional information to gain reasonable assurance that an adequate radiation protection program has been established.

After a license is issued, the licensee must conduct its program in accordance with the following:

- Statements, representations, and procedures contained in the application and in correspondence with VDH;
- Terms and conditions of the license; and
- **12VAC5-481 'Virginia Radiation Protection Regulations'**.

THE 'AS LOW AS IS REASONABLY ACHIEVABLE (ALARA)' CONCEPT

12VAC5-481-630, Radiation protection programs, states that *"each licensee shall develop, document, and implement a radiation protection program commensurate with the scope and extent of licensed activities"* and *"the licensee shall use, to the extent practical, procedures and engineering controls based upon sound radiation protection principles to achieve occupational doses and doses to members of the public that are...ALARA."* This section also requires that licensees review the content of the radiation protection program and its implementation annually.

Information directly related to radiation protection standards in **12VAC5-481 'Virginia Radiation Protection Regulations', Part IV 'Standards for Protection Against Radiation'**, is contained in:

- NRC's NUREG-1736, 'Consolidated Guidance: 10 CFR Part 20 - Standards for Protection Against Radiation.'

Applicants should consider the ALARA philosophy detailed in these reports when developing plans to work with licensed radioactive materials.

WHO REGULATES AT FACILITIES IN THE COMMONWEALTH OF VIRGINIA?

In the special situation of work at federally controlled sites in Commonwealth of Virginia, it is necessary to know the jurisdictional status of the land to determine whether Nuclear Regulatory Commission (NRC) or VDH has regulatory authority. NRC has regulatory authority over land determined to be under "exclusive federal jurisdiction," while VDH has jurisdiction over non-exclusive federal jurisdiction land (see **Table 1**). Applicants and licensees are responsible for finding out, in advance, the jurisdictional status of the specific areas where they plan to conduct licensed operations. VDH recommends that applicants and licensees ask their local contacts for the federal agency controlling the site (e.g., contract officer, base environmental health officer, district office staff) to help determine the jurisdictional status of the land and to provide the information in writing, so that licensees can comply with NRC or VDH regulatory requirements, as appropriate. The following table lists examples of regulatory authority.

Table 1. Who Regulates the Activity?

Applicant and Proposed Location of Work	Regulatory Agency
Federal agency regardless of location (except that Department of Energy [DOE] and, under most circumstances, its prime contractors are exempt from licensing [**10 CFR 30.12**])	NRC
Non-federal entity in non-Agreement State, U.S. territory, or possession	NRC
Non-federal entity in Virginia at non-federally controlled site	VDH
Non-federal entity in Virginia at federally-controlled site not subject to exclusive federal jurisdiction	VDH
Non-federal entity in Virginia at federally-controlled site subject to exclusive federal jurisdiction	NRC

A current list of Agreement States (States that have entered into agreements with the NRC that give them the authority to license and inspect radioactive material used or possessed within their borders), including names, addresses, and telephone numbers of responsible officials are maintained by the NRC Office of Federal and State Materials and Environmental Management Programs and is available on their website: http://nrc-stp.ornl.gov/.

MANAGEMENT RESPONSIBILITY

VDH endorses the philosophy that effective radiation protection program management is vital to safe operations that comply with VDH regulatory requirements.

"Management" refers to the chief executive officer or other individual having the authority to manage, direct, or administer the licensee's activities or that person's delegate or delegates.

To ensure adequate management involvement, a management representative (i.e., chief executive officer or delegate) must sign the submitted application acknowledging management's commitments to and responsibility for the following:

- Radiation protection, security and control of radioactive materials, and compliance with rule;
- Knowledge about the contents of the license application;
- Compliance with current VDH and United States Department of Transportation (DOT) regulations and the licensee's operating and emergency procedures;
- Provision of adequate resources (including space, equipment, personnel, time, and, if needed, contractors) to the radiation protection program to ensure that the public, and workers are protected from radiation hazards;
- Appointment of a qualified individual who has agreed in writing to work as RSO;

Management may delegate individuals (i.e., an RSO or other designated individual) to submit amendment requests to VDH. A correspondence delegation letter must be completed, signed by management, and submitted to VDH. A sample letter has been included in **Appendix L.**

SAFETY CULTURE

Nuclear safety culture is defined as the core values and behaviors resulting from a collective commitment by leaders and individuals to emphasize safety over competing goals to ensure protection of people and the environment. Individuals and organizations performing regulated activities bear the primary responsibility for safely handling and securing these materials. Experience has shown that certain personal and organizational traits are present in a positive safety culture. A trait, in this case, is a pattern of thinking, feeling, and behaving that emphasizes safety, particularly in goal conflict situations (e.g., production versus safety, schedule versus safety, and cost of the effort versus safety). **Table 2** show traits of a positive nuclear safety culture.

Table 2: Traits of a Positive Nuclear Safety Culture

Trait	Result
Leadership: Safety Values and Actions	Leaders demonstrate a commitment to safety in their decisions and behaviors
Problem Identification and Resolution	Issues potentially impacting safety are promptly identified, fully evaluated, and promptly addressed and corrected commensurate with their significance
Personal Accountability	All individuals take personal responsibility for safety
Evaluating Work Processes	The process of planning and controlling work activities is implemented so that safety is maintained
Continuous Learning	Opportunities to learn about ways to ensure safety are sought out and implemented
Environment for Raising Concerns	A safety conscious work environment is maintained where personnel feel free to raise safety concerns without fear of retaliation, intimidation, harassment, or discrimination
Effective Safety Communications	Communications maintain a focus on safety
Respectful Work Environment	Trust and respect permeate the organization
Questioning Attitude	Individuals avoid complacency and continually challenge existing conditions and activities in order to identify discrepancies that might result in error or inappropriate action

Individuals and organizations performing regulated activities are expected to establish and maintain a positive safety culture commensurate with the safety and security significance of their activities and the nature and complexity of their organizations and functions. This applies to all licensees, holders of quality assurance programs approvals, vendors, and suppliers of safety-related components, and applicants for a license or quality assurance program approval, subject to VDH authority. More information relating to safety culture can be found at: http://www.nrc./about-nrc/regulatory/enforcement/safety-culture.html

APPLICABLE RULE

It is the applicant's or licensee's responsibility to obtain, read, and follow **12VAC5-481, 'Virginia Radiation Protection Regulations'**.

The following parts of **12VAC5-481, 'Virginia Radiation Protection Regulations'** contain requirements applicable to sealed sources licensees:

- Part I: 'General Provisions'
- Part III: 'Licensing of Radioactive Materials;
- Part IV: 'Standards for Protection Against Radiation'
- Part X: 'Notices, Instructions and Reports to Workers'
- Part XIII: 'Transportation of Radioactive Material'

Requests for single copies of the above documents (which may be reproduced) can be made in writing to: Virginia Department of Health, Radioactive Materials Program, 109 Governor Street, Room 730, Richmond, VA 23219 or for an electronic copy go to our web site at: http://www.vdh.virginia.gov/Epidemiology/RadiologicalHealth/.

HOW TO FILE

Applicants for a materials license should do the following:

- Be sure to use the current guidance from VDH in preparing an application.
- Complete VDH form, 'Application for Radioactive Material License Authorizing the Use of Sealed Sources' (**Appendix A**).
- For each separate sheet, other than submitted with the application, identify and key it to the item number on the application, or the topic to which it refers.
- Submit all documents on 8 ½ x 11 inch paper.
- Avoid submitting proprietary information unless it is absolutely necessary. If submitted, proprietary information and other sensitive information should be clearly identified and a request made to withhold from public disclosure.
- Submit an original, signed application. This submission can be made via scanned copies forwarded via facsimile or electronic mail or via postal mail of the documents.
- Retain one copy of the license application for your future reference.

Deviations from the suggested wording of responses as shown in this VAREG or submission of alternative procedures will require a more detailed review.

Note: Personal employee information (i.e., home address, home telephone number, Social Security Number, date of birth, and radiation dose information) should not be submitted unless specifically requested by VDH**.**

WHERE TO FILE

Applicants wishing to possess or use radioactive material in Commonwealth of Virginia are subject to the requirements of **12VAC5-481, 'Virginia Radiation Protection Regulations'** and must file a license application with:

Virginia Department of Health
Radioactive Materials Program
109 Governor Street, Room 730
Richmond, VA 23219

LICENSE FEES

The appropriate fee must accompany each application. Refer to **12VAC5-490** to determine the amount of the fee. VDH will not issue the new license prior to fee receipt. Once technical review has begun, no fees will be refunded. Application fees will be charged regardless of VDH's disposition of an application or the withdrawal of an application.

Licensees are also subject to annual fees; refer to **12VAC5-490**.

Direct all questions about VDH's fees or completion of **Item 10** of VDH form, ''Application for a Radioactive Material License Authorizing the Use of Sealed Sources' **(Appendix A)** to: Virginia Department of Health,, Radioactive Materials Program, 109 Governor Street, Room 730, Richmond, VA 23219 or call (804) 864-8150.

CONTENTS OF AN APPLICATION

Item 1: Type of Application

Obtain the correct application form for either a new license or a renewal, check the appropriate box and, if appropriate, list the license number for a renewal.

This guide is written to instruct a new licensee in the process of applying for a radioactive material license. Not all discussions will be appropriate to a licensee renewing an existing license.

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. A Post Office box number is an acceptable mailing address.

Notify the agency of changes in the mailing address.

The licensee must also provide sufficient information for the agency to ensure the proposed corporation or controlling legal entity is a valid entity. Verification of this identity can be accomplished by submitting a copy of the company's license from the NRC or another Agreement State or a government contract or certification, etc.

Note: The agency must be notified immediately in the event of change of ownership or control and bankruptcy proceedings; see below for more details.

Timely Notification of Transfer of Control

Rule: 12VAC5-481-330, 12VAC5-481-450, 12VAC5-481-500

Criteria: Licensees must provide full information and obtain the agency's **written consent prior** to transferring ownership or control of the license, or, as some licensees call it, 'transferring the license'.

Discussion: Transfer of control may be the results of mergers, buyouts, or majority stock transfers. Although it is not VDH's intent to interfere with the business decisions of licensees, it is necessary for licensees to obtain prior VDH written consent. This is to ensure the following:

- Radioactive materials are possessed, used, or controlled only by persons who have valid licenses issued by VDH;
- 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 the possessed material; and
- Public health and safety are not compromised by the use of such materials.

Appendix C identifies the information to be provided about changes of ownership or transfer of control.

Notification of Bankruptcy Proceedings

Rule: 12VAC5-481-500

Criteria: 12VAC5-481-500 states: "*Each licensee shall notify the agency in writing immediately following the filing of a voluntary or involuntary petition for bankruptcy under any Chapter of Title 11 (Bankruptcy) of the United States Code by or against: 1. The licensee 2. An entity (as that term is defined in 11 USC §101 (15)) controlling the licensee or listing the license or licensee as property of the estate; or 3. An affiliate (as that term is defined in 11 USC §101 (2)) of the licensee*" and "*…shall indicate the bankruptcy court in which the petition for bankruptcy was filed and the date of filing of the petition*".

Discussion: Even though a licensee may have filed for bankruptcy, the licensee remains responsible for all regulatory requirements. VDH needs to know when licensees are in bankruptcy proceedings in order to determine whether all licensed material is accounted for and adequately controlled, and whether there are any public health and safety concerns (e.g.; contaminated facility). VDH shares the results of its determinations with other involved entities (e.g.; trustees), so that health and safety issues can be resolved prior to completion of bankruptcy proceedings.

Licensee must notify VDH immediately of the filing of a bankruptcy petition.

Item 3: Person To Be Contacted Regarding Application

Criteria: Identify the individual who can answer questions about the application and include his or her telephone number.

Discussion: This is typically the proposed Radiation Safety Officer (RSO), unless the applicant has named a different person as the contact. The agency will contact this individual if there are questions about the application.

Notify the agency if the contact person or his or her telephone number changes so that the agency can contact the applicant or licensee in the future with questions, concerns, or information. This notice is 'for information only' and does not require a license amendment.

Item 4: Address(es) Where Radioactive Material Will Be Used or Possessed

Rule: 12VAC5-481-450, 12VAC5-481-500

Criteria: Applicants must provide a specific address for each location where radioactive material will be used, stored, or dispatched.

Discussion: Specify the street address, city, and state or other descriptive address (e.g., on Highway 58, 5 miles east of the intersection of Highway 11E and State Route 16, Anytown, VA) for each facility at which licensed material will be used or stored. The descriptive address should be sufficient to allow a VDH inspector to find the use/storage location. A Post Office Box address is not acceptable.

In addition, state whether the sealed sources will be used at temporary jobsites.

Being granted a VDH license does not relieve a licensee from complying with other applicable federal, state, or local regulations (e.g., local zoning requirements for storage locations).

Note*:* As discussed later under "*Financial Assurance and Record keeping for Decommissioning*", licensees need to maintain permanent records on where licensed material was used or stored while the license was in force. This is important for making future determinations about the release of these locations for unrestricted use (e.g., before the license is terminated). For most licensees, acceptable records are sketches or written descriptions of storage or use locations specifically listed on the license. Licensees do not need to maintain this information for temporary job sites or temporary storage locations where sources have never leaked.

Item 5: Radiation Safety Officer (RSO)

Rule: 12VAC5-481-450, 12VAC5-481-490, 12VAC5-481-630, 12VAC5-481-2270

Criteria: RSO must have adequate training and experience. The RSO is responsible for ensuring that the licensee's radiation safety program is implemented in accordance with approved procedures.

Discussion: The person responsible for the radiation protection program is called the 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. VDH requires the name of the RSO on the license to ensure that licensee management has identified a qualified person and that the named individual knows of his or her designation as RSO. This individual should have specific training and experience in the use and handling of sealed sources.

Note: It is important to notify the agency, as soon as possible, of changes in the designation of the RSO**.**

Item 6: Authorized Users

Rule: 12VAC5-481-440, 12VAC5-481-450, 12VAC5-481-2260, 12VAC5-481-2270

Criteria: Authorized users (AUs) must have adequate training and experience.

Discussion: An AU is a person whose training and experience meet VDH's criteria. This individual is named on the license and uses or directly supervises the use of licensed material. AUs must ensure the proper use and security of the sealed sources. 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.

A trained individual must perform any operation that involves the removal of a sealed source from a device or maintenance and repair of a device that involves a sealed source. The trained individual shall have received instruction and training in the principles and practices of radiation safety, the use of radiation detection instruments, and the performance of these operations. See **Appendix D** for suggested training topics. The following information will be required for AUs:

- Name of each trained individual who will perform the operations
- Outline of the instruction and training that each individual has received. The amount of time spent on each topic in the training should be specified.

Note: Persons who will only use a sealed source and device, if applicable, under the supervision of the trained individual named in **Item 6** need no special training. These individuals should not be permitted to perform any

maintenance or repair operations. Only trained individuals specifically named in **Item 6** shall perform such operations.

Item 7: Radioactive Material

Item 7.1: Sealed Sources

Rule: 12VAC5-481-440, 12VAC5-481-450, 12VAC5-481-840, 12VAC5-481-850, 12VAC5-481-860, 12VAC5-481-880, 12VAC5-481-3750

Criteria: Licensees will only be authorized for sealed sources and devices listed in the Sealed Source and Device Registry. Sealed sources and devices may be used only for the purposes for which they are designed and specified in a Sealed Source Device Registration (SSDR) Sheet.

Discussion: Each authorized radioisotope is listed on a VDH license by its element name, form, the maximum quantity per source (in accordance with the SSDR) and the maximum amount of sources the licensee may possess at any one time (maximum possession limit). Licensees must submit a license amendment and receive VDH authorization before they may make changes in the types, forms, and quantities of materials possessed.

Possession limits should be specified in millicuries (mCi) [megabecquerels (MBq)] or curies (Ci) [gigabecquerels (GBq)] for each radioisotope. Applicants should include in the possession limits requested the total estimated inventory, including licensed material in storage and maintained as radioactive waste. The requested possession limits for any radioisotope should be commensurate with the applicant's needs and facilities for safe handling. Applicants, when establishing their possession limits for radioactive materials with half lives greater than 120 days, should review the requirements for submitting a certification for financial assurance for decommissioning, see **Item 7.2.**

Consult with the proposed manufacturer or distributor to ensure that sources and devices conform to the sealed source and device designations registered with NRC or another Agreement State. Licensees may not make any changes to the sealed source, device, or source/device combination that would alter the description or specifications from those indicated in the respective registration certificates, without obtaining VDH's prior permission in a license amendment. Such changes may necessitate a custom review, increasing the time needed to process a licensing action. To ensure that applicants use sources and devices according to the registration certificates, they may want to get a copy of the certificate and review it or discuss it with the manufacturer.

A safety evaluation of sealed sources and devices is performed by NRC or another Agreement State before authorizing a manufacturer (or distributor) to distribute them to specific licensees. The safety evaluation is documented in a SSDR Certificate. SSDR Certificates contain sections on "*Conditions of Normal Use*" and "*Limitation and Other Considerations of Use*". These sections may include limitations derived from conditions imposed by the manufacturer or distributor, by particular conditions of use that would reduce radiation safety of the device, or by circumstances unique to the sealed source or device. Except as specifically approved by VDH, licensees are required to use the sealed source and devices according to their respective SSDR Certificates. Information on SSDR Certificates may be obtained through the agency, if necessary. Applicants must provide the manufacturer's name and model number for each requested sealed source so that, when applicable, the agency can verify that each has been evaluated in an SSDR Certificate.

The following will be required for each:

- The radioisotope(s) that will be used.
- The manufacturer and model number of the sealed source that will be used.
- The quantity (activity) of radioactive material that will be in each sealed source. Provide an estimated number of sources that will be possessed at any one time. If the total number for each type of source is unknown, provide an anticipated total.
- The manufacturer and model number of the device containing the sealed source-if applicable.
- The purpose for which each sealed source(s) will be used (e.g., state that possession of sealed sources will be used for commercial calibration of radiation survey instruments and/or personnel dosimetry).

Note: Unusual uses will be evaluated on a case-by-case basis and the authorized use condition will reflect approved uses.

Item 7.2: Financial Assurance and Record Keeping for Decommissioning

Rule: 12VAC5-481-100, 12VAC5-481-450, 12VAC5-481-500, 12VAC5-481-510, 12VAC5-481-570, 12VAC5-481-571, 12VAC5-481-1161

Criteria: A licensee authorized to possess licensed material in excess of the limits specified in **12VAC5-481-450 C** must meet the requirements for decommissioning financial assurance.

All licensees are required to maintain, in an identified location, records of information important to decommissioning of the facility until the site, or any area, is released for unrestricted use. Licensees must transfer records important to decommissioning either to the new licensee before licensed activities are transferred or assigned in accordance with **12VAC5-481-500** or to VDH before the license is terminated.

Discussion: VDH wants to ensure that decommissioning will be carried out with minimum impact on public and occupational health and safety and the environment. There are two parts to the rule: financial assurance that applies to SOME licensees, and recordkeeping that applies to ALL licensees.

The requirements for financial assurance are specific to the types and quantities of radioactive material authorized on a license. Most applicants and licensees do not need to comply with the financial assurance requirements because the thresholds for sealed sources are 3.7×10^6 gigabecquerels (100,000 curies) of cesium-137 or 3.7×10^3 gigabecquerels (100 curies) of americium-241 or californium-252. Applicants and licensees desiring to possess sealed sources exceeding the threshold amounts must submit evidence of financial assurance.

The same rule also requires that licensees maintain records important to decommissioning in an identified location. All sealed source licensees need to maintain records of structures and equipment where sealed sources are used or stored at locations specifically listed on the license. As-built drawings with modifications of structures and equipment shown as appropriate fulfill this requirement. If drawings are not available, licensees may substitute appropriate records concerning the areas and locations. In addition, if licensees have experienced unusual occurrences (e.g., leaking sources), they also need to maintain records about contamination that remains after cleanup or that may have spread to inaccessible areas.

For sealed source licensees whose sources have never leaked, acceptable records important to decommissioning are sketches or written descriptions of storage or use locations specifically listed on the license. Similar information need not be maintained for temporary job sites.

Licensees must transfer records important to decommissioning either to the new licensee before licensed activities are transferred or assigned in accordance with **12VAC5-481-500** or to VDH before the license is terminated.

Reference: NRC Regulatory Guide 3.66 "*Standard Format and Content of Financial Assurance Mechanisms Required for Decommissioning Under 10 CFR Parts 30, 40, 70 and 72*", is available from NRC at http://www.nrc.gov.

Item 8: Facilities and Equipment

Rule: 12VAC5-481-450, 12VAC5-481-630, 12VAC5-481-730, 12VAC5-481-840

Criteria: 12VAC5-481-450 states that an application will be approved if the applicant's proposed equipment and facilities are adequate to protect health and to minimize danger to life or property. **12VAC5-481-840** states that licensed material stored in an unrestricted area must be secured from unauthorized removal, and licensed materials in an unrestricted area and not in storage must be under the constant surveillance and immediate control of the licensee.

Discussion: The room or storage area in which the sealed source and/or device is located should be:

- Accessible only to persons authorized to use the sealed source or device, and
- Locked when an authorized person is not physically present.

The room or storage area cannot be considered a restricted area if it is accessible to unauthorized persons.

The above are the key elements for applicants to ensure compliance with public dose limits and maintain adequate security and control over the sealed sources.

Provide the following on the facility diagrams:

- Drawings should be to scale, and indicate the scale used;
- Location, room numbers, and principal use of each room or area where radioactive material is prepared, used or stored;
- Location, room numbers, and principal use of each adjacent room (e.g., office, file, toilet, closet, hallway), including areas above, beside, and below; indicate whether the room is a restricted or unrestricted area as defined in **12VAC5-481-10**;
- Provide shielding calculations and include information about the type, thickness and density of any necessary shielding to enable independent verification of shielding calculations, including a description of any portable shields used (e.g., source storage safe, etc.).
- If multiple locations of storage, indicate address on diagram.

Item 9: Radiation Safety Program

Item 9.1: Audit Program

Rule: 12VAC5-481-450, 12VAC5-481-630, 12VAC5-481-990

Criteria: Licensees must review the content and implementation of their radiation protection programs annually to ensure the following:

- Compliance with VDH and DOT regulations, and the terms and conditions of the license;

- Occupational doses and doses to members of the public are as low as reasonably achievable (ALARA) ***(*12VAC5-481-630*)***; and
- Records of audits and other reviews of program content are maintained for 3 years.

Discussion: Appendix F contains a suggested audit program that is acceptable to VDH. All areas indicated in **Appendix F** may not be applicable to every licensee and may not need to be addressed during each audit.

Currently the agency'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 users to determine if, for example, operating and emergency procedures are available, are being followed, etc.

It is essential that once identified, problems be corrected comprehensively and in a timely manner; NRC Information Notice (IN) 96-28, "*Suggested Guidance Relating to Development and Implementation of Corrective Action*", provides guidance on this subject. The agency will review the licensee's audit results and determine if corrective actions are thorough, timely, and sufficient to prevent recurrence. If violations are identified by the licensee and these steps are taken, the agency can exercise discretion and may elect not to cite a violation. The agency's goal is to encourage prompt identification and comprehensive correction of violations and deficiencies.

With regard to audit records, **12VAC5-481-990** requires licensees to maintain records of audits and other reviews of program content and implementation. The agency has found audit records that contain the following information to be acceptable: date of audit, name of person(s) who conducted audit, persons contacted by the auditor(s), areas audited, audit findings, corrective actions, and follow-up.

Item 9.2: Radiation Monitoring Instruments

Rule: **12VAC5-481-450, 12VAC5-481-730, 12VAC5-481-740, 12VAC5-481-750, 12VAC5-481-900, 12VAC5-481-930, 12VAC5-481-1000**

Criteria: Licensees must possess, or have access to, radiation monitoring instruments that are necessary to protect health and minimize danger to life or property.

Discussion: Licensees shall possess, or have access to, calibrated radiation measurement instruments or licensed services to perform, as necessary the following:

- Package receipt surveys
- Sealed source leak tests
- Unrestricted area dose rate measurements

For the purposes of this document, survey instruments are defined as any device used to measure the radiation exposure or contamination levels at a licensed facility. Survey instruments that may be used to perform these measurements include exposure rate meters or contamination survey meters. Survey instruments that will be available for use or that the licensee intends to purchase should be listed along with descriptions of the instrumentation. The description should include type of instrument and detector and its intended purpose.

VDH requires that calibrations be performed by the instrument manufacturer or a person specifically authorized by VDH, NRC, or another Agreement State. Applicants seeking authorization to perform survey instrument calibrations shall submit procedures for review. **Appendix E** provides information about instrument specifications and calibration procedures.

Item 9.3: Material Receipt and Accountability

Rule: 12VAC5-481-10, 12VAC5-481-100, 12VAC5-481-450, 12VAC5-481-500, 12VAC5-481-570, 12VAC5-481-571, 12VAC5-481-840, 12VAC5-481-900, 12VAC5-481-980, 12VAC5-481-1060, 12VAC5-481-1080, 12VAC5-481-1090

Criteria: Licensees must do the following:

- Develop procedures for ordering and safely opening packages of licensed material;
- Maintain records of receipt, transfer, and disposal of licensed material; and
- Conduct physical inventories at intervals not to exceed 6 months (or some other interval justified by the applicant) to account for all sealed sources.

Discussion: Licensed material must be tracked from 'cradle to grave' in order to ensure accountability and to identify when sources could be lost, stolen, or misplaced, and ensure that, if the licensee possesses sources exceeding the threshold amounts, the licensee complies with financial assurance requirements in **12VAC5-481-450 C**. Licensees are required to maintain records of receipt, transfer, and disposal of licensed material. Licensees who use and/or possess sealed sources are required to perform inventories of sealed sources every six months.

'Cradle to Grave' Accountability refers to maintaining the radioactive material from the moment it becomes a part of your organization (whether through creation there, delivered to company, etc) through performing the quarterly inventories (ensuring the material's location, etc) until it leaves your organization (through shipment, disposal on/off site, etc)

Maintain inventory records that contain the following types of information:

- Radionuclide and amount (in units of Bq or curies) of radioactive material in each sealed source;
- Manufacturer's name, model number, and serial number of each sealed source;
- Manufacturer's name, model number, and serial number of each device containing depleted uranium or radioactive material;
- Location of each sealed source and device;
- Date of the inventory; and
- Name of individual performing inventory; and
- For materials transferred or disposed of, the date of the transfer or disposal, name and license number of the recipient, description of the affected radioactive material (e.g., radionuclide, activity, manufacturer's (or distributor's) name and model number, serial number).

Item 9.4: Occupational Dosimetry

Rule: 12VAC5-481-630, 12VAC5-481-640, 12VAC5-481-680, 12VAC5-481-700, 12VAC5-481-710, 12VAC5-481-750, 12VAC5-481-760, 12VAC5-481-990, 12VAC5-481-1000, 12VAC5-481-1020, 12VAC5-481-1040, 12VAC5-481-1100, 12VAC5-481-1110, 12VAC5-481-1130, 12VAC5-481-1140, 12VAC5-481-2260, 12VAC5-481-2270

Criteria: Applicants must do either of the following:

- Provide dosimetry processed and evaluated by a National Voluntary Laboratory Accreditation Program (NVLAP) approved processor that is exchanged at a frequency recommended by the processor.

OR

- Maintain, for inspection by VDH, documentation demonstrating that unmonitored individuals are not likely to receive, in one year, a radiation dose in excess of 10 percent of the allowable limits as shown in **Table 3**.

Table 3: Occupational Dose Limits For Adults

Occupational Dose Limits for Adults (12VAC5-481-640)	
Body Location	Dose (Annual)
Total Effective Dose Equivalent (TEDE)	0.05 Sv (5 Rem)
Dose to the skin of the whole body or any extremity*	0.5 Sv (50 Rem)
Dose to lens of the eyes	0.15 Sv (15 Rem)
*Extremities includes the arms below the elbows and the legs below the knees	

Discussion: Under conditions of routine use, many sealed source users do not require a personnel monitoring device (dosimetry). If a written evaluation demonstrates that sealed source users are not likely to exceed 10 percent of the applicable limits, users are not required to have personnel dosimetry. **Appendix I Part I** provides guidance on preparing this written evaluation.

Licensees who do provide personnel monitoring use either film badges, optically stimulated luminescent (OSLs) dosimetry or thermoluminescent dosimeters (TLDs) that are supplied by a NVLAP-approved processor. Applicants should verify that the processor is NVLAP-approved. Consult the NVLAP-approved processor for its recommendations for exchange frequency and proper use.

Reference: National Institute of Standards and Technology (NIST) Publication 810, "*National Voluntary Laboratory Accreditation Program Directory*", is published annually and is available for purchase from United States Government Printing Office and on the Internet at the following address: http://nvl.nist.gov/

Item 9.5: Public Dose

Rule: 12VAC5-481-10, 12VAC5-481-630, 12VAC5-481-720, 12VAC5-481-730, 12VAC5-481-840, 12VAC5-481-1050, 12VAC5-481-1110, 12VAC5-481-3070

Criteria: Licensees must do the following:

- Ensure that sealed sources will be used, transported, and stored in such a way that members of the public will not receive more than 1 millisievert (100 millirem) in one year, and the dose in any unrestricted area will not exceed 0.02 millisievert (2 millirem) in any one hour, from licensed operations.
- Control and maintain constant surveillance over sealed sources that are not in storage and secure sealed sources from unauthorized removal or use.

Discussion: "*Public dose*" is defined in **12VAC5-481-10** as the dose received by a member of the public from exposure to radiation and/or radioactive material released by a licensee, or to any other source of radiation under the control of a licensee. Public dose excludes doses received from background radiation and from medical procedures. Whether the dose to an individual is an occupational dose or a public dose depends on the individuals assigned duties. It does not depend on the area (restricted, controlled, or unrestricted) the individual is in when the dose is received.

Members of the public include persons who live, work, or may be near locations where sealed sources are used or stored and employees whose assigned duties do not include the use of licensed materials and who work in the vicinity where sealed sources are used or stored.

Operating and emergency procedures regarding security and surveillance specified under that section of this document should be sufficient to limit the exposure to the public during use or storage and after accidents. Public dose is controlled, in part, by ensuring that sealed sources not in use are stored securely (e.g., stored in a locked area) to prevent unauthorized access or use. If sealed sources are not in storage, then authorized users must maintain constant surveillance to ensure that members of the public, who could be co-workers, cannot get near the sealed sources and thus receive unneeded radiation exposure.

Public dose is also affected by the choice of storage location and conditions. Since a sealed source presents a radiation field during storage, it must be stored so that the radiation level in an unrestricted area (e.g., an office or the exterior surface of an outside wall) does not exceed 1 mSv (100 mrem) in a year or 0.02 mSv (2 mrem) in any one hour. Use the concepts of time, distance, and shielding when choosing a permanent or temporary storage location. Decreasing the time spent near an unshielded sealed source, increasing the distance from the unshielded sealed source, and using shielding (i.e., brick, concrete, lead, or other solid walls) will reduce the radiation exposure. As a rule of thumb, sealed sources should be stored as far away as possible from areas that are occupied by members of the public.

Licensees can determine the radiation levels adjacent to the storage location either by calculations or a combination of direct measurements and calculations using any or all of the following: typical known radiation levels provided by the manufacturer, the 'inverse square' law to evaluate the effect of distance on radiation levels, and occupancy factors to account for the actual presence of the member of the public and of the sealed sources used. See **Part 2** of **Appendix I** for examples.

If, after making an initial evaluation, a licensee makes changes affecting the storage area (e.g., changing the location of sealed sources within the storage or use area, removing shielding, adding sealed sources, changing the occupancy of adjacent areas, moving the storage area to a new location), then the licensee must ensure that sealed sources are properly secured, perform a new evaluation to ensure that the public dose limits are not exceeded, and take corrective action, as needed.

Item 9.6: Operating and Emergency Procedures

Rule: 12VAC5-481-450, 12VAC5-481-630, 12VAC5-481-740, 12VAC5-481-840, 12VAC5-481-850, 12VAC5-481-860, 12VAC5-481-870, 12VAC5-481-880, 12VAC5-481-890, 12VAC5-481-1090, 12VAC5-481-1100, 12VAC5-481-1110, 12VAC5-481-2280

Criteria: Operating and emergency procedures must be developed to minimize risks of loss or theft as well as to ensure safe use of radioactive material. The agency considers security of sealed sources extremely important and lack of security is a significant violation for which licensees are fined.

Discussion: Operating and emergency procedures shall contain the following elements:

- Instructions for using the sealed sources and device and, if applicable, performing routine maintenance according to the manufacturer's recommendations and instructions;
- Instructions for maintaining security during use, storage, and transportation;
- Instructions for keeping the sealed source under control and immediate surveillance during use;
- Instructions for keeping radiation exposures ALARA.

Notify the agency when sealed sources are lost or stolen. Refer to **12VAC5-481-1090, 12VAC5-481-1100,** and **12VAC5-481-1110** for a description of when and where notifications are required.

Item 9.7: Leak Tests

Rule: 12VAC5-481-740, 12VAC5-481-1010, 12VAC5-481-1150

Criteria: VDH requires testing to determine whether there is any radioactive leakage from the source in the device. Records of leak tests results must be maintained.

Discussion: The agency finds testing to be acceptable if it is conducted by an organization approved by VDH**,** NRC, or another Agreement State or according to procedures approved by VDH.

A licensee will be required to ensure performance of leak tests at intervals not to exceed 6 months or as approved by the NRC or another Agreement State and specified by the SSDR Certificate. The measurement of the leak test sample is a quantitative analysis requiring that instrumentation used to analyze the sample be capable of detecting 185 Bq (0.005 μCi) of radioactivity.

Manufacturers, consultants, and other organizations may be authorized by VDH, NRC, or another Agreement State either to perform the entire leak test sequence for other licensees or to provide leak test kits to licensees. In the latter case, the licensee is expected to take the leak test sample according to the sealed source manufacturer's (distributor's) and the kit supplier's instructions and return it to the kit supplier for evaluation and reporting results. Leak test samples should be collected at the most accessible area where contamination would accumulate if the sealed source were leaking. Licensees may also be authorized to conduct the entire leak test sequence themselves by adopting the procedures in **Appendix J** or submitting alternative procedures.

Item 9.8: Maintenance and Repair

Rule: 12VAC5-481-450, 12VAC5-481-490, 12VAC5-481-500, 12VAC5-481-630

Criteria: Radiation safety procedures must consider the possibility of receiving exposures to the whole body, as well as to the hands, from handling the sealed sources during maintenance and repair. Licensees should keep such exposures ALARA and ensure that the device functions as designed and source integrity is not compromised.

Discussion: Licensees may need to clean and maintain devices containing sealed sources according to manufacturer recommendations and instructions. Written procedures provided by the device manufacturer should be followed. If a procedure other than that provided by the device manufacturer is to be utilized, submit a proposed procedure.

Item 9.9: Transportation

Rule: 12VAC5-481-100, 12VAC5-481-570, 12VAC5-481-571, 12VAC5-481-630, 12VAC5-481-840, 12VAC5-481-2980, 12VAC5-481-3070, 12VAC5-481-3100, 49 CFR Parts 171-178

Criteria: Applicants must develop, implement, and maintain safety programs for public transport of radioactive material to ensure compliance with DOT regulations.

Discussion: If authorization has been requested in the application to use sealed sources at a temporary jobsite, the applicant must consider DOT regulations.

Item 9.10: Waste Management

Rule: 12VAC5-481-100, 12VAC5-481-570, 12VAC5-481-571, 12VAC5-481-910, 12VAC5-481-1060

Criteria: Licensed materials must be disposed of in accordance with VDH requirements by transfer to an authorized recipient. Appropriate records must be maintained.

Discussion: The usual disposal option is to transfer the licensed material to an authorized recipient. Authorized recipients are the original supplier of the sealed source or device, a commercial firm licensed by VDH, NRC, or another Agreement State to accept radioactive waste from other persons, or another specific licensee authorized to possess the specific licensed material. No one else is authorized to receive licensed material.

Item 9.11: Termination of Activities

Rule: 12VAC5-481-450, 12VAC5-481-500, 12VAC5-481-510, 12VAC5-481-570, 12VAC5-481-980, 12VAC5-481-1161

Criteria: The licensee must do the following:

- Notify the agency, in writing, within 60 days of:
  - The expiration of its license;
  - A decision to permanently cease licensed activity at the entire site or in any separate building or outdoor area if it contains residual radioactivity making it unsuitable for release according to VDH requirements;
  - No principal activities have been conducted at the entire site under the license for a period of 24 months;
  - No principal activities have been conducted for a period of 24 months in any separate building or outdoor area if it contains residual radioactivity making it unsuitable for release according to VDH requirements.
- Submit a decommissioning plan, if required by **12VAC5-481-510;**
- Decommissioning, as required by **12VAC5-481-510 & 12VAC5-481-1161;**
- Submit to the agency, a completed VDH form, 'Certificate of Disposition of Materials', (**Appendix B**) and demonstrate that the premises are suitable for release for unrestricted use (e.g. results of final survey); and
- Before a license is terminated, send the records important to decommissioning to the agency as required by **12VAC5-481-571**. If licensed activities are transferred or assigned in accordance with **12VAC5-481-500**, transfer records important to decommissioning to the new licensee.

Discussion: For guidance on the disposition of licensed material, see the **Item 9.10 Waste Management**. For guidance on decommissioning records, see the section on **Item 7.2 Radioactive Materials - Financial Assurance and Record keeping for Decommissioning**.

Item 10: License Fees

For a listing of application fees, please see **12VAC5-490**. On VDH form, 'Application for a Radioactive Material License Authorizing the Use of Sealed Sources'**,** enter the fee category and the amount.

Item 11: Certification

Individuals acting in a private capacity are required to sign and date VDH form, **'**Application for a Radioactive Material License Authorizing the Use of Sealed Sources' (**Appendix A**). Otherwise, senior representatives of the corporation or legal entity filing the application should sign and date VDH form, 'Application for a Radioactive Material License Authorizing the Use of Sealed Sources' (**Appendix A**). **Representatives signing an application must be authorized to make binding commitments and sign official documents on behalf of the applicant**. The agency will return all unsigned applications for proper signature**.**

Note:

- It is a violation of **12VAC5-481-30** to make a willful false statement or representation on applications or correspondence.
- When the application references commitments, those items become part of the licensing conditions and regulatory requirements.

Appendix A:

VDH Form,
‘Application for a Radioactive Material License Authorizing the Use of Sealed Sources’

Virginia Department of Health
Radioactive Materials Program
(804) 864-8150

APPLICATION FOR A NEW RADIOACTIVE MATERIAL LICENSE AUTHORIZING THE USE OF SEALED SOURCES

The Virginia Department of Health (VDH) is requesting disclosure of all information on this application for the purpose of obtaining a radioactive material license. Failure to provide any information may result in denial or delay of a radioactive material license.

Instructions – Complete all items. Refer to VAREG " Guidance for The Use of Sealed Sources" for additional information. Use supplementary sheets if necessary. Retain a copy and submit the original of the entire application to: Virginia Department of Health, Radioactive Materials Program, 109 Governor Street, Room 730, Richmond, VA 23219.

APPLICATION TYPE

Item 1 Type of Application (Check box)

☐ New License

CONTACT INFORMATION

Item 2. Name and Mailing Address of Applicant	**Item 3. Person to contact regarding this application**
Applicant's /Telephone Number (Include Area Code)	**Contact's Telephone Number** (Include Area Code)

LOCATION OF RADIOACTIVE MATERIAL

Item 4 Address(es) where radioactive material(s) will be used or possessed. (Attach additional pages if necessary)

	Address (Do not use Post Office box)	**Telephone Number** (Include area code)
☐ Used ☐ Stored ☐ Used and Stored		
☐ Used ☐ Stored ☐ Used and Stored		
☐ Used ☐ Stored ☐ Used and Stored		

Are sealed sources used at temporary jobsites?: ☐ Yes ☐ No

RADIATION SAFETY OFFICER

Item 5 Radiation Safety Officer (RSO) (Check both boxes)

☐ The name of the proposed RSO and other potential designees who will be responsible for ensuring that the licensee's radiation safety program is implemented in accordance with approved procedures.

NAME: _____ TELEPHONE NUMBER: _____
(Include area code)

AND

☐ Information demonstrating that the proposed RSO is qualified by training and experience is attached.

AUTHORIZED USERS

Item 6 Authorized Users (Check all that apply)

☐ We will attach a list of each proposed authorized user with the types and quantities of licensed material to be used.

AND

☐ Information is attached demonstrating that each proposed authorized user is qualified by training and experience to use the requested licensed material.

Note: If requesting authorization to perform non-routine maintenance, submit outline of the instruction and training for individuals performing non-routine maintenance.

RADIOACTIVE MATERIAL

Item 7 Radioactive Material (Attach additional pages if necessary)

Element and mass number	
Source manufacturer and model number	Maximum activity per source and total activity to be possessed at any one time
Device manufacturer and model number	Intended use

FACILITIES AND EQUIPMENT

Item 8 Facilities And Equipment (Check boxes and attach diagram.)

☐ Diagrams of radioactive material storage area(s) are attached.

RADIATION SAFETY PROGRAM

Item 9 Radiation Safety Program

Item 9.1 Audit Program

The applicant is not required to submit its audit program to the agency for review during the licensing phase. This matter will be examined during an inspection.

Item 9.2 Radiation Monitoring Instruments (Check all that apply)

☐ We will have access to a survey meter that meets the Criteria in the section titled 'Radiation Monitoring Instruments' in VAREG 'Guidance for Uses of Sealed Sources'. (Description attached)

OR

☐ We will possess a survey meter that meets the Criteria in the section titled 'Radiation Monitoring Instruments' in VAREG 'Guidance for Uses of Sealed Sources'.

AND ONE OF THE FOLLOWING

☐ Each survey meter will be calibrated by an organization licensed by VDH, NRC or another Agreement State to perform survey meter calibrations.

OR

☐ We will implement the model survey meter calibration program published in Appendix E in VAREG 'Guidance for Uses of Sealed Sources'.

OR

☐ We will submit alternative calibration procedures for agency review. (Procedures are attached)

Item 9.3 Material Receipt And Accountability (Check one box)

☐ We will conduct physical inventories at intervals not to exceed 6 months, to account for all sealed sources and devices received and possessed under the license.

OR

☐ We will submit a description of the frequency and procedures for ensuring that no sealed sources have been lost, stolen, or misplaced. (Procedures are attached)

Item 9.4 Occupational Dosimetry (Check one)

☐ We will maintain, for inspection by the agency, documentation demonstrating that unmonitored individuals are not likely to receive, in one year, a radiation dose in excess of 10 percent of the allowable limits in **12VAC5-481-640**.

OR

☐ We will provide dosimetry processed and evaluated by a NVLAP-approved processor that is exchanged at a frequency recommended by the processor

Item 9.5 Public Dose

No response is required, in this license application, however the licensee's evaluation of public dose will be examined during an inspection.

Item 9.6 Operating And Emergency Procedures (Check box)

☐ Operating and emergency procedures will be developed, implemented, and maintained, and will meet Criteria in the section titled 'Operating and Emergency Procedures' in VAREG 'Guidance for Uses of Sealed Sources'. (Procedures are attached)

Item 9.7 Leak Tests (Check one box)

☐ Leak tests will be performed by an organization authorized by VDH, NRC or another Agreement State to provide leak testing services to other licensees; or by using a leak test kit supplied by an organization licensed by VDH, NRC or another Agreement State to provide leak test kits to other licensees according to kit supplier's instructions.

List name and license number of organization authorized to perform or analyze leak test (Specify whether VDH, NRC, or another Agreement State)

Organization Name_____ License Number _____

Note: An alternate organization may be used to perform or analyze leak test, without amending the license, provided the organization is specifically authorized by VDH, NRC, or another Agreement State.

OR

☐ We will perform leak testing and sample analysis and will follow the procedures in Appendix J of VAREG 'Guidance for Uses of Sealed Sources'. (Procedures are attached).

OR

☐ We will submit alternative procedures (Procedures are attached).

Item 9.8 Maintenance and Repair (Check one box)

☐ We will send the device to the manufacturer or other person authorized by VDH, NRC or another Agreement State to perform maintenance or repair operations.

OR

☐ We will implement and maintain procedures for maintenance of devices containing sealed sources according to each manufacturer's recommendations and instructions.

OR

☐ We will develop, implement, and maintain procedures for maintenance of devices containing sealed sources. (Procedures are attached)

OR

☐ We will only possess sealed sources not in devices. No maintenance or repair is required.

Item 9.9 Transportation

No response is needed during the license process; this issue will be reviewed during inspection.

Item 9.10 Waste Management (Check box)

☐ We will transfer the sealed source or device containing the sealed source to the manufacturer or a specifically licensed recipient for disposal.

Item 9.11 Termination Of Activities (Check box)

☐ We will notify VDH, in writing, within 60 days of the decision to permanently cease radioactive material use. (**12VAC5-481-510**)

SPECIFIC LICENSE FEE

Item 10 License Fees (Refer to **12VAC5-490**).
License Fee Enclosed
☐ Yes Amount Enclosed $ _____

CERTIFICATION (To be signed by an individual authorized to make binding commitments on behalf of the applicant.)

Item 11

I hereby certify that this application was prepared in conformance with **12VAC5-481 'Virginia Radiation Protection Regulations'** and that all information contained herein, including any supplements attached hereto, is true and correct to the best of my knowledge and belief.

SIGNATURE - Applicant or Authorized Individual	Date signed

Print Name and Title of above signatory

Revision 1 September 30, 2014

Virginia Department of Health
Radioactive Materials Program
(804) 864-8150

APPLICATION FOR RENEWAL OF A RADIOACTIVE MATERIAL LICENSE AUTHORIZING THE USE OF SEALED SOURCES

The Virginia Department of Health (VDH) is requesting disclosure of all information on this application for the purpose of renewing a radioactive material license. Failure to provide any information may result in denial or delay of a radioactive material license.

Instructions – Complete all items. Refer to VAREG " Guidance for The Use of Sealed Sources" for additional information. Use supplementary sheets if necessary. Retain a copy and submit the original of the entire application to: Virginia Department of Health, Radioactive Materials Program, 109 Governor Street, Room 730, Richmond, VA 23219.

APPLICATION TYPE

Item 1 Type of Application (Check box)

☐ Renewal License Number

CONTACT INFORMATION

Item 2. Name and Mailing Address of Applicant	**Item 3. Person to contact regarding this application**
Applicant's /Telephone Number (Include Area Code)	**Contact's Telephone Number** (Include Area Code)

LOCATION OF RADIOACTIVE MATERIAL

Item 4 Address(es) where radioactive material(s) will be used or possessed. (Attach additional pages if necessary)

☐ as listed on current license

OR

☐ as listed on current license and please add the listed additional locations

OR

☐ see provided information for current information

	Address (Do not use Post Office box)	**Telephone Number** (Include area code)
☐ Used ☐ Stored ☐ Used and Stored		
☐ Used ☐ Stored ☐ Used and Stored		
☐ Used ☐ Stored ☐ Used and Stored		

Are sealed sources used at temporary jobsites?: ☐ Yes ☐ No

RADIATION SAFETY OFFICER

Item 5 Radiation Safety Officer (RSO) (Check both boxes)

☐ As listed on current license

OR

☐ see attached for the name and qualifications of proposed Radiation Safety Officer.

NAME: _____ TELEPHONE NUMBER: _____
(Include area code)

AUTHORIZED USERS

Item 6 Authorized Users (Check all that apply)

☐ As listed on current license.

OR

☐ As listed on license and see attached for the name and qualifications of each proposed authorized users.

OR

☐ See attached for the name and qualifications of each proposed authorized users

Note: If requesting authorization to perform non-routine maintenance, submit outline of the instruction and training for individuals performing non-routine maintenance.

RADIOACTIVE MATERIAL

Item 7 Radioactive Material (Attach additional pages if necessary)

☐ As listed on current license.

OR

☐ As listed on current license and see attached for requested materials.

OR

☐ See attached for requested materials including type, maximum quantity, and intended use.

FACILITIES AND EQUIPMENT

Item 8 Facilities And Equipment (Check boxes and attach diagram.)

☐ Diagrams of radioactive material storage area(s) are attached.

RADIATION SAFETY PROGRAM

Item 9 Radiation Safety Program

Item 9.1 Audit Program

The applicant is not required to submit its audit program to the agency for review during the licensing phase. This matter will be examined during an inspection.

Item 9.2 Radiation Monitoring Instruments (Check all that apply)

☐ We will have access to a survey meter that meets the Criteria in the section titled 'Radiation Monitoring Instruments' in VAREG 'Guidance for Uses of Sealed Sources'. (Description attached)

OR

☐ We will possess a survey meter that meets the Criteria in the section titled 'Radiation Monitoring Instruments' in VAREG 'Guidance for Uses of Sealed Sources'.

AND ONE OF THE FOLLOWING

☐ Each survey meter will be calibrated by an organization licensed by VDH, NRC or another Agreement State to perform survey meter calibrations.

OR

☐ We will implement the model survey meter calibration program published in Appendix E in VAREG 'Guidance for Uses of Sealed Sources'.

OR

☐ We will submit alternative calibration procedures for agency review. (Procedures are attached)

Item 9.3 Material Receipt And Accountability (Check one box)

☐ We will conduct physical inventories at intervals not to exceed 6 months, to account for all sealed sources and devices received and possessed under the license.

OR

☐ We will submit a description of the frequency and procedures for ensuring that no sealed sources have been lost, stolen, or misplaced. (Procedures are attached)

Item 9.4 Occupational Dosimetry (Check one)

☐ We will maintain, for inspection by the agency, documentation demonstrating that unmonitored individuals are not likely to receive, in one year, a radiation dose in excess of 10 percent of the allowable limits in **12VAC5-481-640**.

OR

☐ We will provide dosimetry processed and evaluated by a NVLAP-approved processor that is exchanged at a frequency recommended by the processor

Item 9.5 Public Dose

No response is required, in this license application, however the licensee's evaluation of public dose will be examined during an inspection.

Item 9.6 Operating And Emergency Procedures (Check box)

☐ Operating and emergency procedures will be developed, implemented, and maintained, and will meet Criteria in the section titled 'Operating and Emergency Procedures' in VAREG 'Guidance for Uses of Sealed Sources'. (Procedures are attached)

Item 9.7 Leak Tests (Check one box)

☐ Leak tests will be performed by an organization authorized by VDH, NRC or another Agreement State to provide leak testing services to other licensees; or by using a leak test kit supplied by an organization licensed by VDH, NRC or another Agreement State to provide leak test kits to other licensees according to kit supplier's instructions.

List name and license number of organization authorized to perform or analyze leak test (Specify whether VDH, NRC, or another Agreement State)

Organization Name_____ License Number _____

Note: An alternate organization may be used to perform or analyze leak test, without amending the license, provided the organization is specifically authorized by VDH, NRC, or another Agreement State.

OR

☐ We will perform leak testing and sample analysis and will follow the procedures in Appendix J of VAREG 'Guidance for Uses of Sealed Sources'. (Procedures are attached).

OR

☐ We will submit alternative procedures (Procedures are attached).

Item 9.8 Maintenance and Repair (Check one box)

☐ We will send the device to the manufacturer or other person authorized by VDH, NRC or another Agreement State to perform maintenance or repair operations.

OR

☐ We will implement and maintain procedures for maintenance of devices containing sealed sources according to each manufacturer's recommendations and instructions.

OR

☐ We will develop, implement, and maintain procedures for maintenance of devices containing sealed sources. (Procedures are attached)

OR

☐ We will only possess sealed sources not in devices. No maintenance or repair is required.

Item 9.9 Transportation

No response is needed during the license process; this issue will be reviewed during inspection.

Item 9.10 Waste Management (Check box)

☐ We will transfer the sealed source or device containing the sealed source to the manufacturer or a specifically licensed recipient for disposal.

Item 9.11 Termination Of Activities (Check box)

☐ We will notify VDH, in writing, within 60 days of the decision to permanently cease radioactive material use. (**12VAC5-481-510**)

SPECIFIC LICENSE FEE

Item 10 License Fees (Refer to **12VAC5-490**). _____

CERTIFICATION (To be signed by an individual authorized to make binding commitments on behalf of the applicant.)

Item 11

I hereby certify that this application was prepared in conformance with **12VAC5-481 'Virginia Radiation Protection Regulations'** and that all information contained herein, including any supplements attached hereto, is true and correct to the best of my knowledge and belief.

SIGNATURE - Applicant or Authorized Individual	Date signed
Print Name and Title of above signatory	

Revision 1 September 30, 2014

Attachment A
Sealed Source Applicant's Checklist

Yes	No	Item	Material Needed
		Application	Used the correct form (New for new licensees or Renewal for renewing licensees)
		Application	Checked at least one box and filled in all the required information, as needed, for all Items
		Item 5	Attached training information for the Radiation Safety Officer
		Item 6	Attached a list of authorized users and their training information
		Item 7.1	If applicable, attached radioisotope(s) and/or device(s), manufacturer and model number(s), quantities, and proposed use of licensed material
		Item 8	Attached facility diagram
		Item 9.2	Checked box(es) or attached alternate procedures
		Item 9.3	Checked box or attached alternate procedures
		Item 9.6	Attached operating and emergency procedures
		Item 9.7	Checked at least one box and, if needed, attached alternate procedures including instrumentation information
		Item 9.8	Checked box(es) and, if needed, attached alternate procedure

Appendix B:

VDH Form
‘Certificate of Disposition of Materials’

Virginia Department of Health
Radioactive Materials Program
(804) 864-8150

CERTIFICATE OF DISPOSITION OF MATERIALS

Completion of this form is required to complete termination of a Radioactive Material License as outlined in **12VAC5-481-500**. Failure to provide information will result in this request for termination of a specific license not being processed.

Instructions – Complete all items. Retain one copy and submit original to Virginia Department of Health, Radioactive Materials Program, 109 Governor Street, Room 730, Richmond, VA 23219.

CONTACT INFORMATION

Item 1 Name and Mailing Address of Applicant:	**Item 2 Virginia Radioactive Material License Number**
	Item 3 Contact Person – Name
	Contact Person - Telephone Number (Include area code) ( ) - x

TERMINATION AND DISPOSITION INFORMATION

The following information is provided in accordance with **12VAC5-481-510.** (Check all that apply)

☐ **Item 4** All use of radioactive material authorized under the above referenced license has been terminated.

☐ **Item 5** Radioactive contamination has been removed to the levels outlined in **12VAC5-481-1161 B.**

☐ **Item 6** All radioactive material previously procured and/or possessed under the authorization granted by the above referenced license has been disposed of as follows. (Check all that apply)

☐ Transferred to: Name Address

Who is (are) authorized to possess such material under Licensed Number:

Issued by (Licensing Agency):

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

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

☐ Other (Attach additional pages)

☐ **Item 7** Attached are radiation surveys or equivalent as specified in **12VAC5-481-510 L**. Specify the survey instrument(s) used and certify that each instrument is properly calibrated as required in **12VAC5-481-510 K**.

☐ **Item 8** Records required to be maintained for the license termination requested are available at the following location(s):
Name:

Address:

Contact Person Telephone Number: ( ) - x

Additional remarks (Attach additional pages if necessary.)

CERTIFICATION (To be completed by an individual authorized to make binding commitments on behalf of the applicant.)

Item 10.

The undersigned, on behalf of the licensee, hereby certifies that licensable quantities of radioactive material under the jurisdiction of the Virginia Department of Health are not possessed by the licensee. It is therefore requested that the above referenced radioactive material license be terminated.

SIGNATURE - Applicant or Authorized Individual	**Date signed**

Print Name and Title of above signatory

Appendix C:

Information Needed for Transfer of Control Application

Information Needed for Transfer of Control Application

Control: Control of a license is in the hands of the person or persons who are empowered to decide when and how that license will be used. That control is to be found in the person or persons who, because of ownership or authority explicitly delegated by the owners, possess the power to determine corporate policy, and thus the direction of the activities under the license.

Transferee: A transferee is an entity that proposes to purchase or otherwise gain control of a VDH licensed operation.

Transferor: A transferor is a VDH licensee selling or otherwise giving up control of a licensed operation.

Licensees must provide full information and obtain VDH's **prior written consent** before transferring control of the license. Provide the following information concerning changes of control by the applicant (transferor and/or transferee, as appropriate). If any items are not applicable, so state.

1. Provide a complete description of the transaction (transfer of stocks or assets, or merger). Indicate whether the name has changed and include the new name. Include the name and telephone number of a licensee contact who the agency may contact if more information is needed.

2. Describe any changes in personnel or duties that relate to the licensed program. Include training and experience for new personnel.

3. Describe any changes in the organization, location, facilities, equipment or procedures that relate to the licensed program.

4. Describe the status of the surveillance program (surveys, wipe tests, quality control) at the present time and the expected status at the time that control is to be transferred.

5. Confirm that all records concerning the safe and effective decommissioning of the facility will be transferred to the transferee or to VDH, as appropriate. These records include documentation of surveys of ambient radiation levels and fixed and/or removable contamination, including methods and sensitivity.

6. Confirm that the transferee will abide by all constraints, conditions, requirements and commitments of the transferor or that the transferee will submit a complete description of the proposed licensed program.

Appendix D:

Criteria for Acceptable Training and Experience for Authorized Users

Criteria for Acceptable Training and Experience for Authorized Users Classroom Training

Classroom training may be in the form of lecture, videotape, or self-study that emphasizes practical subject matter important to the safe handling of licensed materials. Duration and technical level of training should be commensurate with the expected hazards encountered during routine and emergency conditions.

Frequency of Training

- Before assuming duties with, or in the vicinity of, radioactive materials;
- Whenever there is a significant change in duties, regulations, or the terms and conditions of the license;
- Annually for refresher training.

Suggested Radiation Safety Topics

- Fundamentals of Radiation Safety:
  - Characteristics of radiation;
  - Units of radiation dose and quantity of radioactivity;
  - Hazards of exposure to radiation;
  - Levels of radiation from licensed material;
  - Methods of controlling radiation dose (time, distance, and shielding);
  - ALARA concept.
- Radiation Detection Instruments:
  - Operation;
  - Calibration;
  - Limitations of radiation survey instruments;
  - Radiation survey techniques for measuring radiation field;
  - Radiation survey techniques for measuring removable/fixed contamination;
  - Handling and proper use of personnel monitoring equipment.
- Radiation Protection Equipment and Use:
  - Proper use of protective equipment;
  - Decontamination of contaminated protection equipment.
- **12VAC5-481, 'Virginia Radiation Protection Regulations'**
- Licensee's operating and emergency procedures.
- Case histories relevant to operations.
- Course Examination (Didactic):
  - Successful completion of closed-book written/oral examination depending on the complexity and hazards of authorized activities;
  - Review of incorrect answers with student.
- On-the Job Training and Examination (Practical):
  - On-the-job training done under the supervision of a qualified individual (AU, RSO, or manufacturer's representative authorized by VDH, NRC, or another Agreement State) that includes supervised hands-on experience performing the task authorized on the license that are commensurate with the expected hazards during routine and emergency conditions;
  - Practical examination consisting of an assessment by the RSO to ensure that each proposed AU is qualified to work independently and that each individual is

knowledgeable of the radiation safety aspects of licensed activities. This may be demonstrated by observing the proposed AU perform licensed activities.

- Discussion and/or drill on emergency procedures.
- Retraining on areas found to be deficient in both the practical and didactic areas.

Classroom Course Instructor Qualifications

The person conducting the training should be a qualified individual (e.g., a person who meets the qualifications for RSO or authorized user (AU) on the license and is familiar with the licensee's program). Instructors who provide classroom training to individuals in the principles of radiation and radiation safety should have knowledge and understanding of these principles beyond those obtainable in a course similar to the one given to prospective AUs. Individuals who provide instruction in the hands-on use of licensed materials should have training and experience that would qualify them to be AUs, or should possess a thorough understanding of the licensee operations.

Appendix E:

Radiation Monitoring Instrument Specifications and Survey Instrument Calibration Program

Radiation Monitoring Instrument Specifications and Survey Instrument Calibration Program

The specifications in **Table 4** will help choose the proper radiation detection equipment for monitoring the radiological conditions at facilities or job sites.

Table 4. Typical Survey Instruments[1]

Portable Instruments Used for Contamination and Ambient Radiation Surveys			
Detectors	**Radiation**	**Energy Range**	**Efficiency**
Exposure Rate Maters	Gamma, X-Ray	FR-R	N/A
Count Rate Meters			
GM	Alpha	All energies (dependent on window thickness)	Moderate
	Beta	All energies (dependent on window thickness)	Moderate
	Gamma	All energies	< 1%
NaI Scintillator	Gamma	All energies (dependent on crystal thickness)	Moderate
Plasitic Scintillator	Beta	C-14 or higher (dependent on window thickness)	Moderate
Stationary Instruments Used to Measure Wipe, Bioassay and Effluent Samples			
Detectors	**Radiation**	**Energy Range**	**Efficiency**
LSC*	Alpha	All energies	High
	Beta	All energies	High
	Gamma		Moderate
Gamma Counter (NaI)*	Gamma	All energies	High
Gas Proportional	Alpha	All energies	High
	Beta	All energies	Moderate
	Gamma	All energies	< 1%

[1] Table from The Health Physics & Radiological Health Handbook, Revised Edition, Edited by Bernard Shleien, 1992 (except for * items).

Instrument Calibration Program

Training

Before allowing an individual to perform survey instrument calibrations, the RSO will ensure that he or she 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 using instruments;
- 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.

Facilities and Equipment for Calibration of Dose Rate or Exposure Rate Instruments

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

Procedure for Calibrating Survey Instruments

A radioactive sealed source(s) used for calibrating survey instruments will:

- Approximate a point source;
- Have its apparent source activity or the exposure rate at a given distance traceable by documented measurements to a standard certified to be within $\pm$ 5% accuracy by the National Institutes of Standards and Technology (NIST);
- Approximately the same energy and type of radiation as the environment in which the calibrated device will be employed or develop energy curves to compensate for differing energies;
- For dose rate and exposure rate instruments, the source should be strong enough to give an exposure rate of at least about 7.7×10^{-6} coulombs/kilogram/hour (30 mR/hr) at 100 cm [e.g., 3.1 GBqs (85 mCi) of cesium-137 or 7.8 X 102 MBqs (21 mCi) of cobalt-60].

The three kinds of scales frequently used on dose or dose rate survey meters are calibrated as follows:

- Linear readout instruments with a single calibration control for all scales should be adjusted at the point recommended by the manufacturer or at a point within the normal range of use. Instruments with calibration controls for each scale should be adjusted on each scale. After adjustment, the response of the instrument should be checked at approximately 20% and 80% of full scale. The instrument's readings should be within $\pm$ 15% of the conventionally true values for the lower point and $\pm$ 10% for the upper point.
- Logarithmic readout instruments, which commonly have a single readout scale spanning several decades, normally have two or more adjustments. The instrument should be adjusted for each scale according to site specifications or the manufacturer's specifications. After adjustment, calibration

should be checked at a minimum of one point on each decade. Instrument readings should have a maximum deviation from the conventionally true value of no more the 10% of the full decade value.

- Meters with a digital display device shall be calibrated the same as meters with a linear scale.
- Readings about 2.58 x 10^{-4} coulomb/kilogram/hour (1 R/hr) need not be calibrated, but such scales should be checked for operation and response to radiation.
- The inverse square and radioactive decay laws should be used to correct changes in exposure rate due to changes in distance or source decay.

Surface Contamination Measurement Instruments

- A survey meter's efficiency must be determined by using radiation sources with similar energies and types of radiation that the survey instrument will be used to measure or develop energy curves to compensate for differing energies.
- If each scale has a calibration potentiometer, the reading should be adjusted to read the conventionally true value at approximately 80% of full scale and the reading at approximately 20% of full scale should be observed. If only one calibration potentiometer is available, the reading should be adjusted at mid-scale on one of the scales, and readings on the other scales should be observed. Readings should be within 20% of the conventionally true value.

Procedures for Calibrating, Liquid Scintillation Counters, Gamma Counters, Gas Flow Proportional Counters, and Multichannel Analyzers

A radioactive sealed source used for calibrating instruments will do the following:

- Approximate the geometry of the samples to be analyzed;
- Have its apparent source activity traceable by documented measurements to a standard certified to be within $\pm$5% accuracy by the National Institutes of Standards and Technology (NIST).
- Approximately the same energy and type of radiation as the samples that the calibrated device will be used to measure.

Calibration

- Calibration of survey instruments used in assessing dose or exposure rates must be conducted at 6 to 12 month intervals or after instrument servicing.
- Calibration must produce readings within $\pm$20 percent of the actual values over the range of the instrument.
- Calibration of liquid scintillation counters will include quench correction.

Calibration Records

Calibration records, for all survey instruments, should indicate the procedure used and the date obtained. The description of the calibration should include:

- The owner or user of the instrument;
- A description of the instrument, including the manufacturer's name, model number, serial number, and type of detector
- A description of the calibration source, including the exposure rate a specified distance or activity on a specified date;
- For each calibration point, the calculated exposure rate or count rate, the indicated exposure rate or count rate, the deduced correction factor (the calculated exposure rate or count rate divided by the indicated exposure rate or count rate), and the scale selected on the instrument;

- For instruments with external detectors, the angle between the radiation flux field and the detector (i.e., parallel or perpendicular);
- For instruments with internal detectors, the angle between the radiation flux field and a specified surface of the instrument;
- For detectors with removable shielding, an indication whether the shielding was in place or removed during the calibration procedure;
- The exposure rate or count rate from a check source, if used;
- The name of the person who performed the calibration and the date it was performed.

The following information should be attached to the instrument as a calibration sticker or tag:

- For exposure rate meters, the source isotope used to calibrate the instrument (with correction factors) for each scale;
- The efficiency, of the instrument, for each isotope the instrument will be used to measure (if efficiency is not calculated before each use);
- For each scale or decade not calibrated, an indication that the scale or decade was checked only for function but not calibrated;
- The date of the calibration and the next calibration due date;
- The apparent exposure rate or count rate from the check source, if used.

References:

1. NRC Draft Regulatory Guide FC 413-4, "*Guide for the Preparation of Applications for Licenses for the Use of Radioactive Material in Calibrating Radiation Survey and Monitoring Instruments*", dated June 1985.
2. "*The Health Physics & Radiological Health Handbook, Revised Edition*", edited by Bernard Shleien, dated 1992.
3. ANSI N323A-1997, "*Radiation Protection Instrumentation Test and Calibration*". Copies may be obtained from the American National Standards Institute, 1430 Broadway, New York, NY 10018 or ordered electronically at the following address http://www.ansi.org.

Appendix F:

Audit Checklist

NOTE*:* All areas indicated in audit notes may not be applicable to every license and may not need to be addressed during each audit.

Licensee's name:_____ License No._____

Auditor: _____Date of Audit _____Telephone No._____

_____
(Signature)

1. AUDIT HISTORY

a. Last audit of this location conducted on (date) _____

b. Are audits conducted yearly? **(12VAC5-481-630)**

c. Are records of previous audits maintained? **(12VAC5-481-990)**

d. Were any deficiencies identified during last two audits or two years, whichever is longer?

If yes, were corrective actions taken? (Look for repeated deficiencies).

2. ORGANIZATION AND SCOPE OF PROGRAM

a. If the mailing address or places of use changed, was the license amended?

b. If ownership changed was prior VDH consent obtained?

c. If bankruptcy was filed was VDH notified immediately?

d. If the RSO was changed, was license amended? Does new RSO meet VDH training requirements?

e. If the designated contact person changed, was the agency notified?

f. Does the license authorize all of the VDH regulated radionuclides?

g. Are the sealed sources and devices being used as described in the Sealed Source and Device Registration (SSDR) Certificate? Are copies of SSDR Certificates available? Are manufacturers' manuals for operation and maintenance available?

h. Are the actual uses of sealed sources consistent with the authorized uses listed on the license?

i. Is RSO fulfilling his/her duties?

3. TRAINING AND INSTRUCTIONS TO WORKERS

a. Are all workers who are likely to exceed 100 mrem (1 mSv) in a year given training annually per **12VAC5-481-2270**?

b. Did each authorized user receive training as committed to in the license application?

c. Are training records maintained for each authorized user?

d. Did interviews with authorized users reveal that they know the operating and emergency procedures?

e. Did this audit include observations of authorized users using the sealed sources or devices (i.e., routine use, transporting, storage)?

If yes, was safe handling and security demonstrated during transportation, use and storage of the sealed source?

f. HAZMAT training provided as required? **[49 CFR 172.700, 49 CFR 172.701,CFR 172.702, 49 CFR 172.703, 49 CFR 172.704]**

4. RADIATION SURVEY INSTRUMENTS

a. Does the licensee possess or have access to a survey meter? (**L/C)**

Is the survey meter calibrated at least annually? **(12VAC5-481-750)**
Are calibration records maintained **(12VAC5-481-1000)**?

5. SEALED SOURCE INVENTORY

a. Are records kept showing the receipt of each sealed source? **(12VAC5-481-100, 12VAC5-481-571)**

b. Are all sealed sources physically inventoried every 6 months?

c. Are records of inventory results maintained?

6. PERSONNEL RADIATION PROTECTION

a. Are ALARA considerations incorporated into the radiation protection program? **(12VAC5-481-630*)***

b. Is documentation kept showing that unmonitored authorized users receive <10% of limit?

c. Did unmonitored users' activities change during the year which could put them over 10% of limit?

If yes, was a new evaluation performed?

d. Is external dosimetry required and is dosimetry provided to users?

1) Is the dosimetry supplier NVLAP approved? **(12VAC5-481-750)**

2) Are the dosimeters exchanged at vendors recommended frequency?

3) Are dosimetry reports reviewed by the RSO when they are received?

4) Are the records VDH Forms or equivalent? **(12VAC5-481-1080)**

VDH form "Occupational Exposure Record for a Monitoring Period" completed?

5) If a worker declared her pregnancy, did licensee comply with **12VAC5-481-710**?

Are records kept of embryo/fetus dose per **12VAC5-481-1040**?

6) Are annual dosimetry reports provided to monitored individuals? **(12VAC5-481-2280)**

e. Are records of exposures, surveys, monitoring, and evaluations maintained? **(12VAC5-481-1000, 12VAC5-481-1040)**

7. PUBLIC DOSE AND SECURITY

a. Are sealed sources stored in a manner to keep doses below 100 mrem (1 mSv) in a year and 2 mrem in any one hour? **(12VAC5-481-720)**

b. Has a survey or evaluation been performed per **12VAC5-481-730**? Have there been any additions or changes to the storage, security, or use of surrounding areas that would necessitate a new survey or evaluation?

c. Are sealed sources being stored in a manner that would prevent unauthorized use or removal? **(12VAC5-481-840)**

d. Are records of surveys or evaluations maintained? **(12VAC5-481-1000, 12VAC5-481-1050)**

8. OPERATING AND EMERGENCY PROCEDURES

Are operating and emergency procedures available?

Are they being followed?

Are they current?

9. LEAK TESTS

a. Was each sealed source leak tested every 6 months or at other approved intervals? **(12VAC5-481-740)**

b. Was the leak test performed as described in license application?

c. Are records of results with appropriate information retained for three years? **(12VAC5-481-1010)**

d. Are any sources found leaking and if yes, was VDH notified?

10. MAINTENANCE OF SEALED SOURCE DEVICES

Is any maintenance of the sealed source device performed?

If yes, was it performed according to license requirements (e.g., scope of work, authorized individuals performing the work, procedures used, dosimetry worn, survey instrument there, compliance with **12VAC5-481-640** limits)?

11. TRANSPORTATION OF SEALED SOURCES OR DEVICES

a. DOT-7A or other authorized packages used? **(49 CFR 173.415, 49 CFR 173.416(b))**

b. Package performance test records on file?

c. Special form sources documentation? **(49 CFR 173.476(a))**

d. Package has 2 labels (ex. Yellow-II) with TI, Nuclide, Activity, and Hazard Class*?* **(49 CFR 172.403, 49 CFR 173.441)**

e. Package properly marked? **(49 CFR 172.301, 49 CFR 172.304, 49 CFR 172.310, 49 CFR 172.324)**

f. Package closed and sealed during transport? **(49 CFR 173.475(f))**

g. Shipping papers prepared and used? **(49 CFR 172.200(a))**

h. Shipping papers contain proper entries? {Shipping name, Hazard Class, Identification Number (UN Number), Total Quantity, Package Type, Nuclide, RQ, Radioactive Material, Physical and Chemical Form, Activity, category of label, TI, Shipper's Name, Certification and Signature, Emergency Response Phone Number, Cargo Aircraft Only (if applicable)} **(49 CFR 172.200, 49 CFR 172.201, 49 CFR 172.202, 49 CFR 172.203, 49 CFR 172.204, 49 CFR 172.604)**

i. Shipping papers within drivers reach and readily accessible during transport*?* **(49 CFR 177. 817(e))**

j. Secured against movement? **(49 CFR 177. 834)**

k. Placarded on vehicle, if needed? **(49 CFR 172.504)**

l. Proper overpacks, if used*?* **(49 CFR 173.25)**

m. Any incidents reported to DOT*?* **(49 CFR 171.15, 16)**

12. AUDITOR'S SURVEY MEASUREMENTS (IF MADE)

a. Were radiation surveys performed?

If yes, describe the type, location, and results measurements.

b. Did any radiation level exceed regulatory limits?

If yes, were corrective actions taken?

13. NOTIFICATION AND REPORTS

a. Was any radioactive material lost or stolen and reports made to VDH? **(12VAC5-481-1090)**

b. Did any reportable incidents occur? Are reports made? **(12VAC5-481-1100, 12VAC5-481-1110, 12VAC5-481-1150)**

c. Did any overexposures and high radiation levels occur? Reported? **(12VAC5-481-1100, 12VAC5-481-1110)**

d. If any events (as described in items a through c above) did occur, what were the root causes? Are corrective actions appropriate?

e. Is the licensee's management/RSO/authorized individuals aware of how to contact VDH for radiological incidents?
Note: VDH office hour number (804) 864-8150 or 24 hour emergency number (804) 674-2400 or (800) 468-8892.

14. POSTING AND LABELING

a. Is VDH form, "Notice to Employees" posted? **(12VAC5-481-2260)**

b. Are **12VAC5-481, 'Virginia Radiation Protection Regulations',** and license documents posted or a notice posted? **(12VAC5-481-2260)**

c. Were any notice of violation, forfeiture assessment, or order issued and any response from the licensee posted until removal is authorized by VDH?
(12VAC5-481-2260)

d. Are emergency procedures posted?

e. Are storage/use areas posted, if required? **(12VAC5-481-860)**

f. Is the sealed source/device properly labeled? **(12VAC5-481-880)**

15. RECORD KEEPING FOR DECOMMISSIONING

a. Are records kept of information important to decommissioning? **(12VAC5-481-450 C)**

b. Do records include all information as outlined in **12VAC5-481-450 C**?

16. INFORMATION NOTICES

a. Are Information Notices received?

b. Was appropriate action taken in response?

17. LICENSE CONDITIONS OR ISSUES

Did auditor review license conditions or other issues (e.g., maintenance)?

18. DEFICIENCIES IDENTIFIED IN AUDIT; CORRECTIVE ACTIONS

a. Summarize problems/deficiencies identified during audit.

If problems/deficiencies were identified in this audit, describe the corrective actions planned or taken.

b. Are corrective actions planned or taken at ALL licensed locations (not just location audited)?

c. Provide any other recommendations for improvement.

19. EVALUATION OF OTHER FACTORS

a. Is senior licensee management appropriately involved with the radiation protection program and RSO oversight?

b. Does the RSO have sufficient time to perform his/her radiation safety duties?

c. Does the licensee have sufficient staff to support the radiation protection program?

Appendix G:

Information Needed to Support a Sealed Source Licensee's Request to Perform Maintenance and Repair

Applicants wishing to perform maintenance must use personnel with special training and follow appropriate procedures consistent with the manufacturer's instructions and recommendations that address radiation safety concerns (e.g., use of radiation survey meter, shielded container for the source, personnel dosimetry). Applicants should include the following information:

- Describe the type of work that necessitates performing maintenance on the sealed source device. The principal reason for obtaining this information is to assist the agency in the evaluation of the qualifications of individuals who will conduct the work and the radiation safety procedures they will follow.
- Identify who will perform maintenance, their training and experience, and why they are competent to perform maintenance.
- Submit procedures for the safe handling of the radioactive source while the maintenance is being performed. These procedures should ensure the following:
  - doses to personnel and members of the public are within regulatory limits and ALARA (e.g., use of shielded containers or shielding);
  - the sealed source is secured against unauthorized removal access or under constant surveillance;
  - appropriate labels and signs are used; and
  - manufacturer's instructions and recommendations will be followed.
- Confirm that individuals performing maintenance on the sealed source device will always wear appropriate monitoring devices or that an evaluation will be available to demonstrate that these individuals are not likely to receive, in one year, more than 10 percent of the applicable dose limits. The dose limits are in **Table 3**.
- Verify possession of at least one survey instrument meeting the following criteria:
  - Be capable of detecting gamma radiation;
  - Be capable of measuring from 0.01 to 0.5 mSv/hr (1 to 50 mrem/hr);
  - Be calibrated at least annually with radionuclide point sources emitting radiation of the type and energy of the sealed sources;
  - Be calibrated on at least 2 points located at approximately 1/3 and 2/3 of each scale; readings within ±20% are acceptable;
  - Be calibrated by a person specifically licensed by VDH, NRC**,** or another Agreement State to calibrate radiation detection instruments; and
  - Be checked for functionality prior to use (e.g., with a check source).

  Note: Records of instrument calibration must be maintained for 3 years after the record is made **(12VAC5-481-1000)**.
- Describe steps to be taken to ensure that radiation levels in areas where maintenance will take place do not exceed **12VAC5-481-720** limits. For example, applicants can do the following:
  - Commit to performing surveys with a survey instrument (as described above);
  - Specify where and when surveys will be conducted during maintenance; and
  - Commit to maintaining, for 3 years from the date of the survey, records of the survey (e.g., who performed the survey, date of the survey, instrument used, measured radiation levels correlated to location of those measurements) as required by **12VAC5-481-1000**.

Appendix H:

Operating and Emergency Procedures

Operating Procedures

- If personnel dosimetry is provided:
  - Always wear your assigned dosimeter when using or around the sealed source;
  - Never wear another person's dosimeter; and
  - Never store your dosimeter near the sealed source.
- Use the sealed source according to the manufacturer's instructions and recommendations.
- Do not touch the unshielded sealed source with your fingers, hands, or any part of your body.
- Do not place hands, fingers, feet, or other body parts in the radiation field from an unshielded sealed source.
- Perform routine cleaning and maintenance according to the manufacturer’s instructions and recommendations.
- When not in use, place the sealed source in a secured location.
- After making changes affecting the sealed source storage area (e.g., changing the location of sealed sources within the storage area, removing shielding, adding sealed sources, changing the occupancy of adjacent areas, moving the storage area to a new location), reevaluate compliance with public dose limits and ensure proper security of the sealed sources.

Emergency Procedures for Sealed Sources

If the sealed source is lost, damaged, or stolen or if any other emergency or unusual incident occurs:

- Immediately secure the area and keep people a safe distance away from the sealed source until the situation is assessed and radiation levels are known. However, perform first aid for any injured individuals and remove them from the area only when medically safe to do so.
- Authorized users and other potentially contaminated individuals should not leave the scene until emergency assistance arrives.
- Notify the persons, in order listed, of the situation.
- Follow the directions provided by the person contacted.

NAME*	WORK PHONE NUMBER*	HOME PHONE NUMBER*

* Fill in with (and update, as needed) the names and telephone numbers of appropriate personnel (e.g., the RSO or other knowledgeable licensee staff, licensee's consultant, sealed source manufacturer) to be contacted in case of emergency.

Upon notification of an emergency or incident, the contacted person (RSO or licensee management) should:

- Arrange for a radiation survey to be conducted as soon as possible by a knowledgeable person using appropriate radiation detection instrumentation. This person could be a licensee employee using a survey meter located at the jobsite or a consultant. To accurately assess the radiation danger, it is essential that the person performing the survey be competent in the use of the survey meter.
- Make necessary notifications to local authorities as well as VDH. Even if not required to do so, you may report any incident to VDH by calling **(804) 864-8150 during office hours or (804) 674-2400 or (800) 468-8892 after hours**. VDH notification is required when sealed sources are lost or stolen, when sealed sources are damaged or involved in incidents that result in doses in excess of **12VAC5-481-640** and **12VAC5-481-720** limits.
- Reports to VDH must be made within the reporting timeframes specified by **12VAC5-481-1090, 12VAC5-481-1100, 12VAC5-481-1110,** and **12VAC5-481-1150**.

Appendix I:

Dosimetry-related Guidance

Part 1:
Worksheet for Determining if Personnel Dosimetry is Required for Sealed Source Users

Worksheet for Determining if Personnel Dosimetry is Required for Sealed Source Users

Instructions: To meet the requirement of **12VAC5-481-760** complete **Steps 1** through **6** and sign and date the evaluation on the line provided.

Disclaimer: If there is a change in workload or if a new sealed source is acquired, a new evaluation will need to be performed.

Step 1.

Determine the radiation level in one of the following ways. Record the results below.

- Obtain from the manufacturer's specifications: the radiation level approximately 30 centimeters from the sealed source, or
- Measure the radiation level with a calibrated survey meter.
  - When making the radiation measurement, place the survey instrument approximately 30 centimeters from the sealed source while following good radiation safety practices.

_____ mrem per hour

Step 2.

Record the average number of minutes per week that the sealed source is used.

_____ minutes per week

Step 3.

Divide the minutes per week (**Step 2.**) by 60 to determine hours per week and record below.

_____minutes per week (**Step 2.**) / 60

= _____ hours per week

Step 4.

Multiply the hours per week (**Step 3.**) by 52 weeks to equal hours per year and record below.

_____hours per week (**Step 3**.) X 52 weeks

= _____ hours per year

Step 5.

Multiply hours per year (**Step 4.**) by mrem per hour (**Step 1.**) to equal mrem received per year and record below.

_____hours per year (**Step 4.**) X _____mrem per hour (**Step 1.**)

= _____ mrem per year

Step 6.

Is the # of mrem per year (**Step 5.**) greater than 500? ☐ Yes ☐ No

- If yes provide dosimetry as required by **12VAC5-481-760**
- If no, proceed to **Step 7.**

Step 7.

Is the # of mrem per year (**Step 5.**) greater than 100? ☐ Yes ☐ No

- If yes, and you have an employee that is a declared pregnant worker, as defined by **12VAC5-481-10,** provide dosimetry to that individual. In addition, provide annual radiation safety training as required by **12VAC5-481-2270** to all employees that use the sealed source.
- If no, you are not required under **12VAC5-481-640** and **12VAC5-481-760** to provide dosimetry to your employees.

_____	_____
Signature of Person Performing the Evaluation	Date

Part 2:
Guidance for Demonstrating that Individual Members of the Public will not Receive Doses Exceeding the Allowable Limit

Licensees must ensure that:

- The radiation dose received by individual members of the public does not exceed 1 mSv (100 mrem) in one calendar year resulting from the licensee's possession and/or use of licensed materials.

Members of the public include persons who live, work, or may be near locations where sealed sources are used or stored. (For storage of sealed sources in personal residences, occupants are considered members of the public.) Employees whose assigned duties do not include the use of licensed materials but who work in the vicinity where sealed sources are used or stored are also considered members of the public.

- The radiation dose in unrestricted areas does not exceed 0.02 mSv (2 mrem) in any one hour.

Typical unrestricted areas may include offices, shops, laboratories, areas outside buildings, property, and non-radioactive equipment storage areas. The licensee does not control access to these areas for purposes of controlling exposure to radiation or radioactive materials. However, the licensee may control access to these areas for other reasons such as security.

Licensees must show compliance with both portions of the rule. Calculations or a combination of calculations and measurements (e.g., using an environmental TLD) are often used to prove compliance.

Calculation Method

The calculation method takes a tiered approach, going through a three-part process starting with a worst case situation and moving toward more realistic situations. It makes the following simplifications: (1) each sealed source is a point source, (2) typical radiation levels encountered when the source is in the shielded position are taken from either the Sealed Source Device Registration Sheet or the manufacturer's literature, and (3) no credit is taken for any shielding found between the sealed sources and the unrestricted areas. Part 1 of the calculation method is simple but conservative. It assumes that an affected member of the public is present 24 hours a day and uses only the ‘inverse square law’ to determine if the distance between the sealed source and the affected member of the public is sufficient to show compliance with the public dose limits. Part 2 considers not only distance, but also the time that the affected member of the public is actually in the area under consideration. Part 3 considers distance and the portion of time that both the sealed source and the affected member of the public are present. Using this approach, licensees make only those calculations that are needed to demonstrate compliance. In many cases licensees will need to use the calculation method through Part 1 or Part 2. The results of these calculations typically result in higher radiation levels than would exist at typical facilities, but provide a method for estimating conservative doses which could be received.

Example 1

To better understand the calculation method, we will look at a sealed source licensee. Yesterday, the company's president noted that the new sealed source storage area is very close to his secretary's desk and he asked Joe, the RSO, to determine if the company is complying with **12VAC5-481-720.**

The secretary's desk is near the wall separating the reception area from the designated, locked sealed source storage area, where the company is storing three sealed sources. Joe measures the distances from each sealed source to the wall and looks up in the manufacturer's literature the radiation levels individuals would encounter for each sealed source. **Figure 1** is Joe's sketch of the areas in question and **Table 5** summarizes the information Joe has on each sealed source.

A Bird's Eye View of Office and Gauge Storage Area

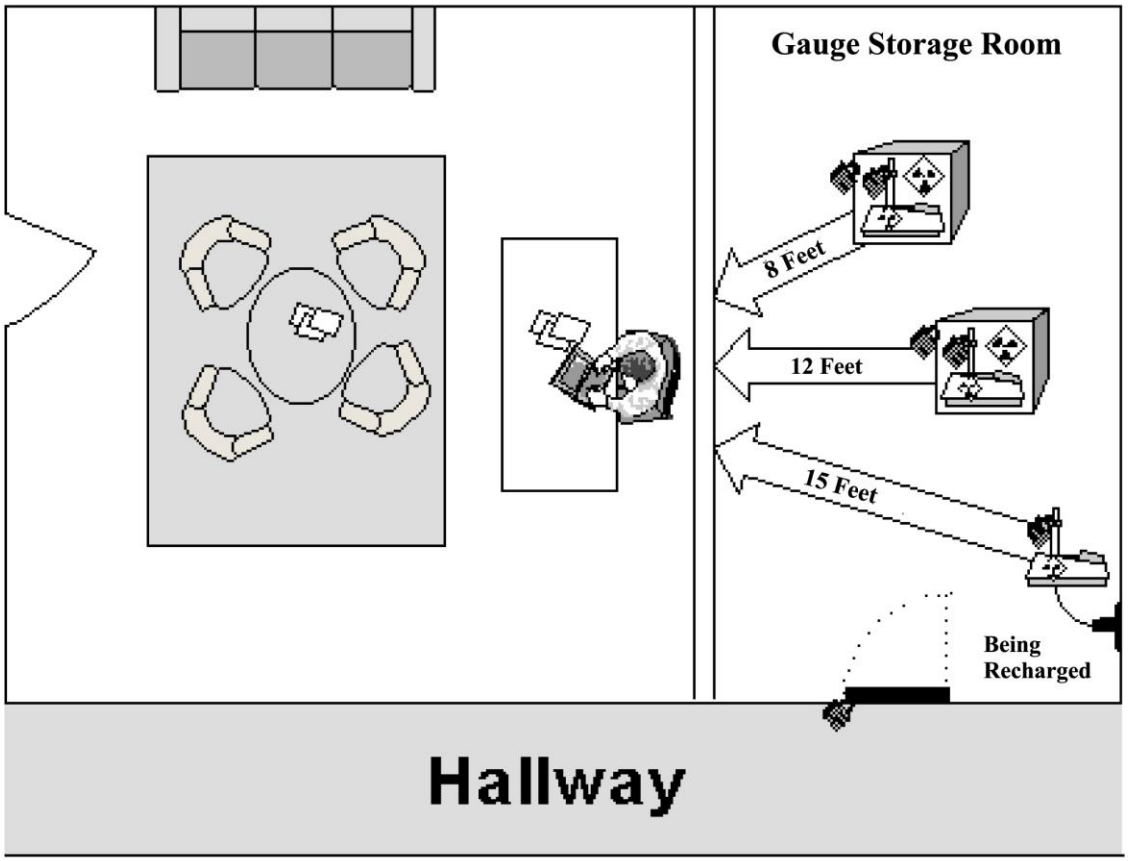


Figure 1. Diagram of Office and Sealed Source Storage Area.

Table 5. Information Known about Each Sealed Source

DESCRIPTION OF KNOWN INFORMATION	SOURCE 1	SOURCE 2	SOURCE 3
How sealed source is stored	Sealed source in storage container	Sealed source in storage container	Sealed source out of storage container
Dose rate in mrem/hr encountered at specified distance from the sealed source (from manufacturer's literature)	2 mrem/hr at 1 ft	8 mrem/hr at 1 ft	2 mrem/hr at 3 ft
Distance in ft to secretary's chair	8 ft	12 ft	15 ft

Example 1: Part 1

Joe's first thought is that the distance between the sealed sources and the secretary's chair may be sufficient to show compliance with the rule in **12VAC5-481-720**. So, taking a 'worst case' approach, he assumes: 1) the sealed sources are constantly present (i.e., 24 hr/d), 2) all three sealed sources remain in storage with no other use, and 3) the secretary is constantly sitting in the desk chair (i.e., 24 hr/d).

Joe proceeds to calculate the dose she might receive hourly and yearly from each sealed source as shown in **Tables 6**, **7**, and **8** below.

Table 6. Calculation Method, Part 1---Hourly and Annual Dose Received from Source 1

		Source 1	
Step No.	**Description**	**Input Data**	**Results**
1	Dose received in an hour at known distance from the sealed source (e.g., from manufacturer's data), in mrem/hr	2	2
2	Square of the distance (ft) at which the Step 1 rate was measured, in ft^2	$(1)^2$	1
3	Square of the distance (ft) from the sealed source to the secretary's desk in an unrestricted area, in ft^2	$(8)^2$	64
4	Multiply the results of Step 1 by the results of Step 2 (this is an intermediate result)	2 x 1 =2	
5	Divide the result of Step 4 by the result of Step 3 to calculate the dose received by an individual at the secretary's desk**, HOURLY DOSE RECEIVED FROM SOURCE 1**, in mrem in an hour.	2/64 = **0.031**	
6	Multiply the result of Step 5 by 24 hr/d x 365 d/yr = **MAXIMUM ANNUAL DOSE RECEIVED FROM SOURCE 1**, in mrem in a year.	0.031 x 24 x 365 = 0.031 x 8760 = **272**	

Table 7. Calculation Method, Part 1---Hourly and Annual Dose Received from Source 2

		Source 2	
Step No.	**Description**	**Input Data**	**Results**
1	Dose received in an hour at known distance from the sealed source (e.g., from manufacturer's data), in mrem/hr	8	8
2	Square of the distance (ft) at which the Step 1 rate was measured, in ft^2	$(1)^2$	1
3	Square of the distance (ft) from the sealed source to the secretary's desk in an unrestricted area, in ft^2	$(12)^2$	144
4	Multiply the results of Step 1 by the results of Step 2 (this is an intermediate result)	8 x 1 = 8	
5	Divide the result of Step 4 by the result of Step 3 to calculate dose received in an hour by an individual at the secretary's desk**, HOURLY DOSE RECEIVED FROM SOURCE 2**, in mrem in an hour	8/144 = **.056**	
6	Multiply the result of Step 5 by 24 hr/d x 365 d/yr = **MAXIMUM ANNUAL DOSE RECEIVED FROM SOURCE 2**, in mrem in a year	0.056 x 24 x 365 =0.056 x 8760 = **491**	

Table 8. Calculation Method, Part 1---Hourly and Annual Dose Received from Source 3

		Source 3	
Step No.	**Description**	**Input Data**	**Results**
1	Dose received in an hour at known distance from the sealed source (e.g., from manufacturer's data), in mrem/hr	2	2
2	Square of the distance (ft) at which the Step 1 rate was measured, in ft^2	$(3)^2$	9
3	Square of the distance (ft) from the sealed source to the secretary's desk in an unrestricted area, in ft^2	$(15)^2$	225
4	Multiply the results of Step 1 by the results of Step 2 (this is an intermediate result)	2 x 9 =18	
5	Divide the result of Step 4 by the result of Step 3 to calculate dose received by an individual at the secretary's desk, **HOURLY DOSE RECEIVED FROM SOURCE 3**, in mrem in an hour	18/225 = **0.08**	
6	Multiply the result of Step 5 by 24 hr/d x 365 d/yr = **MAXIMUM ANNUAL DOSE RECEIVED FROM SOURCE 3**, in mrem in a year	0.08 x 24 x 365 = 0.08 x 8760 = **701**	

To determine the total hourly and total annual dose received, Joe adds the pertinent data from the preceding tables.

Table 9. Calculation Method, Part 1---Total Hourly and Annual Dose Received from Sources 1, 2, and 3

Step No.	**Description**	**Source 1**	**Source 2**	**Source 3**	**Sum**
7	**TOTAL HOURLY DOSE RECEIVED** from Step 5 of Tables 5, 6, and 7, in mrem in an hour	0.031	0.056	0.08	0.031 + 0.056 + 0.08 = **0.167**
8	**TOTAL ANNUAL DOSE RECEIVED** from Step 6 of Tables 5, 6, and 7, in mrem in a year	272	491	701	272 + 491 + 701 = **1464**

Note*:* The sum in Step 7 demonstrates compliance with the 2 mrem in any one hour limit. Reevaluate if assumptions change. If the Sum in Step 8 exceeds 100 mrem/yr, proceed to Part 2 of the calculation method.

At this point, Joe is pleased to see that the total dose that an individual could receive in any one hour is only 0.167 mrem, but notes that an individual could receive a dose of 1,464 mrem in a year, much higher than the 100 mrem limit.

Example 1: Part 2

Joe reviews his assumptions and recognizes that the secretary is not at the desk 24 hr/d. He decides to make a realistic estimate of the number of hours the secretary sits in the chair at the desk, keeping his other assumptions constant (i.e., the sealed sources are constantly present (i.e., 24 hr/d), all three sealed sources remain in storage with no other use). He then recalculates the annual dose received.

Table 10. Calculation Method, Part 2--Annual Dose Received from Sources 1, 2, and 3

Step No.	Description	Results
9	A. Average number of hours per day that individual spends in area of concern (e.g., secretary sits at desk 5 hr/day; the remainder of the day the secretary is away from the desk area copying, filing, etc.)	5
	B. Average number of days per week in area (e.g., secretary is part time and works 3 days/week)	3
	C. Average number of weeks per year in area (e.g., secretary works all year)	52
10	Multiply the results of Step 9.A. by the results of Step 9.B. by the results of Step 9.C. = **AVERAGE NUMBER OF HOURS IN AREA OF CONCERN PER YEAR**	5 x 3 x 52 = **780**
11	Multiply the sum in Step 7 by the results of Step 10 = **ANNUAL DOSE RECEIVED FROM SEALED SOURCES CONSIDERING REALISTIC ESTIMATE OF TIME SPENT IN AREA OF CONCERN**, in mrem in a year	0.167 x 780 = **130**

Note: If Step 11 exceeds 100 mrem in a year, proceed to Part 3 of the calculation method.

Although Joe is pleased to note that the calculated annual dose received is significantly lower, he realizes it still exceeds the 100 mrem in a year limit.

Example 1, Part 3
Again Joe reviews his assumptions and recognizes that the sealed sources are not always in storage when the secretary is seated at the desk. As he examines the situation, he realizes he must consider each sealed source individually.

Table 11. Calculation Method, Part 3---Summary of Information

INFORMATION ON WHEN SEALED SOURCES ARE PRESENT IN THE STORAGE AREA:

- **SOURCE 1: an old sealed source located in the storage area continuously (24 hr/d)**
- **SOURCE 2: a new sealed source located in the storage area continuously (24 hr/d) for 8 months of the year; at job site for the remaining 4 months of the year**
- **SOURCE 3: a new sealed source located in the storage area overnight; it is used every day all year and returned to the storage location at the end of each day. The sealed source is usually present during the secretary's first and last hours of work each day.**

INFORMATION FROM EXAMPLE 1, PART 2 ON WHEN THE SECRETARY IS SITTING AT THE DESK

- **5 hours per day**
- **3 days per week**
- **52 weeks per year**

Table 12. Calculation Method, Part 3---Annual Dose Received from Sources 1, 2, and 3

Step No.	Description	Source 1	Source 2	Source 3
12	Average number of **hours per day** sealed source is in storage while secretary is present	**5**	**5**	**2**
13	Average number of **days per week** sealed source is in storage while secretary is present	**3**	**3**	**3**
14	Average number of **weeks per year** sealed source is in storage while secretary is present	**52**	**32**	**52**
15	Multiply the results of Step 12 by the results of Step 13 by the results of Step 14 = **TOTAL HOURS EACH SEALED SOURCE IS STORED PER YEAR WHILE SECRETARY IS PRESENT**	5 x 3 x 52 = **780**	5 x 3 x 32 = **480**	2 x 3 x 52 = **312**
16	Multiply the results of Step 15 by the results of Step 7 = **ANNUAL DOSE RECEIVED FROM EACH SEALED SOURCE**, in mrem in a year	780 x 0.031 = **24**	480 x 0.056 = **27**	312 x 0.08 = **25**
17	Sum the results of Step 16 for each sealed source = **TOTAL ANNUAL DOSE RECEIVED CONSIDERING REALISTIC ESTIMATE OF TIME SPENT IN AREA OF CONCERN AND TIME SEALED SOURCE IS IN STORAGE**, in mrem in a year	24 + 27 + 25 = **76**		

Note: If the result in Step 17 is greater than 100 mrem/yr, the licensee must take corrective actions.

Joe is pleased that the result in Step 17 shows compliance with the 100 mrem/yr limit. Had the result in Step 17 been higher than 100 mrem/yr, then Joe could have done one or more of the following:

- Consider whether the assumptions used to determine occupancy and the time each sealed source is in storage are accurate, revise the assumptions as needed, and recalculate using the new assumptions;
- Calculate the effect of any shielding located between the sealed source storage area and the secretarial workstation--such calculation is beyond the scope of this Appendix;
- Take corrective action (e.g., move sealed source within storage area, move the storage area, move the secretarial workstation) and perform new calculations to demonstrate compliance; or
- Designate the area outside the storage area as a restricted area and the secretary as an occupationally exposed individual. This would require controlling access to the area for purposes of radiation protection and training the secretary as required by **12VAC5-481-2270**.

Note that in the example, Joe evaluated the unrestricted area outside only one wall of the sealed source storage area. Licensees also need to make similar evaluations for other unrestricted areas and to keep in mind the ALARA principle, taking reasonable steps to keep radiation dose received below regulatory requirements. In addition, licensees need to be alert to changes in situations (e.g., moving any of the sealed source closer to the secretarial workstation, adding a sealed source to the storage area, changing the secretary to a full-time worker, or changing the estimate of the portion of time spent at the desk) and to perform additional evaluations, as needed.

RECORD KEEPING: 12VAC5-481-1050 requires licensees to maintain records demonstrating

compliance with the dose limits for individual members of the public.

Combination Measurement-Calculation Method

This method, which allows the licensee to take credit for shielding between the sealed source and the area in question, begins by measuring radiation levels in the areas, as opposed to using manufacturer-supplied rates at a specified distance from each sealed source. These measurements must be made with calibrated survey meters sufficiently sensitive to measure background levels of radiation. However, licensees must exercise caution when making measurements with currently calibrated radiation survey instruments. A maximum dose of 1 mSv (100 mrem) received by an individual over a period of 2080 hours (i.e., a 'work' year of 40 hr/wk for 52 wk/yr) is equal to less than 0.5 microsievert (0.05 mrem) per hour.

This rate is well below the minimum sensitivity of most commonly available GM survey instruments.

Instruments used to make measurements for calculations must be sufficiently sensitive. An instrument equipped with a scintillation-type detector (e.g., NaI(Tl)) or a micro-R meter used in making very low gamma radiation measurements should be adequate.

Licensees may also choose to use environmental TLD***s*** in unrestricted areas next to the sealed source storage area for monitoring. This direct measurement method would provide a definitive measurement of actual radiation levels in unrestricted areas without any restrictive assumptions. Records of these measurements can then be evaluated to ensure that rates in unrestricted areas do not exceed the 1 mSv/yr (100 mrem/yr) limit.

Note: TLDs used for personnel monitoring (e.g., LiF) may not have sufficient sensitivity for this purpose. Generally, the minimum reportable dose received is 0.1 mSv (10 mrem). Suppose a TLD monitors dose received and is changed once a month. If the measurements are at the minimum reportable level, the annual dose received could have been about 1.2 mSv (120 mrem), a value in excess of the 1 mSv/yr (100 mrem/yr) limit. If licensees use TLDs to evaluate compliance with the public dose limits, they should consult with their TLD supplier and choose more sensitive TLDs, such as those containing CaF_2 that are used for environmental monitoring.

Example 2
As in Example 1, Joe is the RSO of a sealed source licensee. The company has three sealed sources stored in a designated, locked storage area that adjoins an unrestricted area where a secretarial workstation is located. See **Figure 3** and **Table 4** for information. Joe wants to see if the company complies with the public dose limits at the secretarial station.

During the winter while all the gauges are in storage, Joe placed an environmental TLD badge in the secretarial workspace for 30 days. Joe chose a winter month so he did not have to keep track of the number of hours that each sealed source was in the storage area. The TLD processor sent Joe a report indicating the TLD received 100 mrem.

Table 13. Combination Measurement-Calculation Method

Step No.	Description	Input Data and Results
PART 1		
1	**Dose** received by **TLD**, in mrem	**100**
2	**Total hours TLD** exposed	24 hr/d x 30 d/mo = **720**
3	Divide the results of Step 1 by the results of Step 2 to determine **HOURLY DOSE RECEIVED**, in mrem in an hour	**0.14**
4	Multiply the results of Step 3 by 365 d/yr x 24 hr/d = 8760 hours in one year = **MAXIMUM ANNUAL DOSE RECEIVED FROM SEALED SOURCES**, in mrem in a year	365 x 24 x 0.14 = 8760 x 0.14 = **1226**

Note: For the conditions described above, Step 3 indicates that the dose received in any one hour is less than the 2 mrem in any one hour limit. However, if there are any changes, then the licensee would need to reevaluate the potential doses which could be received in any one hour. Step 4 indicates that the annual dose received would be much greater than the 100 mrem in a year allowed by the rule.

PART 2

At this point Joe can adjust for a realistic estimate of the time the secretary spends in the area as he did in Part 2 of Example 1.

PART 3

If the results of Joe's evaluation in Part 2 show that the annual dose received in a year exceeds 100 mrem, then he can make adjustments for realistic estimates of the time spent in the area of concern while the sealed sources are actually in storage as in Part 3 of Example 1. (Recall that the TLD measurement was made while all the sealed sources are in storage--i.e. 24 hr/d for the 30 days that the TLD was in place.)

Appendix J:

Leak Test Program

Leak Test Program

Training

Before allowing an individual to perform leak testing, the RSO will ensure that he or she has sufficient classroom and on-the-job training to show competency in performing leak tests independently.

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 the use of instruments;
- Mathematics and calculations basic to the use and measurement of radioactivity; and
- Biological effects of radiation.

Appropriate on-the-job-training consists of:

- Observing authorized personnel collecting and analyzing leak test samples;
- Collecting and analyzing leak test samples under the supervision and in the physical presence of an individual authorized to perform leak tests.

Facilities and Equipment

- To ensure achieving the required sensitivity of measurements, leak tests will be analyzed in a low-background area.
- Before leak test swipes are analyzed, individuals conducting leak tests will use a calibrated and operable survey instrument to check leak test samples for gross contamination. If the sensitivity of the counting system is unknown, the minimum detectable activity (MDA) needs to be determined. The MDA may be determined using the following formula:

$$MDA = \frac{3 + 4.65(BR)^{*½}}{Et}$$

where MDA = activity level in disintegrations per minute (dpm)

BR = background rate in counts per minute (cpm)
t = counting time in minutes
E = detector efficiency in counts per disintegration (cpd)

For example:

$$MDA = \frac{3 + 4.65(200\ cpm)^{*½}}{(0.1\ cpd)(2\ minutes)}$$

where BR = 200 cpm

E = 0.1 cpd (10% efficient)
t = 2 minutes

- An NaI(Tl) well counter system with a single or multichannel analyzer will be used to count samples from sealed sources containing gamma-emitters (e.g., Cs-137, Co-60).
- A liquid scintillation or gas-flow proportional counting system will be used to count samples from sealed sources containing beta-emitters (e.g., Sr-90) or alpha emitters (e.g., Am-241).

Frequency for Conducting Leak Tests of Sealed Sources

- Leak tests will be conducted every six months (unless it is an alpha emitting source) or at the frequency specified in the respective Sealed Source and Device Registration Certificate.

Procedure for Performing Leak Testing and Analysis

- For each source to be tested, list identifying information such as serial number, radionuclide, and activity.
- If available, use a survey meter to monitor exposure.
- Prepare a separate wipe sample (e.g., cotton swab or filter paper) for each source.
- Number each wipe to correlate with identifying information for each source.
- Wipe the most accessible area where contamination would accumulate if the sealed source was leaking.
- Select an instrument that is sensitive enough to detect 185 Bq (0.005 microcurie) of the radionuclide contained in the gauge.
- Using the selected instrument, count and record background count rate.
- Check the instrument's counting efficiency using standard source of the same radionuclide as the source being tested or one with similar energy characteristics. Accuracy of standards should be within +/-5 percent of the stated value and traceable to a primary radiation standard such as those maintained by the National Institutes of Standards and Technology (NIST).
- Calculate efficiency.

  For example: $\frac{\text{(cpm from std) - (cpm from bkg)}}{\text{activity of std in Bq}}$ = efficiency in cpm/Bq

  where: cpm = counts per minute
  std = standard
  bkg = background
  Bq = Becquerel
- Count each wipe sample; determine net count rate.
- For each sample, calculate and record estimated activity in Bq (or microcuries).

  For example: $\frac{\text{(cpm from wipe sample) - (cpm from bkg)}}{\text{efficiency in cpm/Bq}}$ = Bq on wipe sample
- Sign and date the list of sources, data, and calculations. Retain records for 5 years.
- If the wipe test activity is 185 Bq (0.005 microcurie) or greater, notify the RSO so that the source can be withdrawn from use and disposed of properly. Also notify VDH.

Appendix K:

Major DOT Regulations; Sample Bill of Lading

The major areas in the DOT regulations that are most relevant for transportation of typical sealed sources that are shipped as Type A quantities are as follows:

- Table of Hazardous Materials and Special Provisions **49 CFR 172.101**, and App. A, Table 2: Hazardous materials table, list of hazardous substances and reportable quantities
- Shipping Papers **49 CFR 172.200-204**: general entries, description, additional description requirements, shipper's certification
- Package Markings **49 CFR 172.300, 49 CFR 172.301, 49 CFR 172.303, 49 CFR 172.304, 49 CFR 172.310, 49 CFR 172.324**: General marking requirements for non-bulk packagings, prohibited marking, marking requirements, radioactive material, hazardous substances in non-bulk packaging
- Package Labeling **49 CFR 172.400, 49 CFR 172.401, 49 CFR 172.403, 49 CFR 172.406, 49 CFR 172.407, 49 CFR 172.436, 49 CFR 172.438, 49 CFR 172.440**: General labeling requirements, prohibited labeling, radioactive materials, placement of labels, specifications for radioactive labels
- Placarding of Vehicles **49 CFR 172.500, 49 CFR 172.502, 49 CFR 172.504, 49 CFR 172.506, 49 CFR 172.516, 49 CFR 172.519, 49 CFR 172.556**: Applicability, prohibited and permissive placarding, general placarding requirements, providing and affixing placards: highway, visibility and display of placards, RADIOACTIVE placard
- Emergency Response Information, Subpart G, **49 CFR 172.600, 49 CFR 172.602, 49 CFR 172.604**: Applicability and general requirements, emergency response information, emergency response telephone number
- Training, Subpart H, **49 CFR 172.702, 49 CFR 172.704**: Applicability and responsibility for training and testing, training requirements
- Radiation Protection Program for Shippers and Carriers, Subpart I, **49 CFR 172.800**, etc.
- Shippers - General Requirements for Shipments and Packaging, Subpart I, **49 CFR 173.403, 49 CFR 173.410, 49 CFR 173.412, 49 CFR 173.415, 49 CFR 173.433, 49 CFR 173.435, 49 CFR 173.441, 49 CFR 173.475, 49 CFR 173.476**: Definitions, general design requirements, additional design requirements for Type A packages, authorized Type A packages, requirement for determining A_1 and A_2, table of A_1 and A_2 values for radionuclides, radiation level limit, quality control requirements prior to each shipment, approval of special form radioactive materials
- Carriage by Public Highway **49 CFR 177.816, 49 CFR 177.817, 49 CFR 177.834(a), 49 CFR 177.842**: Driver training, shipping paper, general requirements (secured against movement), Class 7 (radioactive) material

Minimum Required Packaging For Class 7 (Radioactive) Materials This table must not be used as a substitute for the DOT and NRC regulations on the transportation of radioactive materials				
Quantity:	< 70 Bq/g (< 0.002 µCi/g)	Limited Quantity (§173.421)	A_1/A_2 value (§173.435)	1 rem/hr at 3 m, un-shielded (§173.427)
Non-LSA/SCO:	**Excepted**	**Type A**	**Type B [3]**	
Domestic or International LSA/SCO: • LSA-I solid, (liquid)[1] • SCO-I	**Excepted**	IP-I		**Type B [3]**
• LSA-I Liquid • LSA-II Solid, (liquid or gas)[1] • (LSA-III)[1] • SCO-II		IP-II		**Type B [3]**
• LSA-II Liquid or Gas • LSA-III		IP-III		**Type B [3]**
Domestic (only) LSA/SCO: • LSA-I, II, III; SCO-I, II	**Excepted**	**Strong-tight [2]**	**DOT Spec. 7A Type A**	**Type B [3]** **NRC Type A LSA [3,4]**

1. For entries in parentheses, exclusive use is required for shipment in an IP (e.g., shipment of LSA-I liquid in an IP-I packaging would require exclusive-use consignment)
2. Exclusive use required for strong-tight container shipments made pursuant to §173.427(b)(2)
3. Subject to conditions in Certificate, if NRC package
4. Exclusive use required, see §173.427(b)(4). Use of these packages expires on 4/1/99 (10 CFR 71.52)

Package and Vehicle Radiation Level Limits (49 CFR 173.441) [A] This table must not be used as a substitute for the DOT and NRC regulations on the transportation of radioactive materials				
Transport Vehicle Use:	**Non-Exclusive**	**Exclusive**		
Transport Vehicle Type:	Open or Closed	Open (flat-bed)	Open w/Enclosure [B]	Closed
Package (or freight container) **Limits:**				
External Surface	2 mSv/hr **(200 mrem/hr)**	2 mSv/hr **(200 mrem/hr)**	10 mSv/hr **(1000 mrem/hr)**	10 mSv/hr **(1000 mrem/hr)**
Transport Index (TI) [C]	10	no limit		
Roadway or Railway Vehicle (or freight container) **Limits:**				
Any point on the outer surface	N/A	N/A	N/A	2 mSv/hr **(200 mrem/hr)**
Vertical planes projected from outer edges		2 mSv/hr **(200 mrem/hr)**	2 mSv/hr **(200 mrem/hr)**	N/A
Top of . . .		load: **(200 mrem/hr)**	enclosure: 2 mSv/hr **(200 mrem/hr)**	vehicle: 2 mSv/hr **(200 mrem/hr)**
2 meters from. . .		vertical planes: 0.1 mSv/hr **(10 mrem/hr)**	vertical planes: 0.1 mSv/hr **(10 mrem/hr)**	outer lateral surfaces: 0.1 mSv/hr **(10 mrem/hr)**
Underside		2 mSv/hr **(200 mrem/hr)**		
Occupied position	N/A [D]	0.02 mSv/hr **(2 mrem/hr)** [E]		
Sum of package TI's	50	no limit [F]		

A. The limits in this table do not apply to excepted packages - see 49 CFR 173.421-426.
B. Securely attached (to vehicle), access-limiting enclosure; package personnel barriers are considered as enclosures.
C. For nonfissile radioactive materials packages, the dimensionless number equivalent to maximum radiation level at 1 m (3.3 feet) from the exterior package surface, in millirem/hour.
D. No dose limit is specified, but separation distances apply to Radioactive Yellow-II or Radioactive Yellow-III labeled packages.
E. This does not apply to private carrier wearing dosimetry if under radiation protection program satisfying 10 CFR 20 or 49 CFR 172 Subpart I.
F. Some fissile shipments may have combined conveyance TI limit of 100 - see 10 CFR 71.59 and 49 CFR 173.457.

Hazard Communications for Class 7 (Radioactive) Materials

DOT Shipping Papers (49 CFR 172.200-205)

NOTE: IAEA, ICAO, and IMO may require additional hazard communication information for international shipments
This table must not be used as a substitute for the DOT and NRC regulations on the transportation of radioactive materials

Entries Always Required Unless Excepted	Additional Entries Sometimes Required	Optional Entries
• The basic description, In sequence: **Proper Shipping Name,** **Hazard Class (7),** **U.N. Identification Number** • 24 hour **emergency response telephone number** • Name of **shipper** • Proper page numbering (Page 1 of 4) • Except for empty and bulk packages, the **total quantity** (mass, or volume for liquid), in appropriate units (lbs, mL....) • If not special form, **chemical and physical form** • The **name of each radionuclide** (95 percent rule) and total package activity. The activity must be in SI units (e.g., Bq, TBq), or both SI units and customary units (e.g., Ci, mCi). However, for domestic shipments, the activity *may* be expressed in terms of customary units only, until 4/1/97. • For each labeled package: - The **category of label** used; - The **transport index** of each package with a Yellow-II or Yellow-III label - Shipper's **certification** (not required of private carriers)	Materials-Based Requirements • If hazardous substance, "RQ" as part of the basic description • The LSA or SCO group (e.g., LSA-II) • "Highway Route Controlled Quantity" as part of the basic description , if HRCQ • Fissile material information (e.g., "Fissile Exempt," controlled shipment statement [see §172.203(d)(7)]) • If the material is considered hazardous waste and the word waste does not appear in the shipping name, then "waste" must precede the shipping name (e.g., Waste Radioactive Material, nos, UN2982) • "Radioactive Material" if not in proper shipping name **Package-Based Requirements** • Package identification for DOT Type B or NRC certified packages • IAEA CoC ID number for export shipments or shipments using foreign-made packaging (see §173.473) **Administrative-Based Requirements** • "Exclusive Use-Shipment" • Instructions for maintenance of exclusive use-shipment controls for LSA/SCO strong-tight or NRC certified LSA (§ 173.427) • If a DOT exemption is being used, "DOT-E" followed by the exemption number	• The type of packaging (e.g., Type A, Type B, IP-1, ...) • The technical/chemical name may be in included (if listed in §172.203(k), in parentheses between the proper shipping name and hazard class; otherwise inserted in parenthesis after the basic description) • Other information is permitted (e.g., functional description of the product), provided it does not confuse or detract from the proper shipping name or other required information • For fissile radionuclides, except Pu-238, Pu-239, and Pu-241, the weight in grams or kilograms may be used *in place of* activity units. For Pu-238, Pu-239, and Pu-241, the weight in grams or kilograms may optionally be entered *in addition to* activity units [see §172.203(d)(4)] • Emergency response hazards and guidance information (§§172.600-604) may be entered on the shipping papers, or may be carried with the shipping papers [§172.602(b)]

Some Special Considerations/Exceptions for Shipping Paper Requirements

- Shipments of Radioactive Material, excepted packages, under UN2910 (e.g., Limited Quantity, Empty packages, and Radioactive Instrument and Article), are excepted from shipping papers. For limited quantities (§173.421), this is only true if the limited quantity is not a hazardous substance (RQ) or hazardous waste (40 CFR 262).
- Shipping papers must be in the pocket on the left door, or readily visible to a person entering the driver's compartment and within arm's reach of the driver.
- For shipments of multiple cargo types, any HAZMAT entries must appear as the first entries on the shipping papers, be designated by an "X" (or "RQ") in the hazardous material column, *or* be highlighted in a contrasting color.

Hazard Communications for Class 7 (Radioactive) Materials

Marking Packages (49 CFR 172.300-338)

NOTE: IAEA, ICAO, and IMO may require additional hazard communication information for international shipments
This table must not be used as a substitute for the DOT and NRC regulations on the transportation of radioactive materials

Markings Always Required Unless Excepted	Additional Markings Sometimes Required	Optional Markings
Non-Bulk Packages • Proper shipping name • U.N. identification number • Name and address of consignor or consignee, *unless*: 1. highway only and no motor carrier transfers; *or* part of carload or truckload lot or freight container load, and entire contents of railcar, truck, or freight container are shipped from one consignor to one consignee [see §172.301(d)] **Bulk Packages** (i.e., net capacity greater than 119 gallons as a receptacle for liquid, or 119 gallons and 882 pounds as a receptacle for solid, or water capacity greater than 1000 lbs, with no consideration of intermediate forms of containment) • U.N. identification number, on orange, rectangular panel (see §172.332) - some exceptions exist	**Materials-Based Requirements** • If in excess of 110 lbs (50 kg), Gross Weight • If non-bulk *liquid* package, underlined double arrows indicating upright orientation (two opposite sides) [ISO Std 780-1985 marking] • If a Hazardous substance in non-bulk package, the letters "RQ" in association with the proper shipping name **Package-Based Requirements** • The package type if Type A or Type B (½" or greater letters) • The specification-required markings [e.g., for Spec. 7A packages: "DOT 7A Type A" and "Radioactive Material" (see §178.350-353)] • For approved packages, the certificate ID number (e.g., USA/9166/B(U), USA/9150/B(U)-85, ...) • If Type B, the trefoil (radiation) symbol per Part 172 App. B [*size*: outer radius ≥ 20 mm (0.8 in)] • For NRC certified packages, the model number, gross weight, and package ID number (10 CFR 71.85) **Administrative-Based Requirements** • If a DOT exemption is being used, "DOT-E" followed by the exemption number • If an export shipment, "USA" in conjunction with the specification markings or certificate markings	• "IP-1," "IP-2," or "IP-3" on industrial packaging is recommended • Both the name and address of consignor and consignee are recommended • Other markings (e.g., advertising) are permitted, but must be sufficiently away from required markings and labeling

Some Special Considerations/Exceptions for Marking Requirements

- Marking is required to be: (1) durable, (2) printed on a package, label, tag, or sign, (3) unobscured by labels or attachments, (4) isolated from other marks, and (5) be representative of the hazmat contents of the package.
- Limited Quantity (§173.421) packages and Articles Containing Natural Uranium and Thorium (§173.426) must bear the marking "radioactive" on the outside of the inner package or the outer package itself, and are excepted from other marking. The excepted packages shipped under UN 2910 must also have the accompanying statement that is required by §173.422.
- Empty (§173.428) and Radioactive Instrument and Article (§173.424) packages are excepted from marking.
- Shipment of LSA or SCO required by §173.427 to be consigned as exclusive use are excepted from marking except that the exterior of each nonbulk package must be marked "**Radioactive-LSA**" or "**Radioactive-SCO**," as appropriate. Examples of this category are domestic, strong-tight containers with less than an A_2 quantity, and domestic NRC certified LSA/SCO packages using 10 CFR 71.52.
- For bulk packages, marking may be required on more than one side of the package (see 49 CFR 172.302(a)).

Hazard Communications for Class 7 (Radioactive) Materials

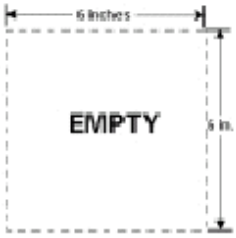
Labeling Packages (49 CFR 172.400-450)

NOTE: IAEA, ICAO, and IMO may require additional hazard communication information for international shipments
This table must not be used as a substitute for the DOT and NRC regulations on the transportation of radioactive materials

Placement of Radioactive Labels

- Labeling is required to be: (1) placed near the required marking of the proper shipping name, (2) printed or affixed to the package surface (not the bottom), (3) in contrast with its background, (4) unobscured by markings or attachments, (5) within color, design, and size tolerance, and (6) representative of the HAZMAT contents of the package.
- For labeling of radioactive materials packages, two labels are required on opposite sides excluding the bottom.

Determination of Required Label

Size: *Sides:* ≥ 100 mm (3.9 in.) *Border:* 5-6.3 mm (0.2-0.25 in.)	 49 CFR 172.436	 49 CFR 172.438	 49 CFR 172.440	 49 CFR 172.450
Label	**WHITE-I**	**YELLOW-II**	**YELLOW-III**	**EMPTY LABEL**
Required when:	Surface radiation level < 0.005 mSv/hr (0.5 mrem/hr)	0.005 mSv/hr (0.5 mrem/hr) < surface radiation level ≤ 0.5 mSv/hr (50 mrem/hr)	0.5 mSv/hr (50 mrem/hr) < surface radiation level ≤ 2 mSv/hr (200 mrem/h) [Note: 10 mSv/hr (1000 mrem/hr) for exclusive-use closed vehicle (§173.441(b)]	The EMPTY label is required for shipments of empty Class 7 (radioactive) packages made pursuant to **§173.428**. It must cover any previous labels, or they must be removed or obliterated.
Or:	TI = 0 [1 meter dose rate < 0.0005 mSv/hr (0.05 mrem/hr)]	TI ≤ 1 [1 meter dose rate < 0.01 mSv/hr (1 mrem/hr)]	TI ≤ 10 [1 meter dose rate < 0.1 mSv/hr (10 mrem/hr)] [Note: There is no *package* TI limit for exclusive-use]	
Notes:	• Any package containing a Highway Route Controlled Quantity (HRCQ) **must bear YELLOW-III label** • Although radiation level transport indices (TIs) are shown above, for fissile material, the TI is typically determined on the basis of criticality control			

Content on Radioactive Labels

2. RADIOACTIVE Label must contain (entered using a durable, weather-resistant means):
   (1) The radionuclides in the package (with consideration of available space). Symbols (e.g., Co-60) are acceptable.
   (2) The activity in SI units (e.g., Bq, TBq), or both SI units with customary units (e.g., Ci, mCi) in parenthesis. However, for domestic shipments, the activity *may* be expressed in terms of customary units only, until 4/1/97.
   (3) The Transport Index (TI) in the supplied box. The TI is entered *only* on YELLOW-II and YELLOW-III labels.

Some Special Considerations/Exceptions for Labeling Requirements

- For materials meeting the definition of another hazard class, labels for each secondary hazard class need to be affixed to the package. The subsidiary label *may* not be required on opposite sides, and must not display the hazard class number.
- Radioactive Material, excepted packages, under UN2910 (e.g., Limited Quantity, Empty packages, and Radioactive Instrument and Article), are excepted from labeling. However, if the excepted quantity meets the definition for another hazard class, it is re-classed for that hazard. Hazard communication requirements for the other class are required.
- Labeling exceptions exist for shipment of LSA or SCO required by § 173.427 to be consigned as exclusive use.
- The "Cargo Aircraft Only" label is typically required for radioactive materials packages shipped by air [§ 172.402(c)].

Hazard Communications for Class 7 (Radioactive) Materials

Placarding Vehicles (49 CFR 172.500-560)

NOTE: IAEA, ICAO, and IMO may require additional hazard communication information for international shipments
This table must not be used as a substitute for the DOT and NRC regulations on the transportation of radioactive materials.

Visibility and Display of Radioactive Placard

- Placards are required to be displayed:
  - On four sides of the vehicle;
  - Visible from the direction they face, (for the front side of trucks, tractor-front, trailer, or both are authorized);
  - Clear of appurtenances and devices (e.g., ladders, pipes, tarpaulins);
  - At least 3 inches from any markings (such as advertisements) which may reduce placard's effectiveness;
  - Upright and on-point such that the words read horizontally;
  - In contrast with the background, or have a lined-border which contrasts with the background;
  - Such that dirt or water from the transport vehicle's wheels will not strike them;
  - Securely attached or affixed to the vehicle, or in a holder.
- Placard must be maintained by carrier to keep color, legibility, and visibility.

Conditions Requiring Placarding

- Placards are required for any vehicle containing a package with a RADIOACTIVE Yellow-III label.
- Placards are required for shipment of LSA or SCO required by §173.427 to be consigned as exclusive use. Examples of this category are domestic, strong-tight containers with less than an A_2 quantity, and domestic NRC certified LSA/SCO packages using 10 CFR 71.52. Also, for bulk packages of these materials, the orange panel marking with the UN Identification number is not required.
- Placards are required for any vehicle containing a package with a Highway Route Controlled Quantity (HRCQ). In this case, the placard must be placed in a square background as shown below (see §173.507(a)).

Radioactive Placard

Size Specs:			
Sides: ≥ 273 mm (10.8 in.) *Solid line Inner border:* About 12.7 mm (0.5 in.) from edges *Lettering:* ≥ 41 mm (1.6 in.) *Square for HRCQ:* 387mm (15.25 in.) outside length by 25.4 mm (1 in.) thick			
	49 CFR 172.556	IAEA SS 6 (1985) paras. 443-444	See 49 CFR 172.527 AND 556
	RADIOACTIVE PLACARD (Domestic) *Base of yellow solid area:* 29 ± 5 mm (1.1 ± 0.2 in.) above horizontal centerline	**RADIOACTIVE PLACARD (International)**	**RADIOACTIVE PLACARD FOR HIGHWAY ROUTE CONTROLLED QUANTITY** (either domestic or international placard could be in middle)

Some Special Considerations/Exceptions for Placarding Requirements

- Domestically, substitution of the UN ID number for the word "RADIOACTIVE" on the placard is prohibited for Class 7 materials. However, some import shipments may have this substitution in accordance with international regulations.
- Bulk packages require the orange, rectangular panel marking containing the UN ID number, which must be placed adjacent to the placard (see §172.332) [NOTE: except for LSA/ SCO exclusive use under §173.427, as above].
- If placarding for more than one hazard class, subsidiary placards must not display the hazard class number. Uranium Hexaflouride (UF_6) shipments ≥ 454 kg (1001 lbs) require both RADIOACTIVE and CORROSIVE (Class 8) placarding.
- For shipments of radiography cameras in convenience overpacks, if the overpack does not require a RADIOACTIVE – YELLOW III label, vehicle placarding is not required (regardless of the label which must be placed on the camera).

Package and Vehicle Contamination Limits (49 CFR 173.443)

This table must not be used as a substitute for the DOT and NRC regulations on the transportation of radioactive materials

NOTE: All values for contamination in DOT rules are to be averaged over each 300 cm^2
Sufficient measurements must be taken in the appropriate locations to yield representative assessments

$\beta\gamma$ means the sum of beta emitters, gamma emitters, and low-toxicity alpha emitters
" means the sum of all other alpha emitters (i.e., other than low-toxicity alpha emitters)

The Basic Contamination Limits for All Packages: 49 CFR 173.443(a), Table 11	General Requirement: Non-fixed (removable) contamination must be kept as low as reasonably achievable (ALARA)
	$\beta\gamma$: 0.4 Bq/cm^2 = 40 Bq/100 cm^2 = $1x10^{-5}$ $\mu Ci/cm^2$ = 2200 dpm/100 cm^2
	α: 0.04 Bq/cm^2 = 4 Bq/100 cm^2 = $1x10^{-6}$ $\mu Ci/cm^2$ = 220 dpm/100 cm^2

The following exceptions and deviations from the above basic limits exist:

Deviation from Basic Limits	Regulation 49 CFR §§	Applicable Location and Conditions Which must Be Met:
10 times the basic limits	173.443(b) and 173.443(c) Also see 177.843 (highway)	On any external surface of a package in an exclusive use shipment, during transport including end of transport. Conditions include: • Contamination levels at beginning of transport must be below the basic limits. • Vehicle must not be returned to service until radiation level is shown to be ≤ 0.005 mSv/hr (0.5 mrem/hr) at any accessible surface, and there is no significant removable (non-fixed) contamination.
10 times the basic limits	173.443(d) Also see 177.843 (highway)	On any external surface of a package, at the beginning or end of transport, if a closed transport vehicle is used, solely for transporting radioactive materials packages. Conditions include: • A survey of the interior surfaces of the empty vehicle must show that the radiation level at any point does not exceed 0.1 mSv/hr (10 mrem/hr) at the surface, or 0.02 mSv/hr (2 mrem/hr) at 1 meter (3.3 ft). • Exterior of vehicle must be conspicuously stenciled, "For Radioactive Materials Use Only" in letters at least 76 mm (3 inches) high, on both sides. • Vehicle must be kept closed except when loading and unloading.
100 times the basic limits	173.428	**Internal** contamination limit for excepted package-empty packaging, Class 7 (Radioactive) Material, shipped in accordance with 49 CFR 173.428. Conditions include: (1) The basic contamination limits (above) apply to **external** surfaces of package. (2) Radiation level must be ≤ 0.005 mSv/hr (0.5 mrem/hr) at any external surface. (3) Notice in §173.422(a)(4) must accompany shipment. (4) Package is in unimpaired condition & securely closed to prevent leakage. (5)Labels are removed, obliterated, or covered, and the "empty" label (§172.450) is affixed to the package.

In addition, after any incident involving spillage, breakage, or suspected contamination, the modal-specific DOT regulations (§177.861(a), highway; §174.750(a), railway; and §175.700(b), air) specify that vehicles, buildings, areas, or equipment have "no significant removable surface contamination" before being returned to service or routinely occupied. The carrier must also notify offeror at the earliest practicable moment after incident.

Sample Bill of Lading

Appendix K

STRAIGHT BILL OF LADING

ORIGINAL — NOT NEGOTIABLE

Shipper No. _____

Carrier No _____

Date _____

Page 1 of 1

(Name of carrier) (SCAC)

TO: Consignee: Builders, Inc. **

On Collect on Delivery shipments, the letters "COD" must appear before consignee's name or as otherwise provided in Item 430, Sec. 1.

Street: 5678 Jefferson Davis Highway **

Destination: Arlington, VA** Zip Code: 22222**

FROM: Shipper: Moisture Density Measurements, Inc. **

Street: 1234 A Street, NW **

Origin: Washington, DC 20000**

Route

Vehicle Number

No. of Units & Container Type	HM	BASIC DESCRIPTION Proper Shipping Name, Hazard Class, Identification Number (UN or NA) per 172.101, 172.202, 172.203	TOTAL QUANTITY (Weight, Volume, Gallons, etc.)	WEIGHT (Subject to Correction)	RATE	CHARGES (For Carrier Use Only)
1	RQ	Radioactive material, special form				
		n.o.s. 7 UN2974				
		0.41GBq (11 mCi) Cs-137 and				
		1.9GBq (50 mCi) Am-241:Be	2.31 GBq			
			(61 mCi)			
		RADIOACTIVE - YELLOW II				
		TI = 0.4 **				
		USDOT 7A TYPE A				
		Emergency Response Telephone No.: 1-800-000-0000 (24 hr/d)**				
		** SUBSTITUTE APPROPRIATE INFORMATION FOR				
		YOUR GAUGE AND YOUR SHIPMENT				

PLACARDS TENDERED: YES ☐ NO ☐

REMIT C.O.D. TO: ADDRESS

Note — Where the rate is dependent on value, shippers are required to state specifically in writing the agreed or declared value of the property.

The agreed or declared value of the property is hereby specifically stated by the shipper to be not exceeding

$ _____ per _____

I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packaged, marked and labeled, and are in all respects in proper condition for transport by [illegible] highway [illegible] ACCURATE NON-APPLICABLE MODE OF TRANSPORTATION according to applicable international and national governmental regulations.

Signature

COD Amt: $

Subject to Section 7 of the conditions, if this shipment is to be delivered to the consignee without recourse on the consignor, the consignor shall sign the following statement:

The carrier shall not make delivery of this shipment without payment of freight and all other lawful charges.

_____ Signature of Consignor

C.O.D. FEE: PREPAID ☐ COLLECT ☐ $

TOTAL CHARGES: $

FREIGHT CHARGES

Prepaid, prepaid unless otherwise specified ☐ Check box if charges are to be collected

RECEIVED, subject to the classifications and lawfully filed tariffs in effect on the date of the issue of this Bill of Lading, the property described above in apparent good order, except as noted (contents and condition of contents of packages unknown), marked, consigned, and destined as indicated above which said carrier (the word carrier being understood throughout this contract as meaning any person or corporation in possession of the property under the contract) agrees to carry to its usual place of delivery at said destination, if on its route, otherwise to deliver to another carrier on the route to said destination. It is mutually agreed, as to each carrier of all or any of said property over all or any portion of said route to destination and as to each party at any time interested in all or any of said property, that every service to be performed hereunder shall be subject to all the bill of lading terms and conditions in the governing classification on the date of shipment.

Shipper hereby certifies that he is familiar with all the bill of lading terms and conditions in the governing classification and the said terms and conditions are hereby agreed to by the shipper and accepted for himself and his assigns.

SHIPPER

PER

CARRIER

PER

DATE

1

Permanent post office address of shipper.

STYLE F65 LABELMASTER Div. of Francan Labelmark Co., Chicago, IL 60646 312/478-0900

Appendix L

Sample Correspondence Letter

SAMPLE CORRESPONDENCE DELEGATION LETTER

[date]

Virginia Department of Health
Radioactive Materials Program
109 Governor Street, Room 730
Richmond, VA 23219

To Radioactive Material Program Director:

As [job title] of [name of licensee], I have delegated authority for all matters pertaining to our Virginia Radioactive Material License to [name of designee]. [Name of designee] has management approval to sign and submit amendment requests to the Virginia Department of Health on behalf of [name of licensee]. I understand that license renewals must still be signed by a representative of upper management.

[This document must be signed by a management representative who has independent authority to reassign job duties and/or provide finances, if necessary, to support an effective radiation safety program.]

_____ _____ _____

Signature Title Date

_____

Print Name