



OFFICE OF THE VICE PRESIDENT FOR RESEARCH

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Br. 2

October 11, 2005

Licensing Assistance Team
Division of Nuclear Materials Safety
US Nuclear Regulatory Commission, Region I
475 Allendale Rd.
King of Prussia, PA 19406-1415

45-09599-03
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RECEIVED
REGIONS

To Whom It May Concern:

Enclosed is an application to renew the materials license for Old Dominion University.

Questions regarding the contents of the renewal application should be addressed to Derek Krepp, Radiation Safety Officer, at 757-683-4495.

Sincerely,

Mohammed A. Karim
Vice President for Research

137851
NMSS/RGNI MATERIALS-002

NRC FORM 313
(4-2004)
10 CFR 30, 32, 33,
34, 35, 36, 39, and 40

U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB: NO. 3150-0120

EXPIRES: 10/31/2005

APPLICATION FOR MATERIAL LICENSE

Estimated burden per response to comply with this mandatory collection request: 7 hours. Submittal of the application is necessary to determine that the applicant is qualified and that adequate procedures exist to protect the public health and safety. Send comments regarding burden estimate to the Records and FOIA/Privacy Services Branch (T-5 F52), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to infocollects@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0120), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

INSTRUCTIONS: SEE THE APPROPRIATE LICENSE APPLICATION GUIDE FOR DETAILED INSTRUCTIONS FOR COMPLETING APPLICATION. SEND TWO COPIES OF THE ENTIRE COMPLETED APPLICATION TO THE NRC OFFICE SPECIFIED BELOW.

APPLICATION FOR DISTRIBUTION OF EXEMPT PRODUCTS FILE APPLICATIONS WITH:

IF YOU ARE LOCATED IN:

DIVISION OF INDUSTRIAL AND MEDICAL NUCLEAR SAFETY
OFFICE OF NUCLEAR MATERIALS SAFETY AND SAFEGUARDS
U.S. NUCLEAR REGULATORY COMMISSION
WASHINGTON, DC 20555-0001

ILLINOIS, INDIANA, IOWA, MICHIGAN, MINNESOTA, MISSOURI, OHIO, OR WISCONSIN, SEND APPLICATIONS TO:

MATERIALS LICENSING BRANCH
U.S. NUCLEAR REGULATORY COMMISSION, REGION III
2443 WARRENVILLE ROAD, SUITE 210
LISLE, IL 60532-4352

ALL OTHER PERSONS FILE APPLICATIONS AS FOLLOWS:

IF YOU ARE LOCATED IN:

ALABAMA, CONNECTICUT, DELAWARE, DISTRICT OF COLUMBIA, FLORIDA, GEORGIA, KENTUCKY, MAINE, MARYLAND, MASSACHUSETTS, MISSISSIPPI, NEW HAMPSHIRE, NEW JERSEY, NEW YORK, NORTH CAROLINA, PENNSYLVANIA, PUERTO RICO, RHODE ISLAND, SOUTH CAROLINA, TENNESSEE, VERMONT, VIRGINIA, VIRGIN ISLANDS, OR WEST VIRGINIA, SEND APPLICATIONS TO:

ALASKA, ARIZONA, ARKANSAS, CALIFORNIA, COLORADO, HAWAII, IDAHO, KANSAS, LOUISIANA, MONTANA, NEBRASKA, NEVADA, NEW MEXICO, NORTH DAKOTA, OKLAHOMA, OREGON, PACIFIC TRUST TERRITORIES, SOUTH DAKOTA, TEXAS, UTAH, WASHINGTON, OR WYOMING, SEND APPLICATIONS TO:

LICENSING ASSISTANCE TEAM
DIVISION OF NUCLEAR MATERIALS SAFETY
U.S. NUCLEAR REGULATORY COMMISSION, REGION I
475 ALLENDALE ROAD
KING OF PRUSSIA, PA 19406-1415

NUCLEAR MATERIALS LICENSING BRANCH
U.S. NUCLEAR REGULATORY COMMISSION, REGION IV
611 RYAN PLAZA DRIVE, SUITE 400
ARLINGTON, TX 76011-4005

03016045
X

PERSONS LOCATED IN AGREEMENT STATES SEND APPLICATIONS TO THE U.S. NUCLEAR REGULATORY COMMISSION ONLY IF THEY WISH TO POSSESS AND USE LICENSED MATERIAL IN STATES SUBJECT TO U.S. NUCLEAR REGULATORY COMMISSION JURISDICTIONS.

1. THIS IS AN APPLICATION FOR (Check appropriate item)

- A. NEW LICENSE
- B. AMENDMENT TO LICENSE NUMBER
- C. RENEWAL OF LICENSE NUMBER 45-09599-03

2. NAME AND MAILING ADDRESS OF APPLICANT (Include ZIP code)

Old Dominion University
Environmental Health and Safety Office
Hughes Hall, Room 2061
Norfolk, Virginia 23529

3. ADDRESS WHERE LICENSED MATERIAL WILL BE USED OR POSSESSED

Old Dominion University
Hampton Boulevard
Norfolk, Virginia 23529

4. NAME OF PERSON TO BE CONTACTED ABOUT THIS APPLICATION

Derek S. Krepp

TELEPHONE NUMBER

(757) 683-4495

SUBMIT ITEMS 5 THROUGH 11 ON 8-1/2 X 11" PAPER. THE TYPE AND SCOPE OF INFORMATION TO BE PROVIDED IS DESCRIBED IN THE LICENSE APPLICATION GUIDE

5. RADIOACTIVE MATERIAL

a. Element and mass number, b. chemical and/or physical form, and c. maximum amount which will be possessed at any one time.

6. PURPOSE(S) FOR WHICH LICENSED MATERIAL WILL BE USED.

7. INDIVIDUAL(S) RESPONSIBLE FOR RADIATION SAFETY PROGRAM AND THEIR TRAINING EXPERIENCE.

8. TRAINING FOR INDIVIDUALS WORKING IN OR FREQUENTING RESTRICTED AREAS

9. FACILITIES AND EQUIPMENT.

10. RADIATION SAFETY PROGRAM.

11. WASTE MANAGEMENT.

12. LICENSE FEES (See 10 CFR 170 and Section 170.31)

FEE CATEGORY Exempt (170.11) AMOUNT ENCLOSED \$

13. CERTIFICATION (Must be completed by applicant) THE APPLICANT UNDERSTANDS THAT ALL STATEMENTS AND REPRESENTATIONS MADE IN THIS APPLICATION ARE BINDING UPON THE APPLICANT

THE APPLICANT AND ANY OFFICIAL EXECUTING THIS CERTIFICATION ON BEHALF OF THE APPLICANT, NAMED IN ITEM 2, CERTIFY THAT THIS APPLICATION IS PREPARED IN CONFORMITY WITH TITLE 10, CODE OF FEDERAL REGULATIONS, PARTS 30, 32, 33, 34, 35, 36, 39, AND 40, AND THAT ALL INFORMATION CONTAINED HEREIN IS TRUE AND CORRECT TO THE BEST OF THEIR KNOWLEDGE AND BELIEF.

WARNING: 18 U.S.C. SECTION 1001 ACT OF JUNE 25, 1948 82 STAT. 749 MAKES IT A CRIMINAL OFFENSE TO MAKE A WILLFULLY FALSE STATEMENT OR REPRESENTATION TO ANY DEPARTMENT OR AGENCY OF THE UNITED STATES AS TO ANY MATTER WITHIN ITS JURISDICTION.

CERTIFYING OFFICER - TYPED/PRINTED NAME AND TITLE

Mohammed A. Karim, Vice President for Research

SIGNATURE

DATE

10-12-05

FOR NRC USE ONLY

TYPE OF FEE	FEE LOG	FEE CATEGORY	AMOUNT RECEIVED	CHECK NUMBER	COMMENTS
			\$		

APPROVED BY

DATE

5. Radioactive Material

5.1 • unsealed sources

A. Any byproduct material with atomic number 1 through 83, with half lives less than 120 days	Any	Not to exceed 150 mCi per radionuclide and 5 curies total
B. Cadmium 109	Any	5 mCi
C. Calcium 45	Any	4 mCi
D. Carbon 14	Any	500 mCi
E. Chlorine 36	Any	5 mCi
F. Hydrogen 3	Any	500 mCi
G. Manganese 54	Any	5 mCi
H. Plutonium 236	Any	5 μ Ci
I. Plutonium 239	Any	5 μ Ci
J. Thorium 229	Any	2 μ Ci
K. Thorium 232	Any	100 μ Ci
L. Uranium 232	Any	1 μ Ci
M. Uranium 236	Solid	15 μ Ci
N. Natural Uranium	Any	100 μ Ci
O. Zinc 65	Any	10 mCi

• sealed sources

A. Cobalt 60	Sealed source	10 mCi
B. Nickel 63	Foils or plated sources	Not to exceed 20 mCi per source and 500 mCi total
C. Cadmium 109	Electroplated sources	20 mCi
D. Tin 119m	Electroplated foils	4 mCi

5.2 Financial Assurance

Old Dominion University shall evaluate its need for a Decommissioning Funding Plan and Financial Assurance in accordance with 10 CFR Parts 30, 40, and 70. Old Dominion University's financial assurance requirement is in Attachment A.

Item 6. Purpose for which licensed material will be used

Radioactive material will be used in research and development, animal studies, in analytical laboratory equipment, and the calibration of instruments.

Item 7. Individuals Responsible for Radiation Safety Program and their Experience

The Radiation Safety Program is under direct administrative control of the Radiation Safety Committee which is a standing committee appointed by the authority of the President of Old Dominion University. An organizational chart is in Attachment B.

7.1 Radiation Safety Committee

The Radiation Safety Committee (RSC) shall consist of at least five members that serve as the final authority in matters pertaining to Old Dominion University's Radiation Protection Program. The RSC meets as often as necessary, but no less than four times a year at intervals not to exceed a calendar quarter. Minutes of the meetings shall be recorded. A quorum consists of the RSC Chair, the Radiation Safety Officer (RSO) and at least two (2) other members.

The duties and functions of the RSC are:

- a. Establish rules, regulations and policies pertaining to Old Dominion University's Radiation Protection Program.
- b. Review applications for possession and use of radioactive material and radiation producing machines.
- c. Establish procedures that ensure persons working with or around radioactive material, and individual members of the public are adequately protected from ionizing radiation.
- d. Review and approve program procedural changes prior to implementation
- e. Review, at least annually, the contents of the Radiation Protection Program to confirm that activities involving ionizing radiation are being conducted safely and in accordance with US NRC regulations and license conditions.
- f. Receive and review periodic reports from the Radiation Safety Officer.
- g. Review instance(s) of alleged infractions of the use of radioactive materials or of safety rules with the Radiation Safety Officer. Take the necessary action to correct such infractions.

- h. Report annually to an administrative officer of at least Vice President status.

7.1.a Criteria used by the RSC for approving new users and new uses of radioactive materials.

Individuals proposing to use radioactive materials in research must demonstrate adequate training and experience in the use of materials commensurate with their request.

Applications to use these materials is made on forms, either hard copy or electronic, to the Radiation Safety Committee. Form RSO-1, Application for Authorized or Qualified User Status, in Attachment C, is submitted for review of training and experience. Form RSO-2, Application for Possession and Use of Radioactive Material, in Attachment D, is submitted for review of the investigator's proposed use. The RSO-2 includes: the radionuclides, form and possession quantity; estimates of types and quantities of waste generated; protocol for use; list and diagram of facilities and equipment; others to be working with the materials; security and accountability of radioactive material; survey frequency; and certification regarding compliance with rules and procedures.

Categories of users are:

- **Authorized User** - An Authorized User is a faculty member with training and experience in the use of radioactive materials in research. They may possess and use radioactive materials under conditions in their authorization approved by the Radiation Safety Committee. The Authorized User is responsible for proper use and storage of radioactive materials in accordance with Old Dominion University procedures and regulations. An Authorized User may supervise and employ Qualified Users that have been approved by the RSC and Restricted Users.
- **Qualified User** - A Qualified User is a student or technical employee with adequate training and experience in the use of radioactive materials. This individual works under supervision of an Authorized User and may independently use radioactive material in protocols approved in the Authorized Users permit-
- **Restricted User** - A Restricted User is an individual that has come into a lab and hasn't had radiation safety training at Old Dominion University. This individual may only use radioactive material under direct (being present) supervision of the Authorized User. The Authorized User must inform Radiation Safety in writing of the name of the Restricted User and what procedures will be supervised.

The Chairman, Radiation Safety Officer and at (2) other Radiation Safety Committee members review the applications. Between regularly scheduled meetings, review may be done by inter-office mail and telephone. Applications will be approved if the reviewers are satisfied that the applicant:

- a. Has adequate training and experience to safely conduct the proposed use, b. Possesses adequate facilities and equipment for the proposed use,

- c. Has safe and effective operating, handling, security, accountability, survey and emergency procedures.
- d. Conforms to all applicable procedures and regulations regarding safe use of radionuclides.

7.1.b Procedure and program changes

The Radiation Safety Committee may approve changes to the Radiation Safety program and procedures as long as:

- a. The proposed revision has been documented, reviewed by the RSC, and approved,
- b. The revision does not change license conditions or diminish effectiveness of the Radiation Safety Program,
- c. The proposed revision is consistent with accepted health physics practices,
- d. Training is provided to staff and users prior to implementation, and the revision is evaluated for effectiveness.

7.2 Radiation Safety Officer

The Radiation Safety Officer is Derek S. Krepp.

Minimum training and experience for the Radiation Safety Officer position include a Bachelor of Science in Health Physics, Radiation Health, Radiological Physics, Physics, or a physical science and have 5 or more years of professional experience in health physics including at least two years experience as an Assistant Radiation Safety Officer on a Type A license of broad scope. The Radiation Safety Officer (RSO) is appointed by the authority of the President of Old Dominion University. The primary mission of the RSO is to execute the policies and procedures established by the Radiation Safety Committee (RSC), and to ensure compliance with applicable Federal and State regulations. The RSO falls under the supervisory and administrative control of the Director of Environmental Health and Safety, but reports directly to the RSC for matters of radiation safety concern.

Duties and responsibilities of the Radiation Safety Officer are:

- a. Monitoring and surveys of all areas in which radioactive material is used
- b. Oversight of ordering, receipt, surveys, and delivery of byproduct material.
- c. Packaging, labeling, surveys, etc., of all shipments of radioactive material leaving Old Dominion University.
- d. Personnel monitoring program, including determining the need for and evaluating bioassays, monitoring personnel exposure records, and developing corrective actions for exposures approaching maximum permissible limits.

- e. Training authorized, qualified and restricted users and ancillary personnel.
- f. Waste disposal program.
- g. Inventory and leak tests of sealed sources.
- h. Decontamination.
- i. Investigating any incidents and responding to any emergencies involving radioactive material.
- j. Maintaining all required records.

The Radiation Safety Officer Delegation of Authority is in Attachment E.

Item 8. Training for Individuals Working In or Frequenting Restricted Areas.

The Radiation Safety training program encompasses two primary groups. First, individuals that will actually handle and use radionuclides in the laboratory (i.e., users with potential to receive greater than 100 mrem per year) and second, ancillary staff that may have need to enter restricted areas for maintenance, housekeeping or other reasons. Training is provided via lecture, demonstration, videotape, on-line, self-study, or combination emphasizing applied aspects of radiation safety.

8.1 Radioactive material users

Proposed users must satisfactorily complete a seven-hour training session (lecture, demonstration, videotape) regardless of prior training and experience. Satisfactory completion is based on a written test score at the end of the course. The course includes a homework handout to reinforce information presented during the first day of the course. Topics in the user training include:

- a. Discovery of radioactivity and radiation
- b. Atomic structure, atomic notation, and isotopes
- c. Radioactivity
- d. Alpha radiation
- e. Beta radiation, beta decay, beta particle energy, beta particle range
- f. Bremsstrahlung radiation
- g. Positron emission
- h. Electron-capture
- i. X-ray and gamma radiation, shielding, time, inverse square law
- j. Internal conversion

- k. Radiation characteristics: half-life, activity, dose units, biological half-life
- l. Sources of exposure
- m. Occupational dose limits
- n. Allowable limit on intake, derived air concentration
- o. Personnel monitoring
- p. ALARA
- q. Biological effects
- r. Radiation detection and instrumentation
- s. Laboratory procedures: user categories, sign and labels, personnel protection, ordering, receipt, waste disposal, inventory, security, corrective action protocol, radiation versus contamination and emergency procedures.

8.2 Ancillary staff

Ancillary staff (security, housekeeping, maintenance) receives general radiation safety training with emphasis on topics applicable to the respective skill group. Topics covered for each group include: types of radiation, sources of radiation, radiation versus contamination, signs and labels, radiation detection demonstration, and emergency procedures. Added topics may include: package labels, radioactive waste containers, plumbing precautions, fume hood use, and accident response or issues requiring special emphasis.

8.3 Refresher training

Refresher training for ancillary staff is performed annually and is essentially a repeat of their initial training due to the potential turnover of staff. When applicable, special interest subjects are included. Refresher training for individuals that use radioactive materials will be conducted at least biennially, however, more frequent training may be required if deemed necessary by the Radiation Safety Officer.

Instructors are the Radiation Safety Officer and the Associate Director of Environmental Health Safety. Each has completed academic training at the Bachelor of Science level and at least 40 hours of formal radiation safety training beyond their on-the-job training. The Radiation Safety Officer will be responsible for conducting radiation safety training for users as well as ancillary staff. The Associate Director of Environmental Health and Safety may conduct radiation safety training for ancillary staff, and/or refresher training for users of material.

8.4 Training program revision

The Radiation Safety training program may be revised as long as:

- a. The revision is documented, reviewed and approved by the RSC,

- b. The revision doesn't change license conditions, and
- c. Radiation Safety staff implement the revision.

Changes in method of presentation, such as new electronic media, or topic order may be made without RSC approval as long as the topic content remains consistent.

9. Facilities and equipment

Laboratories designated for work with radioactivity are classified according to the IAEA Safety Standard, "Safety Series 1, Safe Handling of Radionuclides, 1973 Edition." Individual lab classification is based on the radionuclide in use, the chemical form, activity and the physical facility features. Most laboratories are Type C handling radiotoxicity Groups 3 and 4 materials.

Laboratories and areas where radioactive material is used or stored are clearly marked with radiation signs. A generic laboratory diagram is in Attachment F. Each laboratory or area has a door with a lock to restrict access and secure hazardous material. A typical laboratory has benches, a vinyl floor, at least one sink, a chemical fume hood, and cabinetry. Bench tops are composed of Formica, stone-like material or other composite stone materials. Floors are composed of vinyl tile or cement. Cement floors have sealant applied to prevent radioactive materials from leaching into the floor in case of a spill. In areas where radioactive material is used, benches are covered with plastic backed absorbent paper and acrylic or lead shields are used, where applicable, to protect workers and reduce exposure rate in the laboratory. Stock radioactive materials are stored in their shielded shipping containers. Emergency eyewash and safety showers are in hallways adjacent to the laboratories or work area. The buildings are equipped with audible and visual fire alarms and fire drills are held occasionally. Chemical fume hoods flow rates are measured and recorded during quarterly laboratory surveys. Fume hood flow rates must be 100 ± 20 linear feet per minute with the sash at working height.

Use of Radionuclides Aboard Research Vessels

Radionuclides may be used in research projects aboard research vessels anywhere in the United States where the U.S. Nuclear Regulatory Commission maintains jurisdiction for regulating the use of licensed material. Users must be granted specific authorization to do so by the RSC.

Radionuclides transferred to the research vessel must be in a properly labeled container or containers displaying DOT labels as required by Title 49, CFR. Only a member of the Environmental Health and Safety/Radiation Safety Office staff or the Authorized User may transport the material to and from the vessel. Proper documentation must accompany each transfer to and from the vessel.

Standard procedures to prevent the spread of contamination (e.g., the use of absorbent surface coverings and containment trays) will be employed as needed and feasible. Additionally, the user will have available on the cruise a quantity of absorbent material sufficient to contain and cleanup a spill of the stock solution and/or radiolabeled media.

Personal protective equipment (such as vinyl or latex gloves) will be employed during the use of radionuclides. Radiolabeled samples that will be returned to the University for laboratory analysis will be placed in appropriately labeled containers. Radioactive waste that will be returned to the University will be placed in separate appropriately labeled containers. Additional conditions may be imposed by the RSC if deemed necessary.

Care and Handling of Animals Used in Laboratory Research

- a. Rabbits, rats, and mice are the only animals used in research involving the use of radionuclides.
- b. Radionuclides and maximum activities to be injected:

Radionuclide	Maximum activity injected
H-3	≤ 1.0 mCi
C-14	≤ 1.0 mCi
S-35	≤ 1.0 mCi
Cl-36	≤ 0.1 mCi
Fe-59	≤ 1.0 mCi
I-125	≤ 0.1 mCi

- c. The Animal Facility is located on the fourth floor of the Mills Godwin Life Sciences Building, 4438 Hampton Boulevard. The facility is secured when left unattended. Access to the floor is restricted to authorized personnel only. The elevator is keyed. Key issuance is limited to authorized personnel only. The door in the stairwell is locked at all times when the Animal Facility is left unattended.

The Director of the Animal Facility approves the issuance of keys to the facility. Keys to the Animal Facility are not on a master.

Special Use Facilities

- a. The maximum quantity of radioiodine Old Dominion University expects to authorize for use at any one time and location is 10 mCi. Iodination procedures are not, and will not be performed at Old Dominion University. The majority of the radioiodine being used will be small quantities of bound iodine in readily available in radioimmunoassay kits.
- b. List of alpha emitters (in un-encapsulated form) used, and the maximum activity used in an individual experiment:

Alpha emitting radionuclide	Maximum activity per experiment
Th-229	<1000 dpm (4.50×10^{-4} μ Ci)
Th-232	<1000 dpm (4.50×10^{-4} μ Ci)
U-232	<1000 dpm (4.50×10^{-4} μ Ci)
U-234	<1000 dpm (4.50×10^{-4} μ Ci)
U-235	<1000 dpm (4.50×10^{-4} μ Ci)
U-236	<1000 dpm (4.50×10^{-4} μ Ci)
U-238	<1000 dpm (4.50×10^{-4} μ Ci)
Po-208	<1000 dpm (4.50×10^{-4} μ Ci)
Po-209	<1000 dpm (4.50×10^{-4} μ Ci)
Po-210	<1000 dpm (4.50×10^{-4} μ Ci)

The alpha emitting radionuclides previously mentioned are used as yield tracers in the determination of levels of that particular radionuclide in environmental samples. Because of the extremely low levels at which these radionuclides are used, minimum acceptable facilities are similar to a typical "Type C" laboratory as described in the renewal application, i.e., fume hood(s), available survey meter(s), available contamination monitor(s), gloves and lab coats.

- c. No one experiment will involve the use of ≥ 100 mCi of any radioisotope in un-encapsulated form in any individual laboratory.

10. Radiation Safety Program

10.1 Audit Program

10.1.a Management and Radiation Safety Committee Audits

Old Dominion University has an independent consultant audit the Radiation Safety Program annually to ensure executive management's knowledge of NRC regulations, the provisions of the license, and the compliance status of Old Dominion University's licensed program. The audits may included but are not limited to review of documentation, tours of selected facility areas and meetings with the RSC and/or RSO and the Vice President of Research. A report of the findings will be distributed to members of the RSC and the Vice President of Research for review.

10.1.b Internal Audits

Authorized Users of radioactive material have a responsibility to Old Dominion

University to comply with University policy and US NRC regulations and license conditions. By complying, they help ensure that the University's broad scope license to possess radioactive materials remains in good standing with the NRC, allowing ongoing research to continue.

The Radiation Safety Committee, recognizing the need for an administrative mechanism to expedite User compliance with University policies and procedures, developed the Corrective Action Protocol. This protocol is designed to formally document violations of policy and/or procedures, and provide the Committee and the user a mechanism to take corrective action as needed.

The Corrective Action Protocol can be invoked at the discretion of the Radiation Safety Officer. The Corrective Action Protocol is implemented through the Radiation Safety Office who performs quarterly audits of laboratories permitted to use radioactivity. Random checks are also conducted to verify security of radioactive material. The evaluations typically include a contamination and area survey, where appropriate, a check of surveys conducted by the laboratory staff, and observation of radiation safety practices by the lab staff. A report of the evaluation is sent to the principal investigator listing findings from the evaluation.

The Corrective Action Protocol consists of four steps. In most cases, violators will start at step one of the protocol, however, in cases of a more serious nature, step one (and possibly step two) may be bypassed. In instances of falsification of records, misrepresentation of actions and/or endangerment of radiation workers and individual members of the public, step four of the protocol will be invoked immediately.

The following is a description of each step of the protocol:

Step I - The User is sent a Corrective Action Report outlining the nature of the violation, and the corrective action suggested by the Radiation Safety Office. A copy is sent to the Chair of the Radiation Safety Committee for review and comment. The Corrective Action Report requires the User to specify the steps that will be taken to prevent a reoccurrence of the deficiency and allows the User to comment if he/she deems necessary.

Step II - The Chair of the User's department is sent a letter outlining the repeated nature of the violation. A copy of the step one letter, and any accompanying documentation will also be sent. Copies are sent to the Chair of the Radiation Safety Committee and to the User for review and comment. The Department Chair is encouraged to comment, as he/she deems necessary.

Step III - The Dean of the academic school to which the User belongs, is sent a letter outlining the repeated nature of the violation. A copy of the step one and two letters, and any accompanying documentation is also sent. Copies are sent to the Chair of the Radiation Safety Committee and to the User for review and comment. The Dean is encouraged to comment, as he/she deems necessary.

Step IV - The User is asked to meet with the Radiation Safety Committee at which time the Committee will decide the what further disciplinary action(s) are appropriate.

It is understood that the Radiation Safety Officer has the authority to immediately terminate an activity that is considered unsafe without going through these steps.

10.1.c Audit program changes

The Radiation Safety Committee may approve changes to the audit RSO program and procedures as long as:

- a. The proposed revision has been documented, reviewed by the RSC, and approved,
- b. The revision does not change license conditions or diminish effectiveness of the Radiation Safety Program,
- c. The proposed revision is consistent with accepted health physics practices,
- d. Training is provided to staff and users prior to implementation, and the revision is evaluated for effectiveness.

10.2 Instruments

Portable and laboratory instruments used to perform radiation surveys and assay radioactivity include:

- a. Liquid scintillation counter, Packard Tri-Carb 2300TR
- b. Gamma scintillation counter, Beckman Gamma 5500
- c. 2" x 2" NaI multi-channel analyzer
- d. Ludlum Model 3 survey meter with model 44-9 pancake GM detector (2)
- e. Ludlum Model 3 survey meter with model 44-3 NaI detector – (3)
- f. Ludlum Model 19 with NaI detector (micro-R meter)
- g. Ludlum Model 3 with 44-7 Thin End Window GM detector
- h. Eberline Model E-520 with model HP-270 energy compensated GM detector
- i. Ludlum X-ray/Gamma Radiation Survey Meter, model 36100

Investigators also have survey instruments that are calibrated by or through Radiation Safety.

The RSC and RSO evaluate the type of radiation detection instrumentation necessary for a laboratory based on the type and energy of radiation emitted by radionuclides in

the users application. Since most radionuclides used in this license are low energy beta particle emitters, a laboratory needs access to a liquid scintillation counter. There are a number of liquid scintillation counters available to users in the various departments, as well as one in the Radiation Safety Office. In the case of higher energy beta emitters, the laboratory also needs access to a portable survey meter (GM detector) to monitor during and after each use. Laboratories using radionuclides emitting gamma rays or photons after electron capture must have access to a gamma counter and also have a portable survey meter available.

The portable survey meter can have a GM or NaI scintillation (thin crystal) detector, GM detector for beta (except H-3) and gamma detection and NaI scintillation detector for low energy gamma detection. The Radiation Safety Office has several portable GM, scintillation, and ion chamber instruments available for surveys or incident situations.

A list of portable survey instruments is maintained in a database that identifies the instrument, model, location, and when calibration is due. When due for annual calibration, the Radiation Safety Office picks up the instrument and makes a replacement available while it's being calibrated.

● **Instrument calibration**

In house pulse calibration is performed on instruments used for surface contamination surveys in accordance with instructions in the Ludlum Model 500 Pulser technical manual and instrument technical manual. For each instrument scale with a calibration potentiometer, the reading is adjusted to read the conventionally true value at approximately 80% of full scale, and the reading at approximately 20% of full scale shall be observed. Readings shall be within $\pm 20\%$. Survey instruments that are pulse calibrated are also calibrated against known sources of C-14, Sr-90, or I-129 to determine efficiency for types of radiation and energies that the instrument will be used to measure.

Instruments used to measure exposure or exposure rate are sent out to a commercial vendor licensed by NRC or an agreement state to perform radiation detection instrument calibrations. A record of calibration results for each instrument is retained in file and a tag is attached to each instrument indicating when it was calibrated.

Old Dominion University requires the following information on file from vendors:

- A copy of the vendor's license.
- A copy of the vendor's calibration procedures or a letter from the vendor stating that their calibration procedures meet acceptable US NRC criteria, i.e., the criteria set forth in US NRC Regulatory Guide 10.8, Appendix B (August 1987).

10.3 Material Receipt and Accountability

Procurement of radioactive material is through the University Purchase Order and Purchase Requisition System or the Old Dominion University Research Foundation Purchase Order and Requisition System.

All orders that include radioactive materials are sent to the Environmental Health and Safety Office/Radiation Safety Office for verification by the Radiation Safety Officer of the user's authorization to possess and use the radionuclide ordered. The RSO also ensures that the activity ordered is within the limits specified on the University's byproduct materials license.

Vendors are directed to ship radioactive materials to the Environmental Health and Safety Office/Radiation Safety Office. The RSO or a qualified staff member receives, opens and conducts any survey as required by 10 CFR 20.1906. The procedures for receiving, and opening packages containing radioactive material are documented and maintained by the RSO.

A form, Radioactive Material Receipt Record, RSO-5, in Attachment G, is used during check in. After check in, the package is delivered to the users laboratory where the RSO-5 form is signed to acknowledge receipt. The form is returned to the Radiation Safety Office to update the database and file in the users folder. A Radioactive Material Use and Disposal Log form, RSO-24, in Attachment H, is also delivered to the user at the same time. This form provides an ongoing record of use and is used to complete the semi-annual inventory required by the Radiation Safety Office. The RSO-24 form also serves as a record of transfer to another investigator, if approved by the Radiation Safety Officer.

An inventory of radioactive material is performed every six months. Upon receipt of the users semi-annual inventory, it is reconciled with the Radiation Safety Authorized User database.

10.3.a Transferring radioactive material

Radioactive material may be transferred to another Authorized User within Old Dominion University that is authorized to possess and use that specific radionuclide. To transfer material the transferor completes the transfer section of the RSO-24 and then sends it to the Radiation Safety Office for approval. If approved, the RSO will sign the approval section and the material may be transferred to the recipient who then signs the RSO-24 acknowledging receipt of the material. Each party receives a copy of the RSO-24 for inventory and accountability purposes.

For transfers outside Old Dominion University, Radiation Safety will contact the proposed recipient to verify either NRC or an Agreement state has issued a license to them to receive and possess the specific radionuclide. Radiation Safety will pack and label the material in accordance with DOT, NRC, US Postal Service Regulations, or international shipping regulations. A packing list will accompany the shipment.

10.3.b Material receipt and accountability revisions

The Radiation Safety Committee may approve changes to receipt and accountability procedures as long as:

- a. The proposed revision has been documented, reviewed by the RSC, and approved,

- b. The revision does not change license conditions or diminish effectiveness of the Radiation Safety Program,
- c. The proposed revision is consistent with accepted health physics practices,
- d. Training is provided to staff and users prior to implementation, and the revision is evaluated for effectiveness.

10.4 Occupational Dose

Personnel monitoring is used to demonstrate employee doses are in compliance with occupational dose limits in 10 CFR 20. Monitoring may consist of dosimeters to measure external dose or bioassays to determine dose equivalent due intake of radioactive material. The requirement to monitor an individual is determined during review of their proposed use of radioactivity or radiation producing devices. Monitoring worker's dose is accomplished with whole body and extremity dosimetry provided by a National Voluntary Laboratory Accreditation Program approved dosimetry service.

Dosimeters are issued for one or three months to:

- a. Adults and minors likely to exceed 10% annual dose equivalent limits,
- b. Declared pregnant women likely to receive during the entire pregnancy, from occupational exposures, a deep dose equivalent in excess of 0.1 rem, and
- c. Individuals entering high or very high radiation areas.

On occasion, a monitor may be issued to individuals not likely to require monitoring as a result of their request.

Monitoring for internal exposure is performed where it is likely that an individual could receive in one year an intake of a radionuclide in excess of 10% of the ALI's in Appendix B, Table 1, 10 CFR 20. Bioassay is performed by assaying excreta or by direct measurement such as thyroid counting. Bioassays may be performed for other radionuclides when there is suspected intake due to an incident.

Each use of radioactive materials is conducted utilizing adequate procedures, controls and devices to keep personnel exposures as low as reasonably achievable. No person is permitted to receive a radiation dose in excess of the doses specified in 10 CFR 20, Subpart C. No individual member of the public is permitted to receive a radiation dose (or be exposed to a dose rate) exceeding those specified in 10 CFR 20.1301.

The requirement for bioassays will be determined by the RSC when evaluating applications for the possession and use of radioactive materials. NRC Regulatory Guide 8.9, "Acceptable Concepts, Models, Equations, and Assumptions for a Bioassay Program" will be used as guidance for determining the relevance of a particular bioassay program.

NRC Regulatory Guide 8.20, "Applications of Bioassay for I-125 and I-131" will be used as guidance when determining the need for bioassay when evaluating applications

involving the use of radioiodine, and radioiodine labeled compounds.

Individuals involved in operations using tritium (hydrogen-3) in quantities exceeding 10 mCi per month will have bioassays performed at the frequency suggested in NRC Regulatory Guide 8.32, "Criteria for Establishing a Tritium Bioassay Program."

In the event a bioassay measurement indicates internally deposited radioactive material, additional bioassay measurements will be obtained. If initial bioassay measurements indicate an intake greater than 0.02 ALI, at least two bioassay measurements will be taken to evaluate the intake. If the intake is estimated to be greater than 0.1 ALI, a complete investigation will include adequate measurements with documentation to estimate an internal dose equivalent.

10.4.a Personnel dosimetry program revision

The Radiation Safety Committee may approve changes to the personnel dosimetry program and procedures as long as:

- a. The proposed revision has been documented, reviewed by the RSC, and approved,
- b. The revision does not change license conditions or diminish effectiveness of the Radiation Safety Program,
- c. The proposed revision is consistent with accepted health physics practices,
- d. Training is provided to staff and users prior to implementation, and the revision is evaluated for effectiveness.

10.5 Safe Use of Radionuclide and Emergency Procedures

10.5.a Rules and Procedures for Laboratory Personnel

Radioactive material may only be handled by individuals authorized by the Radiation Safety Committee according to approved permit in designated areas. Radiation Office staff may handle radioactive materials using accepted health physics practices and procedures.

General rules and procedures that apply to all use of radioactive material are:

- Wear a lab coat or other protective clothing at all times when working with radioactive materials. Remove the lab coat before leaving the lab area-
- Wear disposable gloves, when handling radioactive material. Change gloves frequently to prevent spread of contamination. Remove gloves at the work area. Do not touch faucets, light switches, or common use items with contaminated or potentially contaminated gloves.
- After procedures or before leaving the area, monitor hands, feet and clothing in a low background area.

- Do not eat, drink, smoke or apply cosmetics in any area where radioactive material is used or stored.
- Use mechanical pipetting devices. Do not pipette by mouth. Contamination control.
- Designate an area in the lab to conduct work with radionuclides. Place plastic backed absorbent material on the bench and place radiation tape on the boundary of the absorbent material.
- Mark equipment and lab ware used for work with radioactivity with radiation tape to indicate it may contain contamination.
- Designate a sink for cleaning contaminated glassware. Notify Radiation Safety so a tag can be placed on the sink trap to alert Maintenance to the need for monitoring and protective procedures prior to and during repair work.
- Place radioactive material labels on storage areas such as refrigerators, freezers or storage areas. Ensure that containers with radioactive material are clearly marked with a radiation labels that identifies the radionuclide, quantity and date.
- Perform surveys in accordance with requirements of their approved protocols and the procedures in the "Surveys" section.

Personnel monitoring and area monitoring

If issued radiation monitoring device(s), wear it at all times when in radioactive materials storage or use areas. If the dosimeter is lost immediately notify Radiation Safety.

Use of protective equipment

- When using unsealed beta emitting radionuclides with energies greater than 250 keV, place an acrylic, or equivalent, shield between you and the source. The shield should be at least $\frac{1}{4}$ inch thick. Additional shielding may also be necessary behind the source to prevent exposure to coworkers on the other side of the bench.
- Use protective eyewear when pipetting liquids containing radioactivity.
- Respirators can only be used for protection from airborne radioactivity if approved by Radiation Safety. Work practices do not indicate a need for respiratory protection; however, if needed, a respiratory protection program based on OSHA 29CFR1910.134 is in place.

10.5.b. Emergency procedures

Persons likely to respond to an emergency involving radioactive material, i.e., Radiation Safety Office personnel, Campus Police, users of radioactive material, and ancillary personnel are trained in the essentials of emergency response.

During an emergency involving licensed material, the Radiation Safety Officer will be contacted to act in an advisory role. The Radiation Safety Officer is on call at all times to fulfill this duty.

The campus police, who have jurisdiction on Old Dominion University property are aware of the areas in which radioactive materials are used /stored. Officers who routinely patrol are instructed to inform the Radiation Safety Office of any unusual occurrence or security concern involving radioactive material.

Old Dominion University maintains continuous liaison with the local fire department. The most likely responding station is given a map of the campus, indicating the buildings where radioactive material is used and/or stored. This map is distributed annually, and amended as needed.

Emergency procedures are posted in all restricted areas. A copy of the emergency procedures is in Attachment I.

10.5.c. Revisions to safe use and emergency procedures

The Radiation Safety Committee may approve changes/revisions to safe use and emergency procedures as long as:

- a. The proposed revision has been documented, reviewed by the RSC, and approved,
- b. The revision does not change license conditions or diminish effectiveness of the Radiation Safety Program,
- c. The proposed revision is consistent with accepted health physics practices,
- d. Training is provided to staff and users prior to implementation, and the revision is evaluated for effectiveness.

10.6 Surveys

Radiation and contamination surveys are performed to assure that individuals are not exposed to doses above limits, to prevent spread of contamination, and to reduce the likelihood of internal deposition. Radiation surveys may be performed using various radiation detection instruments or calculations or a combination of both.

Survey frequency is based on the radionuclide group and activity handled at one time. To determine frequency the radionuclide is identified by group, then the activity handled at one time is compared in the survey frequency category to establish the minimum frequency.

Laboratory types correspond to the laboratory classification criteria listed in NUREG-1556, Vol. 11, Appendix S)

Radiotoxicity Group	Laboratory Type		
	Low	Medium	High
1	< 10 μ Ci	10 μ Ci to 1 mCi	>1 mCi
2	< 1 mCi	1 mCi to 100 mCi	>100 mCi
3	< 100 mCi	100 mCi to 10 Ci	>10 Ci
4	< 10 Ci	10 Ci to 1000 Ci	>1000 Ci

Radionuclide Groups (only representative radionuclides are listed that correspond to those used in this license. Others radionuclides in each group are the same as those listed in NUREG-1556, Vol. 11, Appendix S)

Group 1	Pb-210 Po-210 Ra-226 U-234 Pu-238
Group 2	Na-22 Cl-36 Ca-45 Mn-54 Co-60 Sr-90 Sb-125 I-125 Cs-137 U-236
Group 3	C-14 P-32 P-33 S-35 Cr-51 Fe-59 Co-57 Ni-63 Cd-109 Eu-155
Group 4	H-3 I-129 Th-232 U-235 U-238 U-Nat

Survey Frequency Category

Laboratory Classification*	Survey Frequency
High	Daily
Medium	Weekly
Low	Monthly

Ambient radiation surveys are conducted in and adjacent to areas where there is a potential to expose members of the general public or when it is likely that the exposure rate could exceed limits set forth in 10 CFR 20.1301(a)(1) and (2), and 10 CFR 20.1301(b).

Contamination surveys are required at least monthly by all labs since the main use is Groups 3 and 4 radionuclides with activity in the range 250 μ Ci to 1 mCi.

To evaluate removable contamination, a dampened filter paper or cotton swab is wiped over an area of approximately 100cm² then placed in a vial and prepared for either liquid scintillation counting or gamma scintillation counting. Results of the monitoring are recorded on a diagram of the lab or area with locations marked and in units of dpm or uCi. Fixed contamination is surveyed with a radiation detection instrument appropriate for the radionuclide present.

For removable contamination, an action level of 100cpm above background is established for restricted and unrestricted areas above which, decontamination must be done and then another survey conducted to evaluate effectiveness of decontamination. In unrestricted areas, the area is decontaminated until removable contamination is at background levels then the area is monitored for fixed contamination. Additional decontamination is performed, including destructive processes, until the contamination is removed. In restricted areas, fixed contamination may be shielded and allowed to decay or a destructive procedure may be applied to remove the contamination.

In addition to monthly surveys conducted by the laboratory staff, Radiation Safety conducts quarterly laboratory surveys for contamination and evaluation of radiation safety procedures. These surveys are documented on a diagram and indicate survey results at various locations in the lab. Wipes are generally done on the floor, bench tops, refrigerator, incubators and water baths, and other lab equipment. Labs are informed of locations with greater than 100cpm and directed to decontaminate and re-survey.

10.6.a. Leak test procedures

Leak tests of applicable sealed sources will be conducted at least every six months by the Radiation Safety Officer and Radiation Safety staff by using the model leak test program published in Appendix T of NUREG-1556, Volume 11, "Program Specific Guidance About Licenses of Broad Scope."

Leak tests are not required if:

- sources contain only H-3;
- sources contain only byproduct material with a half-life less than 30 days;
- sources contain only a radioactive gas;
- sources contain 100 ~Ci or less of beta or gamma emitting material or 10 ~Ci or less of alpha emitting material;
- sources are stored and are not being used (must be leak tested before use or transfer).

10.6.b. Revision to survey and leak test procedures

The Radiation Safety Committee may approve changes to a survey and leak test procedures as long as:

- a. The proposed revision has been documented, reviewed by the RSC, and approved,
- b. The revision does not change license conditions or diminish effectiveness of the Radiation Safety Program,
- c. The proposed revision is consistent with accepted health physics practices,
- d. Training is provided to staff and users prior to implementation, and the revision is evaluated for effectiveness.

11. Waste Management

The radioactive waste management program includes several disposal methods: decay-in-storage, liquid disposal into the sanitary sewer, transfer to an authorized vendor, and incineration. Old Dominion University does not incinerate or compact waste containing licensable quantities of radioactive materials. All radioactive waste generated at Old Dominion University is disposed through and by Radiation Safety. Liquid disposal is conducted at one location in Mills Godwin Life Science Building, Room 205. Radiation Safety stores waste in Hughes Hall, Room 2053 and a 350 square foot waste storage facility. The waste storage facility is locked when unattended and is surrounded by an 8-foot high fence with barbwire.

Radioactive waste generators are required to segregate their waste by radionuclide, physical form (solid, liquid, liquid scintillation vial, or carcasses), and half-life, place the waste in labeled containers and store it in a secure area. Liquid waste is generally collected in 1-gallon polyethylene containers and the pH is adjusted to 6-8 to comply with local POTW regulations. Solid waste is generally collected in 15-gallon waste can with poly liner. Liquid scintillation vials are put back in their shipping boxes for collection. Animal carcasses are placed in double poly bags, labeled, and frozen until picked up by Radiation Safety. Radiation Safety collects carcasses and stores them in a chest freezer in the Environmental Health & Safety Office's waste storage facility.

11.a. Waste disposal procedures.

To dispose of waste, a generator completes a form (RSO-50), in Attachment J, that requires identification of the waste by radionuclide, activity, physical or chemical form and additional hazards such as flammable material, carcinogens, etc. The form is sent to Radiation Safety where it is reviewed and a pick up is scheduled. The waste is picked up, returned to Radiation Safety, logged in, and stored pending disposal. The waste form serves as documentation of the radionuclide and activity disposed. Laboratory personnel are instructed how to determine the activity in the solid and liquid components of their waste during attendance at the "Radiation Safety in the Laboratory" class.

11.a.1. Solid Waste

Solid radioactive waste with half-lives less than or equal to 120 days is segregated by physical half-life and placed in drums in the waste storage facility. Waste meeting this requirement will be managed in accordance with 10 CFR Part 35.92.

1. Waste bags with distinct numbers containing radionuclides with the same half-life are placed in a drum. The drum is numbered and the drum number, bag number and contents are recorded in the waste log notebook.
2. The contents of the drum are allowed to decay until the radiation exposure rate cannot be distinguished from background radiation levels.
3. Prior to disposal as ordinary trash, each bag within a drum is opened in an area of low background and the contents placed in a plastic bin, then monitored with an appropriate survey instrument to detect residual radioactivity. Measurements will be taken at the bag/containers surface and with no interposed shielding.
4. If the survey of the contents indicates no residual radioactivity (surface readings are indistinguishable from background), the waste is discarded as general trash after defacing or removing radiation labels from items in the container. A dose rate measurement at the surface of the container is taken and recorded on the waste disposal form.
5. If the survey indicates residual radioactivity, the waste is sealed and returned to storage for at least two additional half-lives after which the procedure is repeated.
6. A record is retained for each disposal that includes: the disposal date, the radionuclide, activity, survey instruments used, and initials of the individual performing the surveys and disposing of the waste.

Solid radioactive waste with half-lives greater than 120 days is collected and stored in the Environmental Health and Safety Office's waste storage facility awaiting transfer to an off-site vendor approved by the NRC. This waste is collected after generators submit a waste form, identifying the radionuclide, activity, waste form, and comments about potentially hazardous constituents. Each bag is given a distinct identification number that corresponds to a log entry containing information about the type and activity of the waste. When the waste is prepared for transfer, the identifying information is used to generate the manifest for the shipment.

A record of the transfer includes DOT and other required shipping documents that contain a description of the solid waste.

11.a.2. Liquid waste disposal

Liquid radioactive waste from Old Dominion University is disposed to the sanitary sewer, a public system, by Radiation Safety staff via one sink in the Radiation Safety Office. Mixed wastes are transferred to an authorized vendor for processing and disposal. Initial protocols submitted by investigators are reviewed to identify mixed

wastes then the investigator is consulted to seek alternative compounds to reduce generation of mixed wastes.

Liquid radioactive waste is segregated by radionuclide at the point of generation and placed in one-gallon poly containers that are marked with the radionuclide and activity. Laboratory staffs are instructed to assay the liquid waste to determine the total activity in the container and enter this information on a waste disposal form (RSO-50) that is sent to Radiation Safety.

When picked up and returned to Radiation Safety, an aliquot of the contents is again assayed to determine the total activity in the waste and this is compared with a calculated table of allowable daily discharge limits based on the building daily flow rate and monthly concentrations in 10 CFR 20, Appendix B, Table 2. Compliance with 10 CFR 20.1302(2)(i) is demonstrated by obtaining records of water bills from that location to calculate the average annual concentrations of liquid effluents released.

If the activity is within the calculated daily discharge limit and it is soluble or is biological material that is readily dispersible, the liquid is released into the sanitary sewer. If more than one radionuclide is released, the sums of the ratios of daily discharge limits must not exceed unity.

A record of sanitary sewer releases is retained that includes: the date of disposal, radionuclide, activity concentration, volume, total activity, and initials of the individual releasing the waste.

11.a.3. Animal carcass disposal

Radiation Safety collects animal carcasses containing radioactivity for storage in a chest freezer in Environmental Health and Safety Office's waste storage facility. Carcasses containing radionuclide with half-lives <120 days are managed in accordance 10 CFR 35.92. If the survey readings are not distinguishable from background the carcass is incinerated in a pathological incinerator located in the Mills Godwin Life Science Building. A record is retained indicating the date in storage, monitor reading, date disposed, and initials of the individual performing the survey and disposal. If the readings are above background the carcass is returned to storage for a period equivalent to 2 additional half-lives.

Carcasses containing radionuclides with half-lives >120 days are frozen and stored pending transfer to an authorized vendor.

Appendix A



OLD DOMINION UNIVERSITY

Office of the President

Koch Hall
Norfolk, Virginia 23529-0001
Telephone: (757) 683-3159
FAX: (757) 683-5679

CERTIFICATION OF FINANCIAL ASSURANCE

Principal: Old Dominion University
Hampton Boulevard
Norfolk, VA 23529

NRC license number 45-09599-03

Issued to: U.S. Nuclear Regulatory Commission

I certify that Old Dominion University is licensed to possess the following types of sealed sources or plated foils with a half-life greater than 120 days licensed under 10 CFR Part 30, unsealed byproduct material with a half-life greater than 120 days licensed under 10 CFR Part 30, source material in a readily dispersible form licensed under 10 CFR Part 40, and unsealed special nuclear material licensed under 10 CFR Part 70 in the following amounts:

Type of Material	Amount of Material
Cadmium 109	20mCi
Cobalt 60	10mCi
Nickel 63	500mCi
Tin 119m	4mCi
Thorium 229	2 μ Ci
Thorium 232	100 μ Ci
Uranium 232	1 μ Ci
Uranium 236	15 μ Ci
Uranium (natural)	100 μ Ci
Unsealed byproduct material	
Hydrogen 3	500mCi
Carbon 14	500mCi
Cadmium 109	5mCi
Chlorine 36	5mCi
Calcium 45	4mCi
Manganese 54	5mCi
Zinc 65	10mCi

Unsealed special nuclear material

Plutonium 236	5 μ Ci
Plutonium 239	5 μ Ci

I also certify that financial assurance in the amount of \$225,000.00 will be obtained for the purpose of decommissioning as prescribed by 10 CFR Part 30.35.



Roseann Runte
President, Old Dominion University

[Corporate seal]

October 11, 2005



Koch Hall
Norfolk, Virginia 23529-0001
Telephone: (757) 683-3159
FAX: (757) 683-5679

February 22, 2005

Statement of Intent

Old Dominion University is a state corporation under control of the General Assembly of the Commonwealth of Virginia, §23-49.11, Code of Virginia (1950), as amended. Accordingly, Old Dominion University is a state government licensee as defined in 10 C.F.R. §30.35(f)(4).

I, Roseann Runte, acting in my capacity as President, am authorized by the Board of Visitors of Old Dominion University to issue this Statement of Intent on behalf of Old Dominion University. An excerpt from the Board of Visitors' Bylaws, providing my authority, is attached to this Statement of Intent as Attachment A.

Old Dominion University currently holds NRC License Number 45-09599-03. The referenced license describes the facilities for which this Statement of Intent is provided. A copy of the license is attached to this Statement of Intent as Attachment B.

Should Old Dominion University terminate its license, it is estimated that the decommissioning costs would be \$225,000.00. This figure is based on the table contained in 10 C.F.R. §30.35(d). Old Dominion University reserves the right to re-assess this funding estimate at the time of license termination, should that occur. As a state agency, Old Dominion University is subject to a bi-annual appropriation from the General Assembly. In the event that Old Dominion University decides to relinquish its NRC license, it agrees to request an appropriation from the General Assembly to cover the decommissioning costs sufficiently in advance to prevent any delays in required decommissioning activities.

Roseann Runte
President, Old Dominion University

Date

by the Board. When directed by the Board, the Secretary shall take the minutes of closed meetings and be responsible for the security of draft minutes and audio recordings of closed meetings. The Secretary shall be responsible for ensuring that all Board of Visitors' reports required by the Commonwealth are submitted in a timely manner by the Rector.

§ 5.08. Other Representatives of the Board. From time to time, the Rector may designate a member of the Board, who is not an officer, to represent the Board on special occasions or for special ceremonies. Any member so designated shall be limited in his/her actions on behalf of the Board by the express role delegated by the Board for each occasion. The Rector only shall delegate his/her role as Board spokesperson for policy and other Board matters to other Board officers.

ARTICLE VI University Administrative Officers

§ 6.01. The President. The President of the University is appointed by the Board of Visitors and serves at the pleasure of the Board and may be removed only by an affirmative vote of at least nine voting Board members. The President is the chief executive and academic officer of the University and has direct charge of and is responsible to the Board for the operation of the University. The President shall submit to the Board, in writing, an annual report on the condition of the University.

- (a) Responsibilities of the President include, but are not limited to:
- (1) Providing leadership in the development of the University's mission and programs;
 - (2) Providing leadership for the governance of the University's faculty, all other University employees, and students;
 - (3) Balancing the University's revenues and expenditures, managing the University's funds and other resources, assuring the financial integrity of the University, and reporting the financial condition of the University to the Board, on a regular basis.
 - (4) Managing and personally participating in public and private fund-raising;
 - (5) Managing the University's facilities;
 - (6) Implementing the Policies and Procedures of the Board relating to University operations.
 - (7) Making recommendations to the Board concerning the initial appointment of faculty, the award of tenure to faculty, and the granting of emeritus status;

Financial Assurance Worksheet
for
Source Material

Th-229	2
Th-232	100
U-232	1
U-236	15
U (natural)	100
	218

Financial Assurance Worksheet
for
Sealed Sources and Plated Foils

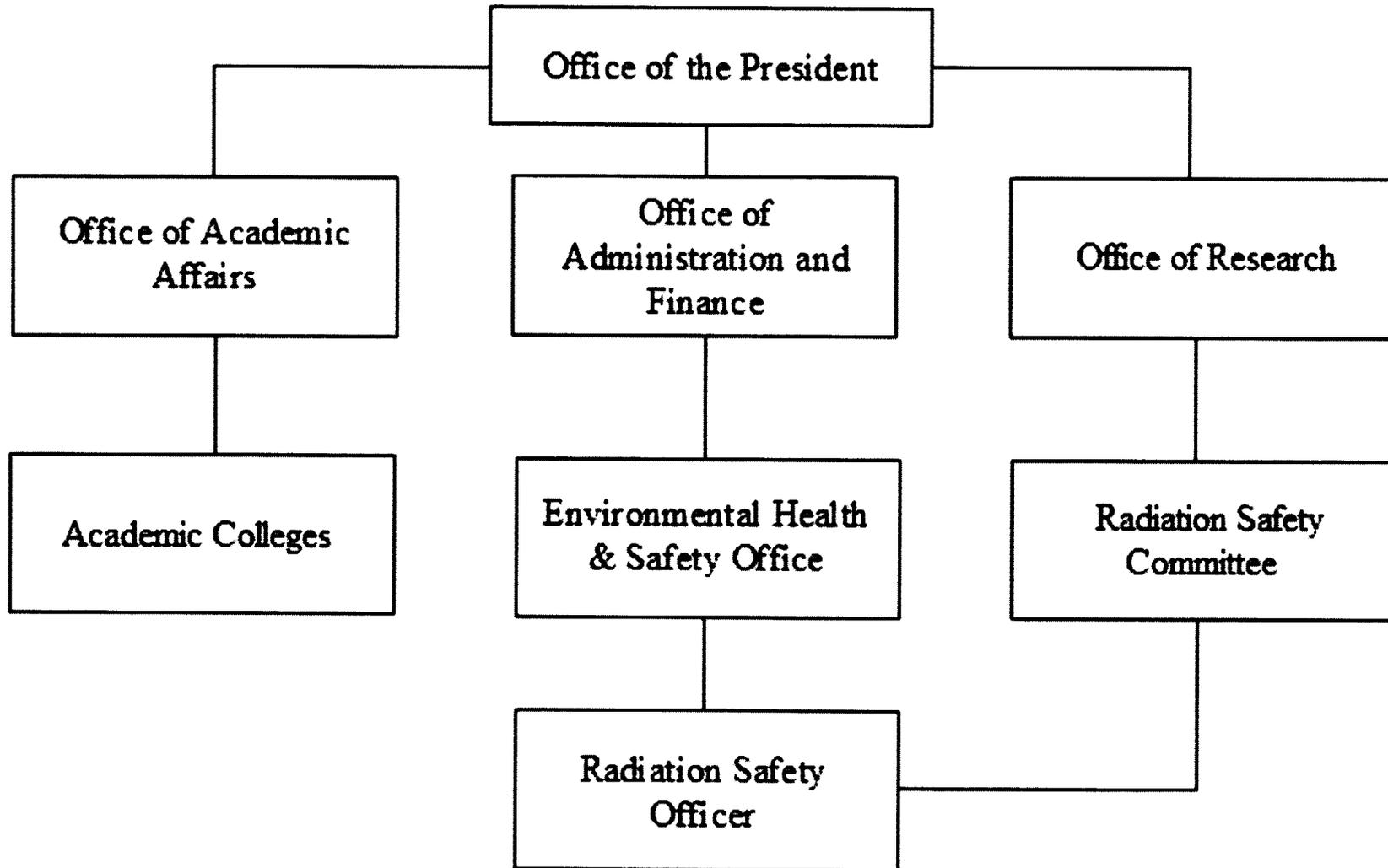
Cadmium 109	20000	10	0.0000002	0.000000002
Cobalt 60	10000	1	0.000001	0.00000001
Nickel 63	500000	10	0.000005	0.00000005
Strontium 90	25100	0.1	0.0000251	0.000000251
Tin 119m	4000	0.1	0.000004	0.00000004
			3.53E-05	3.53E-07
			If < 1, no financial assurance required. If > 1, financial assurance required is \$113,000.	If < 1, no Decommissioning Plan required.

Financial Assurance Worksheet
for
Byproduct Material

H-3	500000	1000	0.5	0.05	0.02
C-14	500000	100	5	0.5	0.0002
Cd-109	5000	10	0.5	0.05	0.0002
Cl-36	5000	10	0.5	0.05	0.0002
Ca-45	4000	10	0.4	0.04	0.00025
Mn-54	5000	10	0.5	0.05	0.0002
Zn-65	10000	10	1	0.1	0.0001
			8.4	0.84	0.02115
			If < 10, Financial Assurance required is \$225,000, unless next limit is exceeded.	If > 1, Financial Assurance is \$1,125,000	If < 1, No Decommissioning Plan Needed

Appendix B

Organizational Flow Chart



Appendix C

Old Dominion University
Radiation Safety Committee

Application for Authorized or Qualified User Status: Radioactive Materials

Directions: This application must be submitted prior to, or concurrently with *Application for Possession and Use of Radioactive Materials*, (RSO-2). Complete in duplicate, sign both copies and return to the Environmental Health and Safety Office/Radiation Safety Office. If approved by the Radiation Safety Committee, one copy will be returned to the applicant and serve as his/her user authorization. This authorization does not expire; however, if additional training is required as a result of a change or changes in the applicant's job responsibilities it may be necessary to update this application.

1. **Applicant:** _____
2. **Department:** _____ **Title:** _____
3. **Office:**
Building _____ Room _____ Phone _____
4. **Lab:**
Building _____ Room _____ Phone _____
5. **Type of Application** (check one): Authorized User Qualified User

(For Qualified User applicant)
Name of Authorized User under whom you will be working _____
6. **Training** (Furnish copies of certificates / Use supplemental sheets if necessary):

In order to be approved as either a Qualified or Authorized User, an applicant must have training. The level of training must be commensurate with the potential radiation hazard(s) the applicant is likely to encounter. Topics must include principals and practice of radiation protection, radioactivity measurement, standardization and monitoring techniques, instrumentation, mathematics and calculations basic to the use and measurement of radioactivity, and biological effects of radiation.

- (a) **Where trained:**

- (b) **Date(s) and total number of hours of training:**

7. **Experience** (Actual use of radioactive material or equivalent experience):

(a) Radionuclide(s) used:

(b) Name of institution(s) where experience was gained:

_____ From _____ to _____

_____ From _____ to _____

_____ From _____ to _____

(c) Brief description of how the radioactive material was used:

8. **Certification:**

The signature below affirms that the applicant has read and will comply with the rules, regulations, and procedures of Old Dominion University's Radiation Safety Program. The applicant accepts responsibility for maintaining current knowledge of those rules, regulations, and procedures governing the use of radioactive materials at the University.

Signature _____

Radiation Safety Committee:

Approved / RSC Chair _____

Approved / RSO _____

Approved / RSC Member _____

Approved / RSC Member _____

Date _____

Restriction(s):

Appendix D

Old Dominion University
Radiation Safety Committee

Application for the Possession and Use of Radioactive Materials

Directions: This application is to be completed only by Authorized Users or persons applying concurrently for Authorized User status (RSO-1). *Complete in duplicate, sign both copies, and return to the Environmental Health and Safety Office/Radiation Safety Office.* When approved by the Radiation Safety Committee, one copy will be returned to the applicant to serve as his/her authorization. *This authorization expires two years from the approval date.* An amendment must be submitted for approval before any change in protocol.

1. **Applicant:** _____

Department: _____

2. **Application Type:** New Renewal Amendment

3. **Office:**

Building _____ Room _____ Phone _____

4. **Location(s) of Proposed Use:**

Building _____ Room(s) _____ Phone _____

5. **Radionuclides for Possession:**

(a) **Radionuclide:** _____ Possession Limit (mCi): _____

Chemical/Physical Form: _____

(b) **Radionuclide:** _____ Possession Limit (mCi): _____

Chemical/Physical Form: _____

(c) **Radionuclide:** _____ Possession Limit (mCi): _____

Chemical/Physical Form: _____

(d) **Radionuclide:** _____ Possession Limit (mCi): _____

Chemical/Physical Form: _____

(e) **Radionuclide:** _____ Possession Limit (mCi): _____

Chemical/Physical Form: _____

6. Sealed Sources Only:

Complete this part for each sealed source proposed for use. Low activity check sources and exempt check sources need not be listed.

(a) Source:

Radionuclide: _____ Half-life: _____

Activity: _____(mCi)

Principal radiation emitted (check one or more) and energy(s) of the emission(s):

Alpha Energy _____(MeV)

Beta Energy _____max. (MeV)

Gamma or x-ray Energy _____(MeV)

Positron Energy _____(MeV)

Date calibrated: _____

Manufacturer: _____

Model No.: _____

Serial No.: _____

(b) Source description:

(c) Describe the proposed use(s) of the source giving particular attention to health and safety aspects:

7. **Unsealed Sources Only:**

Complete this part for *each* radionuclide proposed for use. Use a separate page for each radionuclide.

(a) **Radionuclide:**

Radionuclide _____ Half-life _____

Principal radiation emitted (check one or more) and energy(s) of the emission(s):

- Alpha Energy _____ (MeV)
- Beta Energy _____ max. _____ (MeV)
- Gamma or x-ray Energy _____ (MeV)
- Positron Energy _____ (MeV)

(b) **Experimental Protocol:**

Outline experimental protocol, with particular attention to health and safety aspects of the proposed use. Use additional sheet(s) if necessary.

(c) **Waste:**

Estimate activity and volume (or number) of waste that will be generated by proposed use.

- Aqueous: Activity/Volume per month _____
- Other liquid (specify): Activity/Volume per month _____
- Liquid scintillation vials Activity/Number per month _____
- Animal carcasses Activity/Number per month _____
- Solid (dry)/Incinerable Activity/Volume per month _____
- Solid (dry)/Non-Incinerable Activity/Volume per month _____
- Other (specify): Activity/Volume/Number per month _____

(d) **Associated Wastes:**

If applicable, describe any mixed waste (e.g. carcinogenic, hazardous etc.) that will be generated as a result of proposed use

8. Equipment and Facilities:

(a) Instruments and Equipment:

Check available instruments and equipment

Fume hood Room # _____

Appropriate signs, tape and labeling

Personal protective equipment (PPE)

Disposable gloves

Lab coats

Safety glasses

Waterproof backed absorbent material for benches

Remote pipette(s)

Trays to contain spills

Film badges

Portable radiation detection instrument(s) Specify type _____

Liquid scintillation counter

Gamma scintillation counter

(b) Facilities:

Attach a floor plan of areas where radioactive materials are used or stored showing fixtures such as sinks, hoods, benches, cold rooms etc., and major pieces of equipment such as refrigerators, freezers, centrifuges desks, radwaste containers etc. Indicate work areas, radioactive material storage areas, radioactive waste storage areas, entrances and exits. *Indicate room numbers.*

9. Security and Emergency Procedures:

(a) Security

Describe what provisions have been made to insure that radioactive materials are secure from unauthorized persons. Also describe a key control plan designed to restrict access to areas where radioactive materials are used and stored.

(b) Emergency Procedures:

Describe the emergency procedure(s) that will be followed in case of a spill or accident. Describe decontamination procedures.

(c) Emergency Contacts:

List two names and phone numbers to be called after hours in case of emergency.

Name _____ Phone _____

Name _____ Phone _____

10. Monitoring and Recordkeeping:

(a) Laboratory monitoring:

Describe your laboratory monitoring program. Include a description of your swipe survey schedule (specifically the frequency of surveys), areas to be surveyed, and documentation of surveys. *Note:* Survey frequency must be commensurate with the type(s), form(s), and activities of radionuclides proposed for use. For most applications swipe surveys must be conducted on a monthly basis. See the Radiation Safety Policy and Procedures Manual for guidance.

(b) Recordkeeping:

Describe your method of inventory control and accounting, including records of receipt, use and disposal.

11. Personnel:

List all persons who will use or will be potentially exposed to radiation as the result of proposed use.

12. Certification:

The signature below affirms that the applicant has read and will comply with the rules, regulations, and procedures of the Old Dominion University Radiation Safety Committee and Radiation Safety Officer. The applicant accepts responsibility for maintaining current knowledge of those rules, regulations, and procedures and responsibility for the actions of those persons working under his/her authorization. Any changes in the use protocol, personnel and the location of use will be reported to the Radiation Safety Officer in a timely manner.

Signature _____ Date _____

Radiation Safety Committee:

Approved / RSC Chair _____ Approved / RSO _____

Approved / RSC Member _____ Approved / RSC Member _____

(a) Dosimetry Indicated

- Whole Body
- Whole Body + Extremity
- Bioassay

(b) Special conditions attached to approval:

(c) Date of approval: _____

(d) Expiration date: _____

Appendix E

Memorandum

Date: October 11, 2005

To: All Employess

From: 
Mohammad A. Karim, Vice President for Research

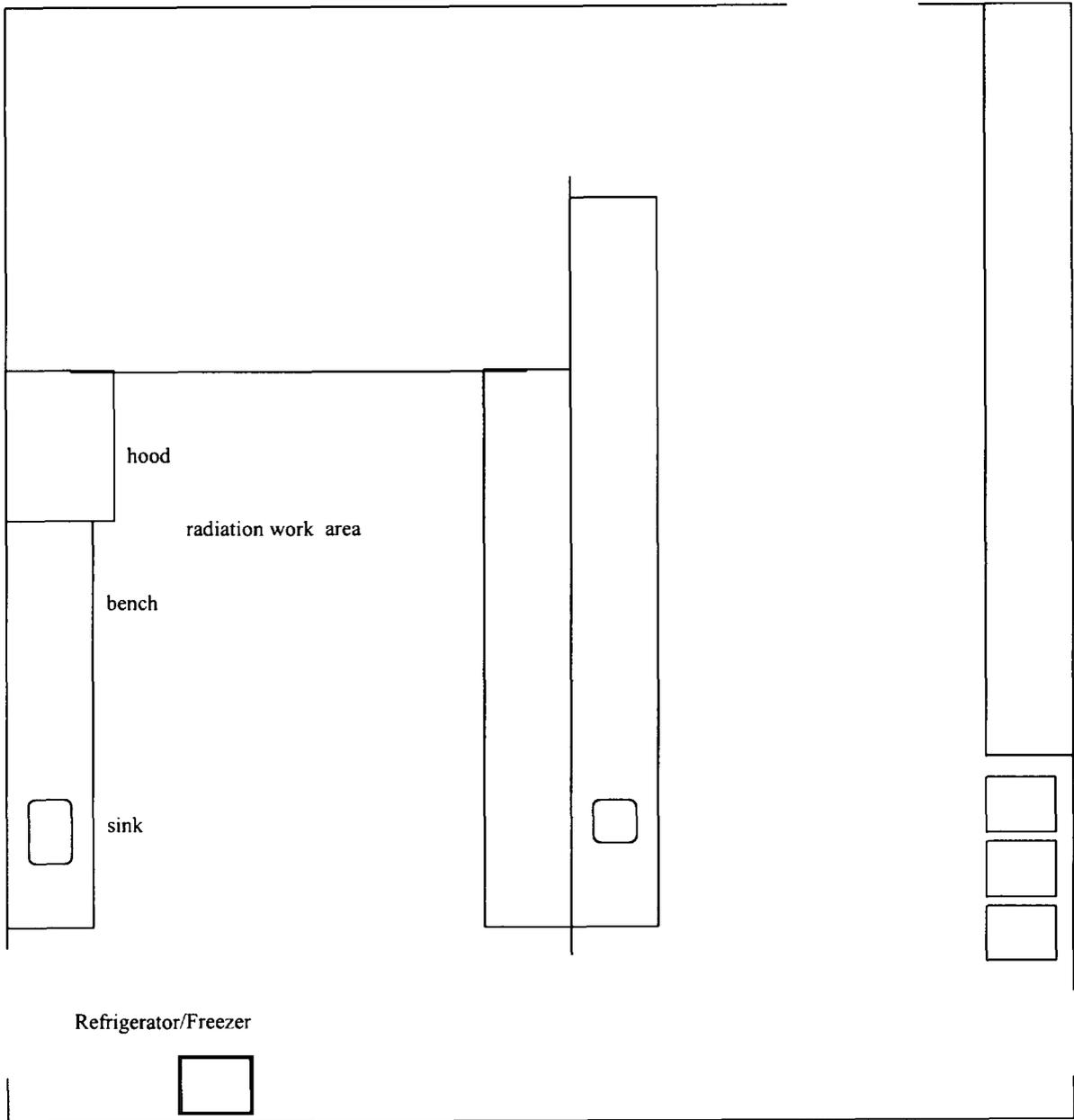
Subject: Delegation of Authority for Radiation Safety Officer

Derek S. Krepp, is the appointed Radiation Safety Officer for Old Dominion University and is responsible for ensuring the safe use of byproduct material. The Radiation Safety Officer is responsible for managing the radiation safety program; identifying radiation safety problems; initiating, recommending, or providing corrective actions; verifying implementation of corrective actions; and ensuring compliance with regulations for the use of byproduct material. The Radiation Safety Officer is hereby delegated the authority necessary to meet these responsibilities.

The Radiation Safety Officer has the authority to immediately stop any operations involving the use of byproduct material in which health and safety may be compromised or may result in non-compliance with NRC requirements.

Appendix F

Oceanography/Physical Sciences 418



Survey Date: _____

Surveyed By: _____

Comments: _____

Appendix G

**Old Dominion University
Radioactive Material Receipt Report**

Authorized User: _____ Department: _____

Order Information

Vendor: _____ Ordered By: _____

Catalog No.	Radionuclide	Activity (mCi)	No.	Form

Receipt Information

A. Package Receipt:

Date: _____ Time: _____ By: _____

Shipper: _____

B. Condition of Package:

No visible damage Package damaged (describe): _____

C. Label:

Exempt (White) Radioactive I (Yellow) Radioactive II TI= _____

(Yellow) Radioactive III TI= _____

D. Measured Radiation Levels:

N/A Package surface: _____ mR/h At 1 meter: _____ mR/h

E. Removable Contamination Survey Results:

N/A Outer packaging: _____ net dpm Source container: _____ net dpm

Package Disposition

Delivered (Building): _____ Room No.: _____

Signature: _____ Date: _____

Inventory adjusted: _____ By: _____

Appendix H

Appendix I

EMERGENCY PROCEDURES

IN THE EVENT OF A SPILL, OF RADIOACTIVE MATERIALS, TAKE THESE INITIAL STEPS:

1. Notify persons in the immediate area that a spill has occurred. Limit the movement of individuals who are potentially contaminated with radioactive material.
2. Contain the spill. Cover liquid spills with an absorbent material and dry spills with damp absorbent paper. If possible, without spreading contamination, survey the area to determine the extent of the spill. Survey your hands, clothing and feet.
3. Contact the Radiation Safety Officer at **683-4495**. If the spill occurs after normal working hours or on a weekend, contact Public Safety at **683-4000**.
4. Secure the area. Restrict access to the spill area at all times until the area has been completely decontaminated.

SPECIAL SITUATIONS: PROCEED AS ABOVE AND TAKE THESE ADDITIONAL PRECAUTIONS AS REQUIRED. IN CASE OF LOSS OR RELEASE OF RADIOACTIVE MATERIALS, CONTACT THE RADIATION SAFETY OFFICER (683-4495) OR PUBLIC SAFETY (683-4000) IMMEDIATELY.

Fire or Explosion Involving Radioactive Materials:

1. If radiation hazard is not immediate, and fire can be managed safely, attempt to extinguish flames with an appropriate type fire extinguisher. Contact the Radiation Safety Officer at **683-4495** during normal working hours, and Public Safety at **683-4000** after normal working hours and on weekends.
2. If fire cannot be managed safely
 - a. Keep upwind and avoid smoke, dust and fumes.
 - b. Pull fire alarm, stop ventilation if possible and close door(s).
 - c. Exit building immediately. Contact the Radiation Safety Officer at **683-4495** during normal working hours, and Public Safety at **683-4000** after normal working hours and on weekends.

Personal Contamination:

1. Immediately flush the contaminated area with copious amounts of water.
2. Survey the area. Wash area again until no activity above background levels is detected.
3. Contact the Radiation Safety Officer at **683-4495** during normal working hours, and Public Safety at **683-4000** after normal working hours and on weekends.

Appendix J

Old Dominion University

Environmental Health & Safety Office

683-4495

Request for Removal of Radioactive Waste

Authorized User: _____ Date: _____

Department: _____ Building and room: _____

Contact and phone no.: _____

Radionuclide	Activity (mCi)	Type of Waste (Solid, Liquid, Carcass, Vials)	Quantity to be picked up. Bags = B, Gallons= GL, Carcass = C, Flats of LSC vials = V)	Hazardous Chemicals Yes or No If Yes, list below*	ID No.

*Hazardous chemical components of liquid waste _____

This information is complete and correct and chemical composition of the waste has been accurately listed above.

Signed: _____

Principal investigator or representative

RSO Use:

Date Received _____ Total Gallons or Liters _____

Picked up by _____ Date picked up _____

Waste properly labeled: _____, If not removed, state reason _____

Form and radionuclide:

Glass _____ Plastic _____ Paper _____ Liquid _____ Vials _____ Carcasses _____

Signature _____

RSO representative

This is to acknowledge the receipt of your letter/application dated

10/11/2005, and to inform you that the initial processing which includes an administrative review has been performed.

Renew 45-09599-03 There were no administrative omissions. Your application was assigned to a technical reviewer. Please note that the technical review may identify additional omissions or require additional information.

Please provide to this office within 30 days of your receipt of this card

A copy of your action has been forwarded to our License Fee & Accounts Receivable Branch, who will contact you separately if there is a fee issue involved.

Your action has been assigned **Mail Control Number** 137851.
When calling to inquire about this action, please refer to this control number.
You may call us on (610) 337-5398, or 337-5260.