UNIVERSITY OF DAYTON

RADIATION SAFETY MANUAL

USER HANDBOOK FOR WORKING SAFELY WITH RADIOACTIVE MATERIALS

2010 Version

PREFACE

- Welcome to the University of Dayton Radiation Protection Program. All University of Dayton employees using radioactive materials or radioactive emitting equipment as subject to the University's Radioactive Materials License are expected to be familiar with the policies and procedures of this handbook. In addition, all authorized users of radioactive material are responsible for upholding safe protection standards within your individual laboratory.

- In order to employ a safe and effective radiation protection program, Environmental Health and Safety / Risk Management (EHS/RM) has put in place a program designed to record the transport, use and disposal of all radioactive material on the University of Dayton campus, provide information regarding the personal protection and safe handling of radioactive material and act as a central location for record keeping and housing this information. The following information describes the radiation protection program in detail.

- On August 31, 1999, the state of Ohio became an Agreement State with the U.S. Nuclear Regulatory Commission (USNRC) for the regulation of radiation protection. With this agreement the USNRC has relinquished control and regulation of radioactive materials within the state of Ohio to the Ohio Department of Health (ODH), Bureau of Radiation Protection (BRP) per the Ohio Revised Code (ORC) 3748.

  The University of Dayton maintains a current license (License Number 03620580000) through the ODH BRP for the use of radioactive materials for the purpose of research and education. As such, the University must abide by the procedures presented in the license by the state (Ohio Administrative Codes OAC 3701-39, Standards for Radioactive Materials Licensees, OAC 3701:1-38, General Radiation Protection Standards for Sources of Radiation, OAC 3701:1-40, Licensing Requirements for By-Product Materials, OAC 3701:1-50, Packaging and Transportation of Radioactive Materials OAC 3701:1-54, Low-Level Radioactive Waste and OAC 3701: 1-66, Radiation Generating Equipment) as well as those drawn up by the Radiation Safety Committee (RSC).

  Failure to comply with the regulations could result in financial penalties and/or revocation of the license.

- The Radiation Safety Committee is responsible for establishing and maintaining a radiation safety program. The Radiation Safety Committee is responsible for the contents of this manual. Clarifications or requests for additional information on the subject matter of this handbook may be sought from the Radiation Safety Officer.

Any future changes in this document will be approved by the Radiation Safety Committee (RSC) and the State of Ohio prior to implementation. You will receive updated copies from EHS/RM when such changes have been made.

- A version of this handbook, all relevant OAC and ORC regulations and any supplemental forms and materials can be found online at xxxxxxxx.

- September 2010

CONTACT INFORMATION

Department Title:
Environmental Health and Safety / Risk Management (EHS/RM)

Mailing Address:
300 College Park
Dayton, Ohio 45469-2905

Campus Location:
College Park Center - 1529 Brown Street

Office Phone Number:
(937) 229-4503 [8:30 a.m. to 4:30 p.m. Monday through Friday]

Emergency Phone Numbers:
(937) 229-2121 Campus Police [Contact number for emergencies or outside regular office hours. Public Safety Dispatcher will contact EHS/RM personnel]

911 Police (any emergency situation)

Office Fax Number:
(937) 229-4395

E-mail:
mark.fuchs@notes.udayton.edu

Personnel:

EHS/RM Director:	Robin Oldfield
Assistant Director:	Katherine Cleaver
Radiation Safety Officer:	Mark Fuchs
Radiation Safety Committee:	Dr. Donald Geiger, Ph. D., Biology Department; Dr. Sanford Singer, Ph. D., Chemistry Department; Jon Borgwardt, Research Institute Purchasing

ABBREVIATIONS AND ACRONYMS

AU	Authorized User
CFC	Code of Federal Regulations
EHS/RM	Environmental Health and Safety / Risk Management
OAC	Ohio Administrative Codes
ODH BRP	Ohio Department of Health Bureau of Radiation Protection
RA	Radioactive
RSC	Radiation Safety Committee
RSO	Radiation Safety Officer
RSP	Radiation Safety Program
UD	University of Dayton
UDRI	University of Dayton Research Institute
USNRC	United States Nuclear Regulatory Commission

TABLE OF CONTENTS

CHAPTER 1

INTRODUCTION

(Issued 9/30/10, Revised n/a)

A. The Need for Radiation Sources at the University

On a campus devoted to higher learning as well as biomedical and material research and development, such as the University of Dayton, the use of radioactive source materials can be useful tools in research and teaching. A number of radioactive source material ranging from biomedical labeled solutions, to irradiated metals, to sealed sources and radiation emitting equipment can be found in research laboratories and teaching classrooms. Such material is used in research to study cellular mechanisms in biological systems, biomedical investigations ranging from the molecular to the whole organism level, genetic processes and interactions and effects of radiation on non-organic materials strength, integrity and molecular make-up. However, with the use of any radioactive material, the employment of such materials needs to be incorporated into campus activities in such a manner that maximum benefit is achieved while potential hazard is reduced to the minimum achievable level.

B. Radiation Protection Philosophy – Introducing ALARA

The setting and execution of guidelines for radiation protection are based upon an underlying philosophy in which two factors are of prime importance. First is the assumption that there is no radiation dose so small that it does not involve some degree of risk. The second major factor to consider is that radiation, like many other developments of modern life, confers great benefit upon both the individual and the society in spite of its small risk to health. Consideration of the extent of these benefits makes a certain degree of risk acceptable. Thus, a balance must be struck in each contemplated radiation usage, in which the benefit to be gained is weighed against the anticipated risk. If the benefit outweighs the risk, the radiation is utilized so that its maximum benefit will be realized while individual exposure will be reduced to the minimum consistent with deriving these benefits. The overall protection philosophy, then, is to maximize the advantages from the use of radiation while minimizing exposure by eliminating whenever possible all unnecessary exposure to radiation.

Occupational exposure includes all the dose equivalents and intakes incurred by a worker during periods of work but excludes medical and natural radiation, unless the latter is enhanced as a result of a particular working environment. The arrangements for restricting occupational exposure should be applied to the source of radiation and to the designed features of the work place so that the use of Personal Protective Equipment should, in general, be regarded as supplemental to these more fundamental provisions. Access to controlled areas should be restricted and subject to local operating instructions. External exposure may be restricted by the use of shielding, distance and limitation of time. Contamination by radioactive material may be avoided by attention to

safety precautions and good work habits should ensure substantial reduction in occupational exposure. The State of Ohio has set occupational exposure limits which should not be exceeded under normal operational conditions. Even though current occupational exposure limits provide a very low risk of injury, it is prudent to maintain exposure to radiation below these limits. The objective is thus to reduce exposure by means of good radiation protection planning, as well as by management commitment to policies that foster vigilance against departure from good, prudent practices. This is the concept of **As Low As is Reasonably Achievable (ALARA)** occupational exposure to radiation. This is only possible if each individual user of radioactive materials joins the efforts in implementation of these concepts.

C. The Purpose of this Handbook

The purpose of this manual is to assist University personnel in using ionizing radiation in accordance with the current standards of good practice, the provisions of the University license and the laws of the State of Ohio. The manual is designed primarily for laboratory personnel as a guide for working with radioactive materials at the University of Dayton. This handbook should be used in accordance with the authorized user binder as a source of information regarding the rules, regulations and policies of the radiation safety program. This handbook provides detailed information for fulfilling the basic requirements of the radiation safety policy from setting up a radioactive laboratory to ordering, working with and storing radioactive material, documenting the use and disposal of radioactive material and protecting yourself and the public from radiation exposure.

D. The University of Dayton Campus Licenses

The University of Dayton campus maintains three campus licenses through the authority of the Ohio Department of Health. One license controls the use of unsealed and sealed radioactive materials and the other two licenses controls the use of radiation emitting equipment on campus.

The University of Dayton is authorized to procure and use radioactive materials in specified areas under a Research and Development Other Materials License issued by the State of Ohio Department of Health Services. This license describes the campus possession limits for each radioisotope, the authorized addresses, and provides for internal authorization procedures.

To obtain this type of license the University has had to (1) demonstrate considerable experience with a radioisotope program, (2) develop a well-developed program capable of evaluating and dealing with radiation safety problems and (3) establish detailed procedures for evaluating proposed uses of radioactive materials and for maintaining surveillance over approved users.

Copies of the license are available for inspection at EHS/RM. Any requests for amendments to the campus Radioactive Materials License must be approved by the

Radiation Safety Committee (RSC) and communicated to the State of Ohio by the Radiation Safety Officer (RSO).

CHAPTER 2

OBJECTIVES AND RESPONSIBILITIES

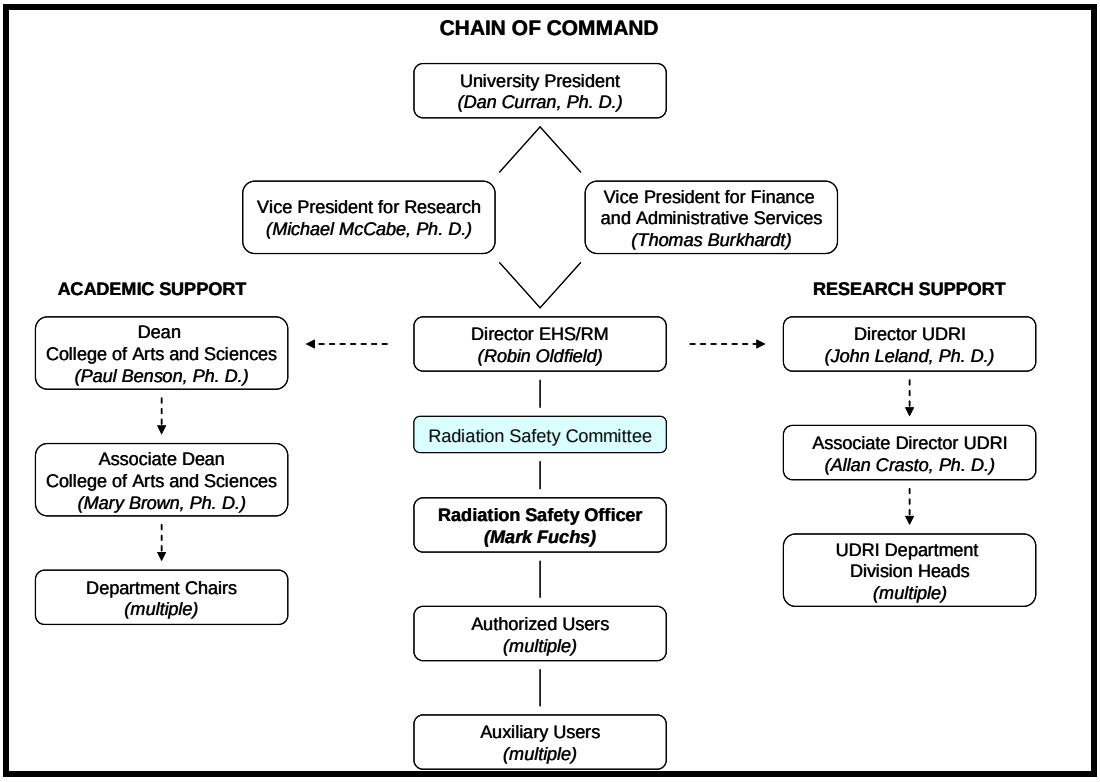
(Issued on 9/30/10, Revised n/a)

A. OBJECTIVES OF THE RADIATION SAFETY PROGRAM (RSP)

The purpose of the campus Radiation Safety Program (RSP) is to provide adequate protective measures against unnecessary and potentially harmful exposure to radioactive exposure to visitors, workers, students, faculty and staff on campus and for the community at large required by the University of Dayton Radioactive Material License. It is through the campus RSP that this internal, delegated responsibility is implemented.

B. CHAIN OF AUTHORITY

The rules and procedures set forth have one single, straightforward purpose -- to protect all students and employees against unnecessary and potentially harmful radiation exposure. In order to achieve this, the RSP at the University of Dayton falls under the jurisdiction of the director EHS/RM with direct administrative leadership from the President of the University and ancillary program support from the academic deans and University of Dayton research director as organized below:



C. RESPONSIBILITIES: THE ROLES OF INVOLVED PERSONS

Since its inception, the University of Dayton EHS/RM has bequeathed the Authorized User (AU) responsibility for storing, maintaining and updating individual inventory records. In order to run an effective radiation safety program, EHS/RM's primary function is to oversee that the approved users are conducting a safe and legitimate program. This is accomplished through the maintenance of a centralized record of activities and ensuring that the regulations in the license are being adhered to.

Environmental Health and Safety / Risk Management (EHS/RM)

Conducts the RSP and includes surveillance of all users of radioactive materials and equipment, monitoring of exposure levels and investigation of incidents. EHS/RM is responsible for the general oversight of the acquisition, use and disposal of radioactive materials and wastes, the maintenance of all records related to the material license and as required and compliance with rules, regulations, license conditions and all financial responsibilities. The Director of EHS/RM is responsible for informing the administration of matters related to radiation safety and oversees implementation of the use and safety policies established by the Radiation Safety Committee (RSC). Items the EHS/RM is responsible for include:

(1) Maintaining and updating the Radiation License
(2) Maintaining a safe and legal operation according to ODH BRP specifications
(3) Ensuring the rules and regulations of the Radiation License and the University of Dayton Radiation Safety Handbook are being followed
(4) Providing updated regulation and safety information to all AU's
(5) Updating and over-seeing AU records
(6) Ordering and receiving isotopes
(7) Monitoring radioactive shipments and inventory
(8) Laboratory inspections
(9) Removal and monitoring of low level waste
(10) Maintaining dosimetry badges and reports
(11) Ensuring calibration of radiation monitoring equipment
(12) Performing an annual audit of the program

To make sure the items are being adhered to, EHS/RM employs a Radiation Safety Officer (RSO) whose sole job is to directly work with and oversee the AU's program and correspond with the ODH BRP.

Radiation Safety Committee (RSC)

The RSC is an official advisory group that oversees the entire RSP. Radioactive materials are to be used by or under the direct supervision of individuals designated by the RSC. The RSC is currently composed of a team of specialized individuals

consisting of the radiation safety officer, a technical advisor, environmental health and safety specialist, the purchasing and property manager and departmental safety coordinators. Chairman and secretary for the RSC is the RSO. The committee meets on a quarterly schedule unless any member of the committee requests a special meeting. At least one member of the RSC has the background and training appropriate to acting as an advisor to the rest of the committee. As such, the RSC has available a competent advisor for all user and protocol evaluations. The RSC's one single, straightforward purpose is to to protect all students and employees against unnecessary and potentially harmful radiation exposure. Duties of the RSC include:

A. Establishing policies and regulations governing the use of ionizing radiation at the University of Dayton.
B. Providing technical and safety related advice of the use of ionizing radiation.
C. Reviewing the safety-related aspects of the use of all sources of ionizing radiation, including radiation producing machines and equipment.
D. Reviewing all AU applications to ensure appropriate training and experience.
E. Reviewing all new and updated protocols for radioactive usage to ensure that all procedures are reasonable and safe.
F. Providing oversight of the campus RSP.
G. Reviewing infractions of use, program deficiencies and safety rules.
H. Reviewing investigations of accidents and incidents and prepare reports, when deemed necessary.
I. Reviewing disciplinary and corrective actions.
J. Reporting program concerns and problems to upper administration as required.

Members of the 2010 Radiation Safety Committee are as follows:

Radiation Safety Officer	Mark Fuchs
Technical Advisors	Donald R. Geiger, Ph.D., Professor Emeritus and Sanford S. Singer, Ph.D., Professor Emeritus
EHS/RM Director	Robin Oldfield
Health and Safety Specialist	Katherine Cleaver
Purchasing Director	Jon Borgwardt
Department Safety Coordinators	(position open)

Radiation Safety Officer (RSO)

The RSO is responsible for the general day to day oversight of the acquisition, use and disposal of anything related to radioactive materials and wastes, maintaining all records related to the radiation program license and ensuring compliance of all rules, regulations and license conditions as required by the ODH BRP. The RSO is also chairman of the RSC and oversees implementation of the use and safety policies established by that committee. The RSO is responsible for the following items:

A. Serving as the communications link between the University of Dayton and the ODH BRP on all matters relating to the radioactive material license. As such, the RSO provides the ODH BRP with information and data necessary to the license and communicates ODH BRP rules, changes in rules and advisory information to byproduct authorized users at the University of Dayton.
B. Overseeing the acquisition, use, and disposal of radioactive materials at the University in order to assure compliance with license conditions.
C. Approving all purchase requests for radioactive material and checks the possession inventory to assure limits are not exceeded prior to issuance of purchase orders.
D. Receiving, surveying and recording all radioactive material received by the University and hand delivers to authorized users (AU).
E. Maintaining copies of disposal records and adjusts inventory accordingly.
F. Maintaining current copies of all Ohio Administrative Codes, materials license and current amendments.
G. Supplying copies of license to materials vendors.
H. Maintaining a roster of all approved AU's, the locations of use, isotopes in use and supervisors.
I. Recording all radioactive materials in the possession of the University of Dayton and disposal of all radioactive waste.
J. Maintaining exposure histories including dosimeter and bioassay records for all AU's.
K. Performing and maintaining leak test results for all sealed sources.
L. Performing laboratory audits of AU facilities, documenting such surveys and updating and overseeing AU records.
M. Ensuring calibration records of survey instruments are up-to-date.
N. Providing radiation exposure history of former students and employees for other radiation safety officials upon request.
O. Updating, revising and maintaining a radiation safety manual which outlines the RSP at the University of Dayton. This document includes procedures for ordering, receiving, and disposal of radioisotopes, safety rules for use in the laboratory, emergency procedures, decontamination procedures, copies of records to be maintained, copies of required postings in laboratories, copies of pertinent sections of Ohio Administrative Codes Chapter 3701:1-38 and miscellaneous useful information regarding radioisotopes.
P. Providing copies of safety rules, ordering procedures, handling procedures, emergency procedures for dealing with radioactive spills, etc. to all AU.
Q. Providing training and consultation services to users, housekeeping, maintenance, and security personnel regarding the hazards and safety associated with working in areas where byproduct materials are in use.
R. Performing facility contamination and compliance surveys for ensuring radiation exposure levels are within required parameters.
S. Inspecting and reporting on any incident involving radioactive materials.

Note that the RSC and the RSO are authorized by the President to limit or revoke an individual's authority to use radioactive material or sources of ionizing

radiation if such use presents a hazard to individuals or violates heath and safety codes (see section xxx on enforcement).

Authorized Users (AU)

AU's are faculty, staff and students wishing to use licensed materials to conduct teaching and research activities who have sufficient experience working with radioactive materials and have been authorized by the RSC. All AU's must have an approved protocol and be listed on the radioactive materials license before they can use, store or work with radioactive materials at the University. AU's are immediately responsible for their own safety and the safety of those around them. AU's who act in supervisory roles to auxiliary users (staff, technicians and students) must be responsible to train and oversee these individuals and to ensure that the laboratory environment of the individual users is kept safe. In general, the AU is responsible for:

(1) Proper and adequate storage of isotopes
(2) Proper and safe disposal of isotopes and any associated low level wastes
(3) Proper record keeping for each isotope
(4) Proper monitoring of isotope usage
(5) Proper posting of areas designated as radioactive "hot" areas
(6) Instruction and supervision of graduate / undergraduate students
(7) Following all ordering and safety procedures
(8) Communicating up-to-date inventory, usage and disposal records and problems or concerns to RSO

Auxiliary Users (AU)

Auxiliary users are faculty, staff and students (generally staff, technicians and students) wishing to use licensed materials under an authorized user to conduct teaching and research activities. These individuals must be approved and trained by the RSO and are not authorized to purchase, dispose, transport or receive licensed material without prior notification by the supervisory AU. These individuals must work under an approved AU and are responsible for ensuring that work with radioactive materials is being performed safely according to the AU's accepted protocol and the University of Dayton RSP and are immediately responsible for their own safety and the safety of those around them.

CHAPTER 3

AUTHORIZATION FOR RADIOACTIVE MATERIAL USE

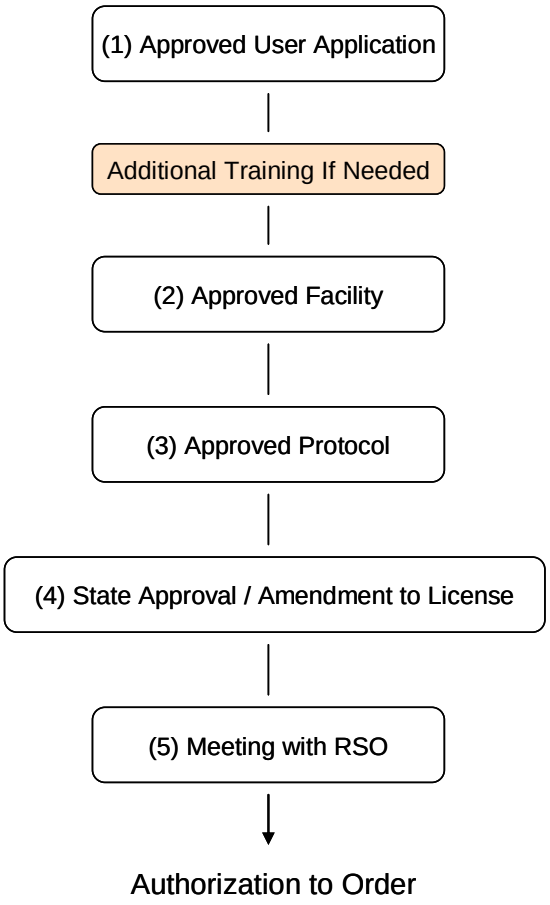
(Issued on 9/1/97, Revised 9/30/10)

A. GENERAL APPLICATION REQUIREMENTS

All individuals wishing to work with radioactive materials must apply for Radiation Use Authorization before purchasing, transporting or using radioactive materials at UD. Application forms are available from EHS/RM or may be found online at xxxx. Completed applications must be sent to the EHS/RM and will be reviewed by the RSC. User status will be granted only to individuals approved by the RSC. This review process is designed to ensure that individuals wishing to work with radioactive materials have prior training and knowledge for working safely with radioactive materials. Applicants are reviewed on their merit, training and ability to provide a safe working environment.

Only faculty and staff at UD with sufficient training may apply for AU status. Qualified graduate student and technicians may be granted AU status by the RSC if they have demonstrated sufficient training and knowledge in the safe use of radioactive materials. All other individuals (undergraduates, technicians) wishing to work with radioactive materials as an individual user may apply for auxiliary user status. Auxiliary user's must be sponsored by a faculty AU and have met all required training requirements provided by the EHS/RM.

Completed Application Form, Facility or Protocol → Submission to RSO → Initial review by RSO to check for missing information → Submission to RSC for review → Approved Outright, Approved with Minor Modification or Denied → RSO submits license amendment to ODH BRP → RSO meets with AU to set-up facility, review procedures and go through training if needed



B. APPLICATION FOR INDIVIDUAL AU STATUS

University faculty, professional research staff, postdoctoral students and in rare cases graduate students (however, graduate student AU's may not be listed as "supervisory" personnel) wishing to work with radioactive materials must apply for authorization before purchasing, transporting or using radioactive materials at UD. Application forms are available from EHS/RM (see Appendix C). Completed applications must be sent to EHS/RM and will be reviewed by the RSC. User status will be granted only to individuals approved by the RSC. This review process is designed to ensure that individuals wishing to work with radioactive materials have prior training and knowledge for working safely with radioactive materials. Applicants are reviewed on their merit, training and ability to provide a safe working environment.

Qualified graduate student and technicians may be granted AU status by the RSC if they have demonstrated sufficient experience, training and knowledge in the safe use of radioactive materials and are recommended for that status by a faculty or staff licensed AU. Generally, graduate students requiring the use of radioactive materials are listed as auxillary users under the direct supervision of a licensed AU. All other individuals (undergraduates, technicians) wishing to work with radioactive materials as

an individual user may apply for auxiliary user status (see Appendix D). Auxiliary user's must be sponsored by a licensed faculty AU and have met all required training requirements provided by EHS/RM.

Authorization to use radioactive materials on campus may proceed only after written notification by the University RSO of the RSC decision to grant the applicant AU status, the RSO trains the AU regarding all procedures associated with the RSP, written acknowledgement of the briefing by the new AU is documented (see Appendix E) and a material protocol is approved.

Use of radioactive materials by personnel not granted AU status or without direct supervision of those granted AU status is a direct violation of the conditions of the license and is punishable by law.

B. ESTABLISHING A LABORATORY FOR RADIOACTIVE MATERIAL USE

From time to time an existing facility must be qualified for use of radioactive materials. When this is necessary, the AU must submit a floor plan of the laboratory, with (1) location(s) within the laboratory where radioactive materials will be used, (2) location of storage locations for radioactive materials, (3) location of radioactive material disposal facilities, (4) location of radioactive waste storage areas, (5) list of radioactive materials to be used, including isotope, amounts, and chemical form of radioisotope, (6) a brief description of the general nature of the research being conducted, (7) a description of radiation survey instrument and date of last calibration and (8) a laboratory survey plan indicating areas to be surveyed and the frequency of survey. Note that wipe tests are required when survey meters are insensitive to contamination. All facility plans must be sent to the RSO who will submit them to the RSC for approval. Work within the new facility may begin upon notification of the plan approval by the RSC and the facility has been approved by ODH BRP and added to the license.

C. DEVELOPING AND SUBMITTING A RADIOCHEMICAL PROTOCOL

A radioactive material protocol is a concise description of the intended use of any radioactive material and lists: (1) how the radiochemical is stored, (2) where the radiochemical is stored, (3) any intermediate preparations required for use of the radiochemical, (4) the actual procedures followed in use of the radiochemical including amount of material used (in microcuries), (5) disposal of the radiochemical and contaminated wastes generated in use of the radiochemical, (6) storage of any contaminated wastes - where and how, (7) a hazard assessment which details the risk to personnel using he radiochemical, level of training required of those using the procedure, and level of supervision required of personnel performing the procedure. Radiochemical protocols are to be filed on a standard form which can be obtained from the RSO (see Appendix F).

The purpose of the radiochemical protocol is to provide a description of the use of radiochemicals for consideration and approval by the RSC which is charged with

overseeing the safe use of radiochemicals at the University. An approved protocol must be on file with the RSO prior to ordering any radiochemical and prior to instituting any new procedure with radiochemicals. The radiochemical protocol is based upon the radiotoxicity of the material being used, the appropriateness of the amount of material per procedure stated in the protocol, whether the protocol is well established and understood, and the potential risk to those working with the protocol. Details presented in the radiochemical protocol must be complete to the point of allowing the RSC to evaluate the safety of the procedure and the adequacy of the laboratory facility to perform the procedures safely.

Submission of protocols for approval are made to the RSO. The RSO either convenes a meeting of the RSC or circulates copies of the proposed protocol among the RSC members and solicits their comments, questions and/or written approval or disapproval. The RSO then informs the applicant of approval of the protocol or changes and/or corrections necessary for approval. Once approved by the RSC, the AU may initiate ordering the material.

D. AMENDING AND MAKING CHANGES TO RADIATION USE (section under construction)

All changes to the applicants status, protocol, area of use, possession types and limits and personnel must be pre-approved by the RSC/RSO. The following describes the forms required to make amendments to your radiation use:

Application Status – AU's may be active, inactive or decommissioned (non-user). To make a change in status level, fill out the AU change in status form

Protocol – To change, update or request a new protocol.

Area of use – To add a new use area, complete the RUA Amendment Request Form and send a copy with the diagram of the room to the DSA. After a site visit the RSP staff will issue the appropriate approvals. To delete a use area, remove all radioactive materials from the room, survey and decontaminate if necessary. Send in the Amendment Request Form. The DSA will conduct a site visit and spot check for contamination prior to approving the request.

Possession Types and Limits – Changes in possession limits of existing approved radionuclides may be requested using the Amendment Form. Minor changes (few mCi) will be approved by the RSP. Addition of substantial quantities (10's of mCi) will be sent to RSC for review and approval. Addition of new radionuclides may be achieved by submitting an Amendment Form. Addition of low mCi quantities of radionuclides with similar hazards to those already permitted (e.g., ^{35}S for ^{14}C users) may be approved by the RSP. All other requests will be forwarded to the RSC for review and approval.

Personnel - To add an auxiliary user, complete a Training Experience Verification Form and have the person attend the "Laboratory Safety for Researchers Class". To delete a person from the RUA, return a copy of their Training Experience Verification Form with the "delete" column checked.

D. TRAINING REQUIREMENTS (section under construction)

All persons using radioisotopes at UCSF must acquire a training number from the RSP. To obtain a training number the applicant must read theRadiation Safety Training Manual, attend the Laboratory Safety for Researchers Class, complete the Training Experience Verification Form, and pass the Certification Exam. All exemptions must be approved by the RSC/RSO. In addition, any auxiliary user (students, adjunct staff, technicians, etc.) must also be provided with adequate in lab training via the AU on any new procedure / protocol involving the use of radioactive materials. This training must be documented through form xxxx and be provided to EHS/RM.

In order to maintain a working knowledge of safety, all staff will be required to undergo radiation safety retraining at least once every two years. This schedule may be revised if the RSO believes that the skills of an individual warrant such a revision.

E. AVAILABLE RESOURCES (section under construction)

Copies of rules, regulations, and standards and the UCSF license to procure and use radioactive materials are available in the OEH&S RSP for review by employees and staff.

A copy of the UCSF Radiation Safety Manual must be maintained in the office of each department that uses sources of ionizing radiation. It must be available for review by all employees. It is highly recommended that these manuals be available in all laboratories using radioactive materials. Personal copies of the manual are available from the DSA.

In addition, the RSP has a wide range of books, publications and audio-visual materials which are available to users. Please contact your DSA for further information.

CHAPTER 4

RECEIPT AND USE OF RADIOACTIVE MATERIALS

(Issued on 9/1/97, Revised 9/30/10)

A. PROCEDURES FOR ORDERING AND RECEIVING RADIOACTIVE MATERIALS

AU's wanting to purchase radioactive materials must fill out a purchase request form with the date, isotope type, amount of activity, costs, name of the supplier (each supplier must have the Universities License on file) and an account number. This information must be telephoned or e-mailed to the RSO. The RSO will assess the order before contacting purchasing and obtaining a purchase order (PO) number (see Appendix G). Only UDRI Purchasing may issue purchase order for radiochemicals, UNDER NO CIRCUMSTANCES ARE RADIOACTIVE ORDERS TO BE PLACED THROUGH UNIVERSITY PURCHASING.

The RSO will then relay the PO number to the AU validating the AU the right to contact the supplier and place an order. The AU may then contact the supplier to purchase the radioactive material through normal purchasing channels. IT IS REQUIRED THAT THE AU DIRECT THE RADIOCHEMICAL PACKAGE TO THE ATTENTION OF THE RADIATION SAFETY OFFICE. After placing an order, the AU should photocopy the purchase order request for their individual records and mail a copy of the request to EHS/RM.

Upon issuance of a purchase order for radioactive materials, the RSO records the order details in the purchase order log / database and assigns a log number, initiates a radioisotope record form, receiving report form, use/disposal form, and notifies Central Receiving to expect delivery of a radiochemical. The assigned log number specifically identifies the radioactive material to EHS/RM. The log number associated with each acquisition (the purchase order number on which the order was placed, the date the order was placed, a description of the ordered chemical, the amount ordered, the AU's name, receipt date of the order) is used for tracking the use, disposal and final removal of the isotope from inventory.

All purchases of radioactive materials should indicate the shipping address to be as follows:

ATTN: Mark Fuchs

Environmental Health and Safety
University of Dayton
300 College Park Avenue
Dayton, Ohio 45469-2905

Upon delivery of a radiochemical to Central Receiving, the RSO is notified immediately. Receiving of radiochemical deliveries is conducted by the RSO (or an authorized radiation safety officer if the RSO is not available) and includes the following actions:

A. The incoming package is surveyed for damage
B. The outer package is measured for signs of radioactive emissions
C. A shipment receipt report form logs the initial receiving and inspection of the material
D. Information is logged into the computer database and a use-disposal form is created
E. RSO notifies AUof receipt of order and delivers radioactive material and accompanying paperwork to USER (note - if the AU is not present to receive the material, the individual is notified of the delivery attempt and the material is temporarily stored in a designated area for safe storage depending on the materials shipping/storing requirements).
F. Upon receipt of the material the AU is required to complete the shipment receipt form by conducting GM scans and wipe tests of the inner package(s) and source material for detecting signs of contamination or leakage. This form must be signed, dated and returned to the Environmental Health and Safety Office within 3 days of receipt.
G. AU records radiochemical in his/her log and inventory and places relevant forms into the facility user binder.
H. RSO files Radioisotope Record Form, Receiving Report Form, and other miscellaneous data pertaining to the order in an isotope record folder which is then filed by P.O. log number.

B. SUMMARY OF REQUIRED RECORDS

Several different record forms must be maintained as a condition for the use of radioactive materials. These records involve traceability of the radioactive materials being used, disposal of these materials, and laboratory safety procedures. Records are updated continuously and quarterly renewed for verification of status from the USER. Radiochemicals are removed from the inventory when the RPO receives a completed (signed and dated) Use-Disposal form from the USER, thus indicating the disposal of the radiochemical from his/her possession (includes all stored materials).

Active Inventory of Radioactive Materials - All users of radioactive materials must maintain a current inventory of radioactive materials in his/her possession (includes those in use and those in storage). In the users binder this form should be kept up-to-date and available for inspection at any time.

In addition, complete active inventory records are maintained in a centralized database by EHS/RM and serves as the official record to the types and amounts of radioactive material is in use for the entire University (see Appendix H).

Shipment Receipt Form - The radioactive shipment receipt report is a record of the receipt and inspection of a shipped radiochemical. The Shipment Receipt Form is initiated by the RSO and is a record of the receiving inspection of a delivered radioactive material order. Initial inspection of the order is conducted by the RSO and the receiving report form is delivered with the radioactive material to the AU. The AU then completes the form by performing wipe tests on the packing materials and the internal package, records the results of these tests, and returns the form to the RSO.

Upon arrival, the top portion of the form is filled out by a RSO, whereas, the bottom portion of the form is to be completed by the AU. Once completed, the AU should sign, date and photocopy the form to keep for their files and mail the original back to EHS/RM (see Appendix I).

Use-Disposal Form - Each radioactive material delivered to a laboratory has a use-disposal form attached, which must be maintained current. The use-disposal form is a detailed record of the use and disposal of a radiochemical. The form lists the radiochemical, its log number, chemical form, specific activity, AU's name, location of use and purchase order number relating to the use of the material. Use of the radiochemical and its disposal, amount and manner, is tabulated for each usage. With each use and/or disposal of a radioactive material, this form must be updated. When the radioactive material associated with any particular log number is exhausted, a copy of the complete use-disposal form must be sent to the RSO and the AU should eliminate that log number from his/her active inventory (see Appendix J).

At any time that radioactive waste is disposed of, regardless of the method used, records of the disposal must be maintained. Disposal, regardless of the methods, must be documented. When hazardous waste is transferred to the RPO, records must be maintained. The method of disposal must be entered on the Use-Disposal Form.

C. DISPOSAL OF MATERIAL

The disposal of radioactive and radioactive contaminated materials governed by OAC Chapter 3701:1-38-19 and by restrictions placed upon the University by the Ohio Environmental Protection Agency. Disposal is only allowed through acceptable means (the sanitary sewerage, decay in storage, by commercial disposal or shipment to an authorized facility). Hazardous materials may not be placed in the sanitary sewer. Radiochemicals having half-lives less than 90 days may be decayed in storage at the University. A commercial disposal company licensed to receive radiochemicals must handle other wastes. Refer to Item No. 13 in this license application for a more detailed description as to the disposal of low-level radioactive waste.

D. TERMINATION OF ACTIVITIES

From time to time, laboratories formerly using radioactive materials will be converted to other uses. This happens with reassignment of space, resignation of AU's, termination of research funding, etc. When such an occurrence happens, certain procedures must be followed. The following lists the procedures required for decommissioning a laboratory (see Appendix K):

A. Notify RSO that the laboratory is to be decommissioned

B. Dispose of or transfer all radioactive material inventory and waste in a proper manner. Record all disposal of radioactive materials and transfer records to the RSO. Report transfer of radioactive materials to RSO. If the transfer is to another AU at the University of Dayton simply notify the RSO to whom the material was transferred and the amount transferred. If the transfer is to another institution, it is necessary to receive permission from that institution's radiation department for the transfer. A letter from the receiving RSO must be sent to the University of Dayton RSO indicating approval of the transfer prior to removal of any radioactive materials from the University. Upon receipt of the approval letter, the UD RSO will remove the material from the inventory list and oversee proper packaging of the radioactive material for transfer.

C. All areas in the laboratory used for storage or processing of radioactive materials must be wipe tested to assure no contamination exists within the laboratory. Records of these tests must be given to the RSO.

D. Radiation survey instruments provided by EHS/RM must be returned.

Decommissioning paperwork must be filed and approved by the ODH BRP as an amendment to the radiation license. Once decommissioned by the state, all labels or placards indicating the presence of radioactive materials must be removed from the laboratory following wipe tests demonstrating a clean laboratory.

CHAPTER 5

RADIATION MONITORING

(Issued on 9/1/97, Revised 9/30/10)

A. RADIATION MONITORING

Each laboratory in which radioactive material is being used are required to survey the working areas and surfaces for contamination at the conclusion of each day's work (after working with the radioisotope). Survey meter recordings should be used continuously when radioactive materials are in use and wipe tests should be conducted in areas where survey meters are ineffective. Records of survey meter recording in the laboratory and laboratory wipe tests must be maintained for inspection. Areas surveyed in the laboratory, regardless of method, should be recorded according to location as indicated by a survey plan filed for each laboratory.

Each laboratory must have a survey plan based upon the layout of the laboratory. It is suggested that the location of radioisotope use be designated to specific areas and a floor plan of the laboratory be used as a reference guide. On the floor plan, mark designated potential “hot” areas where radioactive material is used or stored (See ITEM NO. 11 for room schematic information). When monitoring of the area is conducted, record the date of the survey and the results obtained in each area surveyed (see Appendix L).

For laboratories that use high-energy alph or beta emitters should use a portable survey meter for personnel and area monitoring. The use area and gloves should be checked frequently during operations using radioactivity. After the procedure is completed, the user should monitor all potentially contaminated surfaces (i.e., the use areas, gloves, lab coat, shoes, adjacent areas). If the survey is negative, the gloves should be disposed and hands washed prior to leaving the laboratory. Survey action levels is 0.5 mrem/hour.

In areas where only tritium is in use, wipe tests must be performed as a survey method. In addition, exterior surfaces of refrigerators used for storage of radiochemicals must also be surveyed.

If an area is found to be contaminated, as identified with a swipe action level in unrestricted areas of 200 dpm per 100 cm^2 or greater , decontamination procedures should be instituted and cleaning should continue until contamination is removed (less than 200 dpm/100 cm^2). A follow-up survey must follow to confirm proper cleaning of the area.

B. TYPES OF SURVEY INSTRUMENTATION (GENERAL)

The energy of decay, combined with the mode, determines how the nuclide can be measured. Beta-emitters can be measured by liquid scintillation counting, autoradiography and (providing the energy of emission is not too low) thin end-window ionzation counting. Gamma-emitters usually require measurements by solid scintillation methods.

The portable Geiger-Muller (GM) survey meter is best used for P-32, a high-energy beta emitter, and other high energy beta and gamma emitters, such as Co-60, Zn-65, Cs-137, and U-238. GM meters can also be used to identify areas heavily contaminated with lower energy betas, such as C-14 or S-35, for which the GM meter has a relatively low efficiency. GM meters should not be used to survey for I-125 contamination, since GM meters will detect I-125 only when there are very high levels of contamination.

The portable thin crystal NaI scintillation survey meter is used to locate I-125 contamination and to conduct surveys around low-energy x-ray sources such as x-ray diffractometers and electron microscopes.

The liquid scintillation counter**,** used for counting wipe tests, is not portable but is the most versatile counting instrument because it has a high counting efficiency for a wide range of radionuclides.

Gamma counters are not portable and are used to count wipe tests for photon emitters, such as Cr-51 or I-125.

Acceptable survey methods for some of the common radioisotopes on campus

Isotope	Half-life	Energy	Geiger Counter		Beta Scintillator	Low-Energy Gamma Scint.	Wipe Test + Liq. Scint.
			End Window Pancake				
3H	12.2 yrs	Beta	No	No	No	No	Yes
14C	5730 yrs	Beta	No	Yes	Yes	No	Yes
35S	87.4 days	Beta	No	Yes	Yes	No	Yes
32P	14.3 days	Beta	Yes	Yes	Yes	No	Yes
51Cr	27.7 days	X-ray, Electron	No	Yes	No	Yes	Yes*

* Counting wipe samples in a gamma counter is also acceptable.

Summary of Radiation Types and Characteristics

TYPE	ALPHA	BETA	GAMMA	NEUTRON
PENETRATING POWER	very small	Small	very great	very great
HAZARD	internal	internal/external	External	external
SHIELDING MATERIAL	Paper	plastic, aluminum	lead, steel, concrete	water, concrete, steel (high energy)
QUALITY FACTOR	20	1	1	2-10

The following list of radiation detection instrumentation available for use at The University of Dayton.

Type of Instrument	Manufacturer	Model No.	Quantity	Radiation Detected	Location
Liquid Scintillation Counter	Beckman	LS-6500	1	Beta	SC 054
Microplate Scintillation and Luminescence Counter	Packard	Top Count NXT	1	Beta	SC 137
Gamma Counter	Packard	Cobra II 5005	1	Beta-Gamma	SC 137
Gamma Ray Spectrometer	Spectrum Techniques	R5S8	1	Gamma	SC 21A
Portable GM Survey Meter	Ludlum Measurements Inc.	M3	4	GM and Scintillation	varies
Portable GM Survey Meter	Ludlum Measurements Inc.	2241-2	1	GM and Scintillation	EHS/RM
Portable GM Survey Meter	Ludlum Measurements Inc.	2241-3	1	GM and Scintillation	EHS/RM
GM and Scintillation Detectors	Ludlum Measurements Inc.	44-7	2	Alpha, beta, gamma	varies
GM and Scintillation Detectors	Ludlum Measurements Inc.	44-9	3	Alpha, beta, gamma	varies
GM and Scintillation Detectors	Ludlum Measurements Inc.	44-2	3	Gamma	varies
GM and Scintillation Detectors	Ludlum Measurements Inc.	44-21	1	Beta, gamma	varies

All radiation survey instruments are available to individual user for routine survey activities within their respective laboratories. Liquid scintillation counters are routinely used for evaluating wipe test surveys of laboratory areas where radioactive material is used, for leak testing sealed sources and for wipe test inspection of incoming shipments. Gamma ray counter is used for inspection of gamma-emitting sources. Gamma ray spectrometer is a diagnostic instrument for teaching and identifying unknown samples. GM monitors are given to AU's for surveying purposes and personal monitoring / protection.

Hand held G-M and Scintillation survey monitors are calibrated annually or following repair. Calibration is performed at Ludlum Measurements, Inc., 501 Oak street, Sweetwater, Texas 79556. Records of calibration are maintained by EHS/RM.

Beckman and Packard liquid scintillation counters and gamma counter are under the manufacturer's annual service contract.

No air monitoring or air sampling equipment is installed as material used at the University of Dayton are almost exclusively in solution or solid form. The only likely airborne radioisotopes would be ^{14}C, as plant respirated carbon dioxide. Experimental research producing small quantities of $^{14}CO_2$ is performed within a laboratory hood having positive drafts.

C. PERSONAL MONITORING DEVICES

Records of personal dosimetry data is kept for all individuals working with radioactive materials capable of producing an external dose. It is important that all individuals working with radioactive material wear their dosimetry badge at all times when in the presence of source material. Remember to not place or store it near a radioactive source and please return it so that it can be periodically measured.

Personnel monitoring devices consist of TLD badges. TLD badges are supplied by Landauer, Inc., 2 Science Road, Glenwood, Illinois 60425-1586 on a quarterly basis. The issuing, distribution and collection of dosimetry badges is managed by the RSO who also takes care of the records (original copies as well as on-site database that keeps a tally of a persons lifetime accumulation). Personal occupation dose reports (NRC Form 5 equivalent) are provided to the wearer on an annual basis.

D. SEALED SOURCE LEAK TESTING

Sealed sources, except those that qualified as exempt, must be tested for leakage on a semi-annual basis or when removed from storage for use or transferred to another person. The RSO will perform a wipe test according to the manufacturers specification and maintain a record of such test. Leak test kits are supplied and analyzed by Suntrac (1818 East Main Street League City, Texas 77573) on a six month period. If the test reveals the presence of 0.005 μCi or more of removable contamination, the source shall be removed from service and decontaminated, repaired or disposed of in accordance with ODH BRP. The University will file a report to ODH BRP within 5 days when contamination of a sealed source exceeds the values above. The report will specify the source involved, the test results, and corrective actions taken.

CHAPTER 6

INSPECTIONS AND REVIEWS

(Issued on 9/1/97, Revised 9/30/10)

A. LABORATORY INSPECTIONS

EHS/RM has developed protocols for ensuring that users of radioactive materials are operating safely and will routinely inspect the users operation and activities to ensure compliance with all rules and regulations. The RSO performs surveys for removable contamination in use and storage areas on a quarterly basis. The RSO monitors each laboratories to ensure that AU's are following all rules and regulations specified by the radiation license and maintaining proper records of isotope usage, disposal and storage. The following items are checked during these inspections (see Appendix M):

- general lab safety
- safe and proper storage of radioisotopes
- proper labeling of hot sinks and radioactive signage
- necessary employee notifications and postings
- use / disposal records for active radioisotopes
- isotope inventory and storage
- proper and documented disposal of radioactive material and associated low level wastes
- wipe test and scintillation records
- up-to-date protocol information

The AU will either be presented with a pass certification or instructed on what changes need to be made and given a time by which to comply. When necessary, the RSO will perform a follow-up inspection to verify that deficiencies have been corrected. If adequate changes are not performed, the AU may be suspended and/or risk losing their user status.

B. STORAGE FACILITY COMPLIANCE SURVEY

On a quarterly basis the RSO performs and documents compliance surveys of all storage sites to ensure that radiation exposures to members of the public are not exceeding 100 mrem in any one year and that the dose in any unrestricted area does not exceed 2 mrem in any one hour.

C. ANNUAL PROGRAM AUDIT

Once a year, the RSO coordinates a review of the radiation program. The RSO works with an internal or external reviewer to review the content and implementation of the program. Generally, the reviewer is another safety coordinator within the University who is not associated with EHS/RM, another University or an outside third party

organization. The reviewer is expected to identify deficiencies and provide recommendations about the program. The RSO is responsible to implement corrective action where appropriate. See Appendix N for the audit checklist.

CHAPTER 7

SAFETY

(Issued on 9/1/97, Revised 9/30/10)

A. GENERAL CONSIDERATION

The safety of laboratory operations is everyone's responsibility. In the use of radioactive materials all individuals in the laboratory must be aware of their presence and of the procedures to be followed in case of an accident. To this effect, copies of significant postings and regulations such as the general laboratory safety rules and emergency procedures must be posted within the laboratory in a conspicuous location. Such required postings include the following:

A. ODH Notice to Employees
B. Lab Safety Rules
C. Emergency Numbers
D. Radiation Safety Handbook
E. Ohio Administrative Code Chapter 3701:1-38

New personnel being oriented to laboratory procedures must attend radioactive materials training conducted by the RSO.

The AU is ultimately responsible for seeing that safe day to day practices exist in the laboratory. The user must establish safe handling practices for the radiochemical when he or she filed the protocol for the use of the material. Changes to the protocol must be approved by the RSC. New protocols, including those using the same material, may not be instituted without the approval of the RSC.

The setting and execution of guidelines for radiation protection are based upon an underlying philosophy in which two factors are of prime importance. First is the assumption that there is no radiation dose so small that it does not involve some degree of risk. The second major factor to consider is that radiation, like many other developments of modern life, confers great benefit upon both the individual and the society in spite of its small risk to health. Consideration of the extent of these benefits makes a certain degree of risk acceptable. Thus, a balance must be struck in each contemplated radiation usage, in which the benefit to be gained is weighed against the anticipated risk. If the benefit outweighs the risk, the radiation is utilized so that its maximum benefit will be realized while individual exposure will be reduced to the minimum consistent with deriving these benefits. The overall protection philosophy, then, is to maximize the advantages from the use of radiation while minimizing exposure by eliminating whenever possible all unnecessary exposure to radiation.

Occupational exposure includes all the dose equivalents and intakes incurred by a worker during periods of work but excludes medical and natural radiation, unless the latter is enhanced as a result of a particular working environment. The arrangements for restricting occupational exposure should be applied to the source of radiation and to the designed features of the work place so that the use of personal protective equipment should, in general, be regarded as supplemental to these more fundamental provisions. Access to controlled areas should be restricted and subject to local operating instructions. External exposure may be restricted by the use of shielding, distance and limitation of time. Contamination by radioactive material may be avoided by attention to safety precautions and good work habits should ensure substantial reduction in occupational exposure. The ODH BRP has in place set occupational exposure limits which should not be exceeded under normal operational conditions. Even though current occupational exposure limits provide a very low risk of injury, it is prudent to maintain exposure to radiation below these limits. The objective is thus to reduce exposure by means of good radiation protection planning, as well as by management commitment to policies that foster vigilance against departure from good, prudent practices.

The University follows the philosophy of **As Low As is Reasonably Achievable (ALARA)** occupational exposure to radiation. This is only possible if each individual user of radioactive materials joins the Management's efforts in implementation of these concepts. The ALARA concept is an integral part of all activities that involve the use of radiation or radioactive materials. This includes the design, construction and operations of existing and future facilities. This concept includes reducing both internal and external exposure to ionizing radiation. There are four ways to accomplish this: (1) work with a minimum amount of radiochemical (2) keep a maximum reasonable distance from the radiochemical (3) minimize exposure time and (4) make use of proper shielding.

The dose rate varies inversely with the square of the distance between the radiochemical and the worker. At a distance of 3 inches, the dose rate is 1/9th that at a distance of 1 inch. Dose rate is linear with time, so minimize handling times by first developing handling techniques using dummy runs. In most cases, the glass walls of lab containers and the self absorption of solution are very effective shields in most cases (low energy alpha and beta emitters), but in some cases, additional shielding may be required. This shielding should be of low atomic weight materials and have the highest density possible. This will minimize the danger of harmful high energy x-radiation being fluorescing from the shield.

Table 3. Required Shielding for some of the common radioisotopes on campus

Isotope	Half-life	Energy	Required Shielding Material
3H	12.2 yrs	Beta	none
14C	5730 yrs	Beta	none
35S	87.4 days	Beta	none
32P	14.3	Beta	Lucite (1cm)

	days		
51Cr	27.7 days	X-ray, Electron	Lead (2cm)

B. SAFE PRACTICES FOR WORKING WITH RADIOACTIVE MAERIALS

A. The radiation exposure received by each person shall be kept as low as reasonably achievable.

B. Each individual is required to wear a TLD badge, a film badge, or a pocket dosimeter depending upon the energy of the emission products. These will be collected and processed on a regular basis. Results of the monitoring will remain on file with EHS/RM.

C. Each individual shall wear laboratory coats or other protective clothing at all times in the areas where radiochemicals are being used.

D. Disposable gloves shall be worn when the likelihood of hand contamination is significant. The technique of double gloving is a beneficial precaution.

E. Each individual is required to monitor his/her hands, clothing, and work area periodically to check for contamination. The frequency of the monitoring will depend upon the type of work being done and the amount of radioactivity being handled. Monitoring must be done at the end of every work period. Contaminated items must be cleaned immediately.

F. Any contamination detected during a survey must be cleaned up immediately. Procedures for decontamination are listed at the end of the manual.

G. The use of absorbent paper on the lab bench tops and/or the use of liquid tight trays while handling radiochemicals is strongly encouraged as an aid in preventing and minimizing contamination.

H. Mouth pipetting is prohibited. Safety bulbs are to be used routinely.

I. Eating or drinking in laboratory areas is prohibited. Storage of food or drink in refrigerators or freezers used for storage of radiochemicals is prohibited.

J. Cosmetics, hand lotions, etc. are prohibited in the laboratory.

K. Evaporation of liquids containing radiochemicals shall be conducted in a hood and under conditions such that splattering cannot occur.

L. Operations causing dusting of radioactive materials are to be avoided whenever possible. Techniques capable of confining and controlling the dusting are essential.

M. Transporation of radiochemicals shall always be performed in adequately shielded containers according to the provisions provided by Chapter 3701:1-50 of the Ohio Administrative Code and 49 CFR 173.435 as it relates to the transportation of radioactive materials as designated by the Department of Transportation (DOT).

N. Dispose of radioactive waste only in specially designated receptacles or hot sinks and by acceptable means.

C. PREVENTATIVE MEASURES

In order to prevent accidents or to minimize the seriousness of those few that may occur, use the following preventive measures when working with radioactive materials.

A. Where the danger of spills of radiochemical solutions exists, use secondary confinement - pans or trays. The outer container should be unbreakable and of sufficient capacity to retain the total volume of the solution.

B. Incorporate “dummy” runs when prior to implementation new or unfamiliar procedures.

C. Keep radioactive work separated from other work, preferably by maintaining areas used solely for radioactivity.

D. Wear personal monitoring devices, film badge or TLD, at all times in areas where radioactive materials are used or stored. These should be worn in areas most likely to receive exposure- hands or at chest or waist level.

E. Confine radioactive solutions in covered containiers plainly identified and labeled with name of compound, radionuclide, date, activity, and dosage level if applicable.

F. Wash hands before leaving area.

CHAPTER 8

CORRECTIVE ACTION AND DISCIPLINE

(Issued on 9/30/10, Revised n/a)

The RSC and the RSO are authorized to limit or revoke an individual's authority to use radioactive material or sources of ionizing radiation if such use presents a hazard to individuals or violates health and safety codes. In addition, any AU who violates program policies will be made to perform corrective action. Failure to perform corrective action may result in further discipline including a suspension or termination from the program.

Matters involving an AU who shows repeat violations or has deficiencies in their program will be brought to the attention of the appropriate academic dean or UDRI director. The RSO will work with the RSC and the support personnel to determine a corrective action plan and disciplinary action. AU's who are suspended from the program will be required to provide a description stating why the violation occurred and must present a corrective action plan that is approved by the RSC. Following approval of the plan and all deficiencies brought into compliance, the AU will be re-initiated into the program on a six month probationary period. Violations noted under the probationary period may result in immediate termination from the program.

Currently, disciplinary action from program deficiencies are reviewed by the RSC by a case to case situation.

CHAPTER 9

EMERGENCY PROCEDURES

(Issued on 9/1/10, Revised 9/30/10)

A. GENERAL INFORMATION

Emergencies resulting from accidents in laboratories while working with radiochemicals will range from simple spills of small amounts of radioactive materials, where no serious contamination problem results, to major contamination resulting from fires, explosions, or natural phenomena. Correspondingly, the hazards resulting from such accidents will cover the range of situations from no hazard whatsoever to very serious situations involving exposure of the public to unforeseen radioactive contamination which might possibly result in injury from such contamination. In view of the complicating factors that may result from such emergencies, simple rules of procedure cannot be set for every circumstance. However, in any emergency situation, the primary concern must always be the protection of the laboratory personnel and the public from radiation hazards. Second should be the confinement of the contamination to the local area of the accident, if possible.

Accidents involving more than **10 microcuries** must be properly decontaminated and documented following protective measures taken to insure the safety and reduction of risk to all personnel. When in doubt about the seriousness of the accident, call EHS/RM at 229-4503 so that advice and guidance may be given regarding proper techniques for clean-up and decontamination.

In the event of an emergency involving radioactive materials (1) take appropriate action to protect all personnel, take appropriate action to prevent the spread of contamination and notify the proper authorities.

B. EMERGENCY NUMBERS

Radiation Protection Officer:
Mark Fuchs x94503 937-603-4122

Director EHS/RM
Robin Oldfield x94503 937-603-6554

Assistant Director EHS/RM
Katherine Cleaver x94503 937-313-4560

Campus Public Safety x92121

Police 911

C. PROCEDURES FOR DEALING WITH RADIOACTIVE SPILLS, ACCIDENT, INJURIES OR OTHER EMERGENCIES

In any emergency situation, the primary concern must always be the protection and safety of the laboratory personnel and the public from radiation hazards. Remove all persons to a safe location and check for injuries. If a spill is on the skin, flush thoroughly. If the spill is on the clothing, discard outer or protective clothing. Monitor all persons involved in the spill and decontaminate personnel as necessary. Wash minor wounds immediately, under running water, while spreading the edges of the wound.

Emergency Procedures for Minor Radioactive Spills*

A. Immediately notify all personnel in the room that a spill has occurred

B. Locate and confine the spill immediately. For liquid spills – don protective gloves and with tongs, right the container and cover the spill with absorbent paper. For dry spills – don protective gloves and with tongs, dampen the spill thoroughly, taking care not to spread the contamination and cover the spill with absorbent paper

C. If the spill is on the skin, flush thoroughly.

D. If the spill is on the clothing, properly discard outer or protective clothing.

E. Monitor all person(s) involved in the spill and decontaminate personnel as necessary.

F. Decontaminate the area

G. Monitor the area and repeat step F until the area has been totally decontaminated

H. Discard any waste accordingly

* Users should be trained to handle events in the case of a small spill, thus it is not necessary to immediately contact or report the incident to EHS/RM unless additional assistance is required. The user must decontaminate and document the event.

Emergency Procedures For Major Spills Involving Radiation Hazard to Personnel*

A. Immediately notify all personnel in the room that a spill has occurred.

B. Check all personnel for injuries

C. Notify all persons not involved in the spill to vacate to a safe location (retain contaminated persons nearby for monitoring, if needed).

D. Prevent the spread and confine the spill if possible in a safe and protected manner without risking personal safety

E. Shield the source if it can be done without further contamination or without significant risk of increasing your radiation exposure

F. Mark off the contaminated area and post notification of a spill

G. Survey all personnel for contamination

H. Take immediate steps to decontaminate all personnel involved as necessary. Decontaminate yourself and all clothing. If the spill is on the skin flush the area with water thoroughly, if the spill is on clothing discard outer or protective clothing

I. Switch off all fans and air conditioners

J. Vacate the room

K. Notify the Environmental Health and Safety Office as soon as possible

L. Decontaminate the area under supervision of Radiation Safety Officer making sure that all personnel involved in the decontamination procedure are adequately protected

M. Monitor all persons involved in the spill and cleaning to determine adequacy of decontamination

N. Permit no persons to resume work in the area until a survey is made and approval of the Radiation Protection Office is secured

O. Prepare a complete history of the accident and subsequent activity related thereto for the laboratory records with a copy for the Radiation Safety Officer's records.

* For large spills or those that present a significant risk of exposure to personnel, immediately notify EHS/RM

<u>Accidents Involving Radioactive Dusts, Mists, Fumes, Organic Vapors, and Gases</u>

A. Notify all other persons to vacate the room immediately

B. Hold breath and close escape valves; switch off air conditioning devices, etc., if time permits

C. Vacate the room

D. Notify EHS/RM at once

E. Ascertain that all doors giving access to the room are closed and post conspicuous warnings to prevent accidental opening of the doors

F. Report at once all known or suspected inhalations of radioactive materials

G. Evaluate the hazard and the necessary safety devices for safe re-entry

H. Determine the cause of contamination and rectify the condition

I. Decontaminate the area under supervision of the Radiation Protection Office

J. Perform air survey of the area before permitting work to be resumed

K. Monitor all persons suspected of contamination

L. Prepare a complete history of the accident and subsequent related activity

Injuries to Personnel Involving Radiation Hazard

A. Wash minor wounds immediately, under running water, while spreading the edges of the wound

B. Report all radiation accidents (wounds, overexposures, ingestion, inhalation) to EHS/RM as soon as possible

C. Permit no person involved in a radiation injury to return to work without the approval of the RSO and the attending physician

D. Prepare a complete history of the accident and subsequent activity related to the incident

D. TABLE OF GENERAL DECONTAMINATION METHODS

Contaminated Area	Decontamination Agent	Remarks	Permissible Levels of Contamination
Skin and Hands	Mild Soap and Water If necessary, follow by soft brush, heavy lather and tepid water	Wash 2-3 min. and monitor. Use light pressure with heavy lather. Wash for 2 min., 3 times. Rinse and monitor. Use care not to scratch or erode skin. Apply lanolin or hand cream to prevent chapping.	Alpha: 150 DPM per 100 cm^2 Beta: Average less than 0.3 mr/hr for each hand surface or 100cm^2 of skin surface
Wounds or Cuts and Breaks in the Skin	Running Tap Water	Wash the wound with large volumes of running water immediately. Spread the edge of wound to permit flushing action by the water	Keep contamination as low as possible.
Ingestion by Swallowing	Immediately induce vomiting Drink large quantities of liquids to dilute the activity	Urine analysis will be necessary to determine amount of radionuclide in the body	
Clothing	Wash if levels permit	Use standard laundering procedures (3% citric acid may be added to wash water). Wash water must be below minimal permissible limits for sewer disposal	Alpha: 150 DPM per 100 cm^2 Beta: No area to average more than 0.1 mr/hr with GM meter.
Glassware and Laboratory Tools	Soak 24-48 hours Soap or detergent and water. Immersion in dilute solutions of nitric acid	Monitor wash water through scintillation counting	The level for glassware or tools that are handled with the bare hands is the same as for the hands and skin
Plastic Equipment	Soak in dilute solutions of ammonium citrates, acids or organic solvents Clean with soap and water	Solvents may attack the plastic	
Walls and Floors	Detergents and water with mechanical scrubbing action	Monitor used water	