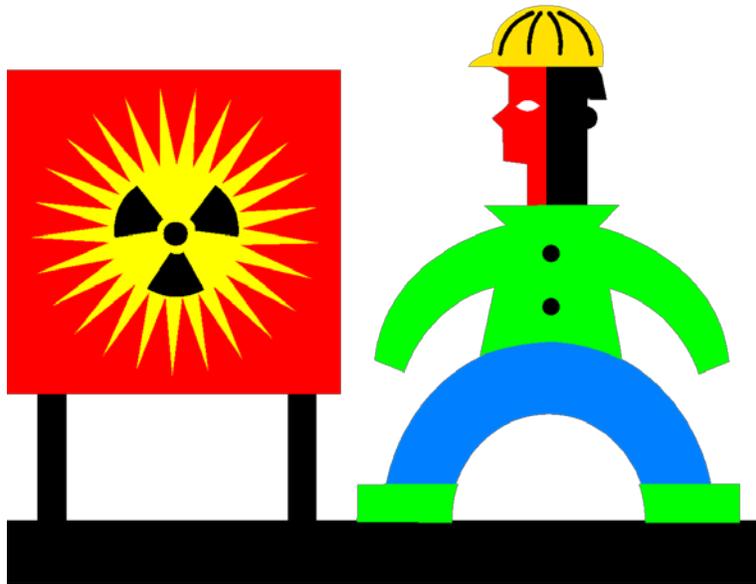


Radiation Safety Program



RADIATION SAFETY

I. INTRODUCTION

This manual conveys the official policies and rules of Linn-Benton Community College (LBCC). The LBCC Radiation Safety Program applies to all locations under LBCC control wherein radioisotopes or radiation-producing machines are used or stored, regardless of ownership or location. It applies to all persons working at or frequenting these locations, regardless of their relationship with the College. It applies to a limited extent to College personnel and equipment at non-College controlled locations. This manual defines responsibilities of individuals and organizations for radiation control; it specifies the rules that guide specific decisions on radiation control matters and outlines general safety procedures that are required for all users of radiation sources.

A. Federal and state regulations require a written radiation protection program that includes provisions for keeping doses As Low As Reasonably Achievable (ALARA). All radiation users will be included in and informed of the program and their individual responsibilities.

B. Linn-Benton establishes and maintains a program in radiation safety that emphasizes the health and welfare of all individuals. Every function that uses ionizing radiation must be reviewed and follow the procedures and policies established by the College.

C. Any practice or operation involving ionizing radiation at LBCC will comply with the existing Oregon Administrative Rules developed by the Department of Human Services, Public Health. Linn-Benton Community College will obtain and maintain all licenses that are necessary or useful for the conduct of the radiation safety program. The College will, in so far as possible, obtain and maintain copies of applicable federal, state and local laws and regulations pertaining to the radiation safety program. The College will also comply with associated licensing agreement(s) at the College. The College will develop procedures that prevent unnecessary exposures to any individual and insure that all exposures that do occur are ALARA.

II. LICENSES AND REGULATIONS

A. Policy

Linn-Benton Community College will obtain and maintain all licenses that are necessary or useful for the conduct of the radiation safety program. The College will, insofar as possible, obtain and maintain copies of applicable federal, state, and local laws and regulations pertaining to the radiation safety program. The Radiation Safety Officer is responsible for the maintenance of the licenses. Each individual department is responsible for the cost of maintaining the licenses.

B. Procedure

State Licenses and Regulations: Radiation-producing machines and radioisotopes (other than fissionable material in quantity) which are used or stored at locations under State of Oregon jurisdiction are subject to provisions of Oregon Rules for the Control of Radiation (ORCR), found in Chapter 333, division 100, Oregon Administrative Rules (OAR). At LBCC, possession of radioisotopes in a quantity above the allowable limit for exemption of licensure will be governed by provisions of a radioactive materials license issued to Linn Benton Community College by Radiation Protection Services, Health Services, Department of Human Services, State of Oregon. This license specifies the radioisotopes, chemical forms, quantities, locations, and activities permitted by the license. Radioactive material transport, storage, and disposal must comply with rules issued by Oregon Department of Energy and Department of Environmental Quality.

III. RADIATION SAFETY PROGRAM RESPONSIBILITIES

A. Policy

1. The College permits the use of ionizing radiation sources for beneficial applications in teaching, research, and community service. The health and welfare of each member of the faculty, staff, student body, and general public is of primary importance; however, the financial, legal, and societal obligations of the College are also considered in the implementation of practical radiation protection policies.

2. The College is committed to eliminate unnecessary radiation exposures and to reduce all exposures to levels that are ALARA. The ALARA principle is a formal requirement of the U.S. Nuclear Regulatory Commission and is applicable even when the potential dose is well below the individual dose limit(s). ALARA also means balancing the benefits of dose reduction against social benefits and economic considerations.

B. Procedure

The ALARA (As Low As Reasonably Achievable) program is implemented by:

- a) Training all radiation users or verifying previous training and qualifications,
- b) Performing safety evaluations of proposed facilities or projects utilizing radiation,
- c) Performing regular surveys of work areas for contamination and exposure rates,
- d) Monitoring radiation exposures to groups and individuals,
- e) Investigating all exposures that exceed predetermined ALARA levels (included in this manual, Table II), and
- f) Performing annual audits of the College radiation safety program.

C. **Responsible Parties:**

Responsibilities of the various participants in the radiation safety program shall be made clear to all. Each participant is responsible for understanding and carrying out the required responsibilities and for understanding the interactions with other participants

1. **LBCC ADMINISTRATION:** The Director of Safety & Loss Prevention has the primary responsibility for coordinating and supporting a radiation safety program at LBCC and reviewing the integrity of the program annually to ensure that the College is in compliance with existing regulations.

2. **RADIATION SAFETY OFFICER (RSO):** The RSO is the individual appointed by the Director of Safety & Loss Prevention and named on the radioactive registration(s) to establish and enforce procedures as necessary to assure compliance with applicable federal, state, and College regulations. The RSO reports to the Director of Safety & Loss Prevention for the purposes of the Radiation Safety Program. The RSO is required to provide an annual documented review to the Director of Safety & Loss Prevention on the status of the radiation safety program. The RSO is responsible for interpreting and implementing regulations, policies, and rules established by the committee. The RSO also provides technical advice to radiation users and the administration. The RSO is responsible for managing the day-to-day affairs of Radiation Safety.

- a) The RSO will immediately review any College operation that poses a radiological threat.
- b) The RSO establishes radiation exposure investigation levels and if exceeded, initiates a prompt investigation of the cause and recommends actions to reduce the probability of recurrence.
- c) Additionally, the RSO is responsible for:
 - (1) Ensuring adequate credentialing of individuals teaching radiation safety of radiation related procedures and processes.
 - (2) Maintaining copies of pertinent regulations, registrations, license applications, licenses and amendments;
 - (3) Maintaining all records required by the state;
 - (4) Developing, conducting, and documenting appropriate training;
 - (5) Providing radiation protection services to potentially exposed personnel;
 - (6) Providing advice to LBCC personnel and others concerning radiation and safety matters;

- (7) Managing radiation incidents and occurrences and supervising decontamination and other corrective tasks.

3. PROGRAM DIRECTOR (AUTHORIZED USER): The Program Director has primary responsibility for all safety aspects of work under the program. The Program Director has the primary responsibility for providing adequate training for individuals who work routinely with radiation under his/her area. This includes:

a) **Responsibilities:**

- (1) Being familiar with applicable parts of federal, state, and local laws and regulations;
- (2) Ensuring the personnel working under the program have received proper training;
- (3) Ensuring that all tasks involving radioisotopes or radiation machines are properly planned with respect to safety and that personnel involved understand what is to be done;
- (4) Ensuring that needed surveys, inspections and inventories are performed and documented properly and timely;
- (5) Ensuring that facilities and equipment needed for safety purposes are present and are properly maintained, including proper posting and labeling;
- (6) Ensuring that activities, materials, facilities, and personnel used during program work are properly authorized;
- (7) Ensuring proper security and marking of radioactive materials;
- (8) Ensuring proper notification of Radiation Safety and completion of proper corrective procedures in event of a spill, overexposure, etc.
- (9) Ensuring proper notification and clearing of facilities and records upon termination of program work;
- (10) Ensuring all copies of the Radiation Safety Manual and of each Radiation Authorization is kept up to date.

b) **Qualifications:**

- (1) The Program Director must provide to the RSO documentation of adequate initial Radiation Safety Training in the form of transcripts and/or certifications.
- (2) The Program Director should provide the RSO with documentation of continuing education in radiation safety.

4. TEACHING FACULTY (AUTHORIZED USER): Faculty teaching radiation safety courses and/or radiation related processes and procedures have the responsibility for all safety aspects of work under their individual courses. The instructional faculty have the responsibility for providing adequate training for individuals who work routinely with radiation in their course. This includes:

a) **Responsibilities:**

- (1) Being familiar with applicable parts of federal, state, and local laws and regulations;
- (2) Ensuring that all tasks involving radioisotopes or radiation machines are properly planned with respect to safety and that personnel involved understand what is to be done;
- (3) Ensuring that needed surveys, inspections and inventories are performed and documented properly and timely;
- (4) Ensuring that facilities and equipment needed for safety purposes are present and are properly maintained, including proper posting and labeling;
- (5) Ensuring that activities, materials, facilities, and personnel used during program work are properly authorized;
- (6) Ensuring proper security and marking of radioactive materials;
- (7) Ensuring proper notification of Radiation Safety and completion of proper corrective procedures in event of a spill or overexposure, etc.

b) **Qualifications:**

- (1) Faculty teaching radiation safety courses and/or radiation related processes and procedures must provide to the RSO documentation of adequate initial Radiation Safety Training in the form of transcripts and/or certifications.
- (2) Faculty teaching radiation safety courses and/or radiation related process and procedures should provide the RSO with documentation of continuing education in radiation safety.

5. **X-RAY USER:** An “x-ray user” is any individual that will be using x-rays exclusively. An “x-ray student,” “dental assisting student,” or “metallurgy student” is any individual registered at LBCC in these programs. These individuals work with in the College under several Qualified Users.

5. **OTHERS INVOLVED WITH RADIATION:**

All others working with or around radioisotopes and/or radiation machines are responsible for complying with safety and operating regulations and procedures pertaining to their activities. This includes such persons as:

- (1) Lab workers
- (2) Police and security workers
- (3) Janitorial personnel
- (4) Package delivery personnel

The College recognizes that personnel not previously approved by the RSO need to have temporary radiation user approval in order to work with or near

radiation for the purposes of education, research, or repair of equipment. The RSO should be provided documentation of radiation safety training by the Program Director for individuals that fall within the categories above.

B. Financial Responsibility

1. Program Directors are responsible for costs associated with their use of radioactive materials as set forth in the schedule of charges published by Radiation Safety (e.g. radioactive waste disposal, x-ray machine registration, survey instrument calibration fees.)
2. Departments will be responsible for any charges for which a Program Director is unable to pay.

IV. RADIATION SAFETY TRAINING

A. Policy

1. Regulations governing the possession and use of radioactive materials and other radiation sources require that every individual working with or in the presence of such sources be instructed in the applicable provisions or regulations and license conditions, in the potential health problems associated with exposure to radiation, in the precautions and procedures required for safe use of radiation and in the proper use of protective and measurement devices. The greater the potential risk of radiation exposure the more training that is required.

B. Procedure

1. **REGULAR USERS:** For individuals with ongoing experience with radiation sources, annual retraining is not required. Retraining may be required if:
 - a. regulations, license conditions, or procedures change
 - b. contamination or exposure problems occur
 - c. procedures are not followed.
2. **NEW USERS:** Individuals must demonstrate knowledge, proficiency, and/or experience in the following areas or be required to pass an examination prior to use of any form of radiation.
 - a. Orientation to equipment
 - b. Safety and Radiation
 - a. Basic Radiation Principles
 - b. X-ray machines and equipment

V. PREGNANCY

A. Policy:

- A. The National Council on Radiation Protection and Measurements recommends that the Maximum Permissible Dose equivalent to the

embryo-fetus from occupational exposure to the expectant mother should be limited to 5 mSv (0.5 rem) for the entire gestation period.

B. All students, during orientation are provided U.S. Nuclear Regulatory Commission Regulatory Guide 8.13 - Instruction Concerning Prenatal Radiation Exposure

B. Procedure: Keeping with the Oregon Administrative Rules (OAR), the NRC, and the NCRP recommendations, the following steps must be taken if a student suspects pregnancy.

- a) Student must decide to declare or not declare the pregnancy.
 - a. Students are advised to have a discussion with the Program Chair, Program Coordinator and/or the Clinical Coordinator as soon after conception as practical.
 - b. The Program Chair, Program Coordinator and/or the Clinical coordinator can review this policy with the student.
 - c. This discussion will not affect program status.
 - d. **Requirements of a declaration:**
 - i. If the student chooses to declare the pregnancy, the student should be counseled by the LBCC Program Director/Chair and advised of available options:
 1. Medical leave until delivery.
 2. Continued full time status with limited rotation in high exposure situations, i.e. fluoroscopy, portables, and operating room procedures (extended clinical time may be required).
 3. Continued part time status with limited rotation in high exposure situations, i.e. fluoroscopy, portables, and operating room procedures (extended clinical time maybe required).
 - ii. If a student chooses to declare the pregnancy, the Declaration of Pregnancy Form must be signed by the student to declare the pregnancy. This document will be placed in the student's permanent record.
 - iii. A student may withdraw her Declaration of Pregnancy at any time.

b) **Student responsibilities:**

1. If a student chooses to continue, all courses must be completed with a passing grade. Continued attendance and successful progress must be maintained. If the student wishes to complete courses as scheduled, she must attend class on an ongoing basis during and after the pregnancy. In the event that the student cannot complete a course, the student will be required to either retake the course the next time it is offered or receive a grade of incomplete and complete the assignments at a later date. It is possible for the student to continue and successfully complete the academic courses without disruption.

2. If a student chooses to continue, the student must obey strict adherence to ALL safety precautions for protection purposes. The student's clinical rotation will be monitored so that the student will NOT receive unnecessary radiation. The student will be expected to satisfactorily perform in the clinical setting and to make up competencies and time missed at the completion of the pregnancy.
 185232960. The student will practice ALARA.
 185232961. The student will NEVER place herself in the primary beam of radiation.
 185232962. The student must adhere to the pregnancy policy at the clinical or lab facility.
3. If a student chooses to continue, the student must wear two (2) personnel monitoring devices: one on the collar and one on the abdomen for fetal monitoring. The radiation safety officer and Program Director/Chair will monitor the reading closely, and the student will be subject to immediate leave of absence from clinical if at any point the radiation doses are deemed unsafe.
4. If a student chooses to continue, the student will immediately report activities that she feels are unsafe or that are detrimental to her or the fetus. She will report these activities to the Program Director/Chair and/ or the Clinical Instructor.

VI. AUTHORIZATION TO POSSESS AND USE

A. Policy

In general, possession or use of any radioisotope of radiation-emitting machine at any LBCC jurisdiction location must be in accordance with a written Radiation Authorization issued by the Radiation Safety Officer.

B. Procedure

1. **REQUEST:** The applicant shall submit a written request to the RSO. The request must provide sufficient detailed information to enable adequate safety analysis and prescription of adequate precautions. Authorization request instructions may be obtained from the RSO.
2. **REVIEW:** The RSO will review the request, review the proposed facilities, obtain any additional information desired, and then prepare a safety review and a proposed Radiation Authorization.
3. **AUTHORIZATION:**
 - a. Authorization disapproval requires written notification to the applicant stating the reasons for disapproval and giving possible alternatives.
 - b. An authorization becomes valid when signed by the RSO to signify approval and by the applicant to signify acceptance.

C. Authorization

1. **INFORMATION:** The authorization shall specify every location, person, source of radiation, and activity authorized. It shall list the expiration date

and any special precautions required, and shall include any additional information desired by the RSO.

2. **COPIES:** An up to date copy of the RA must be posted in each workplace listed in the RA.
3. **AMENDMENT:** Amendment of an authorization requires the formal authorization process to repeat. An amendment is needed for changes in location, changes in radioactive materials, or radiation machines, changes in quantities, activities, chemical forms, or changes from the Program Director.
4. **TERMINATION:**
 - a. A Radiation Authorization will be terminated upon:
 - (1) Expiration without renewal
 - (2) Completion of work authorized
 - (3) Departure from LBCC of the Program Director
 - b. Termination requires:
 - (1) Disposal of all radioactive material and radiation machines
 - (2) Survey by RSO of facilities to ensure removal of radiation signs and labels, to ensure no remaining radioactive contamination, to verify all final inventory and survey records
 - (3) Return of all radiation dosimeters, and payment of charges
 - (4) Transfer of survey, inventory, training and occurrence records to RSO
 - (5) Notification sent to the Department that RA has been completed.

D. Exceptions

1. **NON-REGULATED SOURCES:** There are exemptions for non-regulated sources. Exceptions can include:
 - a. Cloud chamber needles
 - b. Alpha-beta-gamma enclosed demo sources
 - c. Unregulated low power lasers
2. **SMALL QUANTITY:** There are no exceptions for small quantity of low emission rate.
3. **SPECIFIC USE:** There are exceptions for specific uses. Exceptions for which written RA is not required include:
 - a. Modest quantities of naturally occurring radioactive material in unprocessed form: i.e.: ore samples, rock samples.
 - b. Readily available commercial items containing small amounts of

radioactive materials; i.e.: gas lantern mantles, smoke detectors, thoriated weld rod, exit signs so long as the radioactive materials will not be separated or used for experimental purposes.

- c. Dental porcelain containing radioactive material.
- d. Optics having thorium in anti-reflection coatings.
- e. Radioisotopes in humans when administered (at non-LBCC jurisdictions) by the healing arts professionals for diagnosis or treatment.
- f. Electron microscopes, electron beam welders, or other similar devices exempt from state registration in accordance with 333.101 OAR.

VII. RADIATION DOSE LIMITS

A. Policy

Work with sources of ionizing radiation will be conducted so that doses received by individuals do not exceed the applicable limit and doses are maintained as low as reasonably achievable (ALARA).

Notification: In accordance with the requirements of the U.S. Nuclear Regulatory Commission and the Oregon Administrative Rules (OAR), the following documents must be posted on a bulletin board in every Radiation area:

- a. Oregon "Notice to Employees"
- b. NRC Form 3 "Notice to Employees"
- c. These must be posted where anyone entering the lab can see it in the following conditions:
 - (1) These must be posted if any dose rate exceeds 2 mrem/hour at 1 foot from an accessible source or surface.
 - (2) These must be posted if the room is considered a "Restricted Area".

(a) A Restricted Area is any area in which access is limited for the purpose of protecting individuals against undue risks from exposure to radiation and radioactive materials.

(b) A Restricted Area will have some type of marked or physical boundary so that untrained personnel will be prevented from accessing the area.

B. Definitions

1. **COMMITTED DOSE EQUIVALENT (CDE):** the dose equivalent to organs or tissues of reference that will be received from and intake of radioactive material by an individual during the 50-year period following intake.
2. **COMMITTED EFFECTIVE DOSE EQUIVALENT (CEDE):** the sum of the products of the weighting factors applicable to each of the body organs or tissues that are irradiated and the committed dose equivalent (CDE) to each of these organs or tissues. This is a measure of the overall risk associated with internal deposition of radioactive material.
3. **DEEP DOSE EQUIVALENT (DDE):** the dose equivalent at a tissue depth of 1cm; applies to external exposure.
4. **DETERMINISTIC EFFECTS (non-stochastic):** observed in an

exposed individual. These effects are caused by a very large exposure over a short period of time. These effects are only seen if the dose exceeds a specific limit. If the dose is below the limit, no effect is expected. If the limit is exceeded, the effect is expected.

5. **EFFECTIVE DOSE EQUIVALENT (EDE):** the distinction of the biological effects of a particular type of radiation or mixed radiations in human tissue. Since different types of radiation physically interact differently in matter, the Effective Dose Equivalent allows all types of radiation to be measured on the same scale. Measured in rem or Sievert (Sv).
6. **EYE DOSE EQUIVALENT (LDE):** the dose equivalent to the lens of the eye at a tissue depth of 0.3 cm (300 mg/cm^2).
7. **IONIZING RADIATION:** defined as any type of radiation that has enough energy to eject electrons from atoms. Major types are x-rays, gamma, photons, beta particles, alpha particles, and neutrons. Ionizing radiation is capable of producing biological effects that may impair health. Regulatory agencies assume that any radiation dose, no matter how small, has associated risks.
8. **MEMBER OF THE PUBLIC:** an individual who is not in a restricted area and who is not performing assigned duties that involve exposure to sources of radiation.
9. **OCCUPATIONAL DOSE:** the dose received by an individual in a restricted area or while performing assigned duties that involve exposure to sources of radiation.
10. **SHALLOW DOSE EQUIVALENT (SDE):** the dose equivalent at a tissue depth of .007cm (7 mg/cm^2) averaged over 1 cm^2 ; applies to external whole body or extremity exposure.
11. **STOCHASTIC EFFECTS:** those that occur randomly in an exposed population and not on an individual basis. These effects are usually observed long after the exposure. Since these effects cannot be distinguished from those that occur in an unexposed population, the relationship is based on the likelihood of an effect. For these effects it is assumed that no dose produces no effect and that the likelihood of occurrence increases as the dose increases. The severity of the effect, it is occurs, is the same no matter what the dose.

12. **TOTAL EFFECTIVE DOSE EQUIVALENT (TEDE):** the sum of the deep dose equivalent (DDE) for the external exposure and the committed effective dose equivalent (CEDE) for internal exposure.
 13. **TOTAL ORGAN DOSE EQUIVALENT (TODE):** the sum of the deep dose equivalent (DDE) and the committed dose equivalent (CDE) to the organ receiving the highest dose.
- C. **Annual Doses:** In the U.S., average annual doses are:
1. ~ **100 mrem from cosmic rays and other natural sources**
 2. ~ **200 mrem from radon in homes**
 3. ~ **50 mrem from medical examinations**
 4. ~ **10 mrem from consumer products and other manmade sources**
 5. **Total of ~360 mrem per year**
- D. **BASELINE RISK:** The baseline risk of a fatal cancer from all causes (not only from radiation), averaged over the entire U.S. population is approximately 1 in 4, or ~25%. It is recognized, however, that certain subgroups, e.g. smokers, residents of large cities, or individuals that are genetically predisposed, have cancer risks that are above average. A continuous dose rate of 400 mrem per year for 70 years is estimated to add ~1.5% to the baseline risk.
- E. **OCCUPATIONAL DOSE FOR ADULTS:**
1. An annual limit of 5 rem (0.05 Sv) TEDE
 2. An annual limit of 50 rem (0.5 Sv) to an individual organ or tissue other than the lens of the eye, as determined by the deep-dose equivalent and the committed dose equivalent.
 3. An annual limit of 15 rem (0.15 Sv) to the lens of the eye.
 4. An annual limit of 50 rem (0.50 Sv) to the skin.
 5. An annual limit of 50 rem (0.50 Sv) to each of the extremities.
- F. **OCCUPATIONAL DOSE LIMITS FOR MINORS (UNDER AGE 18)**
The occupational dose limits for minors are 10 percent of the above occupational dose limits for adults.

G. DOSE TO AN EMBRYO OR FETUS:

1. A limit of 0.5 rem (5 mSv) during the entire pregnancy due to occupational exposure of a declared pregnant woman. For external exposure, the dose to the embryo or fetus will be estimated by the deep-dose equivalent to the declared pregnant woman.
2. An effort will be made to avoid substantial variation above a uniform monthly dose rate to a declared pregnant woman. The Radiation Safety Officer will investigate any report of a dose in excess of 0.050 rem (0.5 mSv) to a declared pregnant worker within 7 working days of receiving knowledge of the dose.

H. DOSE LIMITS FOR THE PUBLIC

1. An annual limit of 0.1 rem (1 mSv) TEDE
2. An hourly limit from external sources of 0.002 rem (0.02 mSv) in unrestricted areas.

VIII. RADIATION PRACTICES

A. Policy

Radiation protection practices have been established for the protection of all personnel, students, and employees.

B. Procedure

1. **CARDINAL RADIATION PROTECTION PRINCIPLES:**
 - a. Do not allow unfamiliarity to result in poor radiation protection procedures.
 - b. Never stand in the primary beam of radiation.
 - c. Always wear protective apparel or stand behind protective barriers. Shielding places protective materials between personnel and the source.
 - d. Always stand as far from the radiation source as is applicable. The farther away from the source the smaller the amount of exposure.
 - e. Always spend as little time as possible with the radiation source. The less time spent exposed to a radioactive source, the less exposure there is. Exposures are additive in their effect.
2. **MONITORING DEVICES:** Always wear the supplied and monitored radiation monitoring devices as specified by the vendor or positioned on the outside of any lead shielding on the collar.
3. **PROTECTIVE EQUIPMENT:** A variety of specialized protective equipment is available. A partial listing of major equipment which is regularly available follows:
 - a. Shielding for all types of radiation such as concrete blocks, lead bricks, lead sheets, lead containers, thick plastic sheets and masonite.
 - b. Protective clothing such as gloves of all types, lab coats, coveralls, hoods, caps, shoe covers of all types, face shields, hard hats, safety glasses, and respiratory protection devices using filters or supplied air. Many of these items are available in either a disposable or reusable form.
 - c. Decontamination kits for personnel and equipment.
 - d. Radiation warning signs, labels, tapes, ropes, and standards

4. **LABORATORY RULES:**
 - a. No one may work in a Radioactive material lab or a radiation producing lab unless they are authorized by the LBCC Radiation Safety Officer or work under the direct supervision of someone who is authorized such as a program director.
 - b. Eating, drinking, smoking, and the application of cosmetics in the radiation areas are not permitted.
 - c. Protective clothing, i.e.: lab coats, gloves, and safety glasses, should be worn in the radiation areas as appropriate.
 - d. The wearing of long acrylic or “fake” nails is prohibited in the lab area.
 - e. Radiation Monitoring devices are required to be worn, as appropriate when present in any area or laboratory containing or producing radiation.
 - f. Radioactive materials shall not be left unattended in laboratories unless properly labeled, contained, and shielded.
 - g. Protective devices such as shielding, remote handling equipment, ropes and signs will be used to minimize doses to students and instructors.

IX. REGULATIONS CONCERNING RADIOISOTOPES

A. Policy

Radioisotopes must be acquired, used, stored, and disposed of in ways which will ensure compliance with federal, state and local laws and maintains doses to workers as low as reasonably achievable

B. Definitions

1. **IDENTIFICATION NUMBER:** number issued by the RSO and used to identify a shipment of radioactive material for receipt, inventory, and waste disposal records.
2. **CLEAN AREA:** an area within a room authorized for radioactive material, designated by the RSO and the responsible Program Director, in which the consumption of food and drink, application of cosmetics, etc. is permitted.
3. **DOT:** U.S. Department of Transportation

C. Procedure

1. **PERSONNEL TRAINING:** No person may work with radioisotopes at any LBCC jurisdiction location unless safety training has been given and

documentation is on file at RSO.

2. **ACQUISITION – TRANSFER:** Acquisition of any radioactive material, regardless of whether by purchase, gift, loan, transfer, or other means must be in accordance with a valid RA must have prior approval from RSO via phone or written request to ensure that acquisition will not violate provisions of the RA.
3. **IDENTIFICATION NUMBER:** number is assigned by the RSO upon receipt of an isotope.
 - a. Identification number will be shown on each package inspection survey form, and on any other transfer document.
 - b. Identification number must be shown on all inventory and disposal documents (waste tags, etc.).
4. **TRANSPORT:** Each package containing radioisotopes, whether incoming or outgoing, must be inspected by the RSO, to determine compliance with Department of Transportation packaging, labeling, and inspection regulations.
 - a. “Ship To” address for all incoming packages containing radioisotopes destined for the LBCC Campus:
Program Director’s name and Department:
c/o Radiation Safety Office
Room 209
East Linn Center
44 Industrial Way
Lebanon, Oregon 97355
 - b. Packages will be delivered to RSO who will inspect and deliver to the intended user or will arrange to have the package inspected and delivered.
 - c. Should a package be inadvertently be delivered direct to the intended user, RSO must be notified immediately to arrange the required inspection to assign an identification number.
 - d. For outgoing packages, the shipping group must contact RSO to arrange for inspection, labeling, preparation of shipping document, etc., and to arrange transportation to RSO and from RSO to the transporter.

5. **Posting**
- a. Each entryway to every location where radioisotopes are used or stored must be posted with a “Caution – Radioactive Material” (CRAM) sign or equivalent other sign.
 - b. Each hood wherein radioisotopes are used or stored must be posted with a CRAM sign.
 - c. Each refrigerator or freezer wherein radioisotopes are used or stored must be posted with a CRAM sign containing the statement “Store No Edibles.” No edibles are permitted in posted freezers or refrigerators except when clearly labeled for experimental use only, with human consumption forbidden.
 - d. Any container holding radioactive material must be labeled to show radioisotope, activity, and initial date, or must be kept in a container, which is so labeled. This includes containers holding radioactive wastes, test tubes, vials, etc.
 - e. Any contaminated tools must be labeled with CRAM tape.
 - f. Each transport container must be labeled in accordance with DOT regulations.
 - g. Any sign or label posted per above regulations must be removed when no longer applicable, and must be replaced when no longer legible or when otherwise no longer suitable for its intended purpose. Deface an labels that do now apply.
6. **Access:**
- a. Any location where radioisotopes are used or stored shall have entry doors closed, and preferably locked, whenever using personnel are not present.
 - b. Access for such locations must be controlled sufficiently to prevent theft or loss of radioactive material.
 - c. Stock vials and sealed sources must be secured with a locking mechanism to prevent theft or loss when not in use.
 - d. Any known or suspected loss, including theft, of radioactive material must be reported immediately to the RSO.

- e. Eating, drinking, smoking, or applying cosmetics is not permitted in any area where unsealed radioactive materials are stored or used.
- f. Change of custody other than within the using group requires approval of RSO.
- g. Radioactive material shall not be stored or used in a designated clean area, or in any area not authorized for radioactive material.

7. Inventory

- a. Inventory of all radioactive materials in possession must be maintained reasonably up-to-date by using group, and must be available for inspection at any reasonable time by the RSO. Inventory must include approval number for each item, initial receipt date, reasonable log of uses and disposals, date and method of final deposition. Inventory form must contain a running total or permit rapid easy totaling by radioisotope.
- b. Inventory records must be preserved for later inspection and review. All such records must be given to RSO should the using group disband or terminate radioisotope use.

8. Dosimetry

- a. A radiation dosimeter does not provide protection; it merely verifies, after the fact, the adequacy of the radiation control program within the facility. The primary purposes for performing the individual monitoring are:
 - (1) to monitor the individual's radiation environment
 - (2) to promote safe working habits
 - (3) to document radiation accidents
 - (4) to satisfy medical and legal requirements as is necessary to protect the employee and the employer
 - (5) to comply with pertinent federal, state and local regulations.
- b. Based on the location and the nature of the anticipated radiation use, the RSO will determine if an individual or area dosimeter is

needed.

The RSO will also determine the type of Dosimetry provided to the individual.

- c. Radiation users who are exposed to penetrating radiation from external sources, and who are UNLIKELY to receive more than 10% of any external occupational dose limit, are not required to wear personal badges.
- d. Personnel dosimeters will be prescribed and provided by RSO and listed in the RA.
- e. Personnel body dosimeters will be prescribed when annual deep body dose equivalent is likely to exceed 500 mrem or when annual shallow dose equivalent is likely to exceed 5000 mrem. Hand dosimeters will usually be prescribed where hand doses could exceed 50 mrem in any month.
- f. Dosimeters usually will not be prescribed where use involves only isotopes, which emit only alpha radiation and/or only beta radiation having E_{max} no greater than 0.26 MeV (e.g. 3H , ^{14}C , ^{35}S , ^{45}Ca , ^{63}Ni).
- g. Dosimeters usually will not be prescribed for work in rooms containing less than 100Ci aggregate of radioisotopes.
- h. All dosimeters will be returned promptly at the end of the monitoring period to the designated locations or to the RSO. Dosimeters not returned by the 15th of the month are considered late. Badges which are returned more than 30 days after the end of the month, lost, damaged, or misused in any way that invalidates the reading are considered to be lost and an average exposure is assigned to the worker.
- i. Groups of badges are provided from the supplier with a “control” or background badge to determine the approximate dose to the badges during shipping. Late returned badges cannot accompany their respective control badges and therefore cannot have the dose associated with background subtracted from the actual dose received by the wearer. Thus, a significant dose is always reported for late badges, which will be assigned to the wearer and may be investigated by the RSO. To reduce the time spent on unnecessary investigations and additional handling of late badges by the RSO, the RSO may suspend the use of radiation sources by persons that repeatedly return dosimeters late.

9. **Records and Surveys**

- a. Routine surveys of facilities and equipment must be made at least once each week wherein radioisotopes are handled.
- b. Each survey must include contamination swipes, and must include direct measurements via survey meters when appropriate.
- c. Each survey must be documented and kept on file. State-approved units must be used, i.e. dose rates in mrem/hr and contamination rates in microcuries per 100 cm² or disintegrations per minute (dpm) per 100cm². RSO must be notified when surface contamination at or above 500 dpm/100cm² beta-gamma, or 10 dpm/100cm² alpha in an accessible area is found; corrective actions taken must be documented. Survey reports must be given to RSO whenever the using group disbands or otherwise stops using radioisotopes.
- d. In addition, each person handling unsealed radioisotopes or visiting an area where such was handled should self-survey using appropriate survey meters before leaving the area for the day. Notify RSO immediately if contamination is found.
- e. RSO will perform surveys at least once every year to independently determine radiation levels and contamination levels, verify posting and labeling and ensure adequate radiation safety precautions in the lab. Report of findings will be sent to the using group, who will be responsible for any corrective actions needed.
- f. Special surveys may be required by RSO whenever conditions warrant. Surveys must be documented, with reports kept on file, in the same manner as routine surveys.

10. **Survey Meters**

- a. An operable appropriate radiation survey meter must be present whenever handling radioisotopes other than 3H in aggregate quantities exceeding 10 microcuries.
- b. Each radiation survey meter must undergo routine calibration and maintenance at least once each year, and, when repaired, must be recalibrated before being placed back into service.
- c. Routine calibration and maintenance shall include visual inspection and exposure to radiation levels or calibrated pulse

signals appropriate for each operable scale. Responses must be within manufacturer's specifications. Records of calibration must be kept by or for the using group.

11. **Handling – Storage Requirements**

- a. Radioisotopes must be handled in such ways as to keep personnel doses and contamination incidents as low as reasonably achievable considering the nature of the activities to be performed.
- (1) Minimum protective apparel for handling unsealed radioisotopes is lab coat and impervious gloves (vinyl, rubber, etc.). Additional protective apparel required will be noted in the RA.
 - (2) Working with unsealed radioisotopes is not permitted by persons having an open wound.
 - (3) Remote handling devices (tongs, forceps, pliers, etc.) must be used whenever contact dose rates exceed 100 mrem/hr., and should be used with lower dose rates. Additional remote handling needs will be listed in the RA.
 - (4) Care must be used in handling and storing used beakers, test tubes, pipette tips, and other contaminated items to prevent bumping, dropping, or otherwise inadvertently spreading contamination.
 - (5) Containers holding non-trivial quantities of radioiodines or other volatiles must be opened in an operating fume hood. Waste and other materials containing such radiochemicals must be double bagged in plastic and sealed before disposal or storage.
 - (6) Radioactive materials transported through hallways must be securely contained. Radioactive liquids require secondary containment via tray, bucket, bag, etc., sufficient to hold the liquid in case of breakage.
 - (7) In case of spill or accident involving radioactive materials, contact Radiation Safety.
- b. Radioisotope storage must provide adequate safety.
- (1) Liquids, including wastes, must be stored in secondary containers able to prevent contamination spread should the primary container break.

- (2) Radioisotope storage locations must provide adequate protection against bumping, falling, overheating, and other mechanical hazards.
 - (3) Shielding should be used when necessary and appropriate.
- c. Sealed radiation sources must be leak-tested and inventoried per State requirements. Sources emitting alpha particles must be leak-tested at intervals of approximately three months.
- (1) Sources emitting other types of radiation must be leak-tested at intervals of approximately six months.
 - (2) Copy of each leak test report must be kept on file at RS. Results must be in units of microcuries.
 - (3) Positive results must be reported to RS immediately, and corrective actions taken as directed by RSO.
 - (4) Sources placed in storage by RS are exempt from the leak test requirement. Sources in storage must be leak-tested prior to use.

12. **Waste Disposal**

- a. Radioactive waste may be stored for decay in individual laboratories.
- b. Radioactive waste may not be drain disposed. Waste must be packaged per instructions from RS.
- c. Dry wastes must be placed in containers supplied by RS and marked "Dry Radioactive Waste Only."
- d. Liquid radioactive wastes must be placed in containers approved by RS. Liquid radioactive waste containers must be kept in secondary containers able to contain the liquid in case of breakage.
- e. Liquid scintillation vials containing counted fluid must be placed in containers supplied by RS and marked "Scintillation Vials Only." Note that the liquid scintillation counting fluid may be disposed of alternatively by treating as liquid waste, i.e., emptying into containers approved by RS. Liquid scintillation counting fluids must be segregated from aqueous liquid.
- f. Biological wastes, i.e. animal carcasses or parts, blood, urine, feces, bedding, etc., shall be bagged, properly labeled to show radioisotopes, amounts, dates, and Program Director, and stored in a freezer until RS pickup.
- g. Each container must have a proper waste tag attached that is kept up-to-date. Each container must also be marked as containing radioisotopes.
- h. Liquid waste must be segregated by half-life to the extent reasonable to permit efficient disposal by decay. Generally, this will involve three categories: less than 30 days; 30-60 days; and greater than 60 days.
- i. RS should be notified prior to generating any radioactive waste that contains other hazardous constituents or demonstrates hazardous characteristics (mixed waste). Mixed waste must be segregated from other radioactive waste.
- j. Waste will be disposed of by RSO. RSO will pick up and dispose of properly packaged radioactive waste upon request from the using group.
- k. RSO will arrange disposal by sewerage, by incineration, by land burial, or other means as appropriate.
- l. Cost of disposal if via land disposal, commercial incineration, or other commercial means will be borne by the generating group.

13. **Radiation Emergency Response**

- a. To report a radiological based emergency, call Oregon Emergency Response System (OERS) 800-452-0311 or 503-378-6377
- b. Provide the following information
 1. Name of reporter and agency
 2. Contact phone number

3. Type of incident and materials involved
4. Location and time of incident
5. Background and how the incident occurred
6. Severity of incident (injuries, threat to people, property or environment)
7. On-scene contact
8. Actions taken
9. Responsible party and phone number

**APPENDIX A
LINN-BENTON COMMUNITY COLLEGE
RADIOLOGICAL SCIENCES**

PERSONNEL DOSIMETRY NOTIFICATION REPORT

Date: _____

The following person, _____, has received the following dose equivalent measured in millirems for the monitoring period of _____ as reported on their Dosimetry report. This exceeds acceptable limits.

	Current:	Lifetime to Date:
Deep	0	0
Eye	0	
Shallow	0	

Please provide the following information.

Describe the working area during the exposure period:

Describe where was the dosimeter device worn during the exposure period?

Describe where the dosimeter was stored during the exposure period?

Was the dosimeter ever taken home? YES NO

Was the dosimeter left anywhere where it could have obtained a reading? YES NO

DESCRIBE: _____

Radiation Safety Officer Recommendation:

<hr/> <hr/>

<hr/> Personnel Signature	<hr/> Date
<hr/> Department Head Signature	<hr/> Date
<hr/> Radiation Safety Officer	<hr/> Date