Bowdoin

RADIATION SAFETY PROGRAM

Office of Environmental Health and Safety

Revision: September 18, 2023

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Revision List

Revision Date	Section	Revision	Date Approved by RSC
10.30.15	Table of Contents	Added a Revision List	N/A
	Attachment 11 added to include *Radiation Safety Program Calendar*		N/A
	11. Storage	Included Director of Facilities Management as a key holder	N/A
06.19.17	2. Organization of the Committee	Added three faculty/staff members representing the Science Departments will be part of the committee. This was a result of being in a "Possession Only" mode, and continuing with meetings even if our license is not active.	10.17.17
06.19.17	18. Leak Testing of Sealed Sources	Added detail of leak testing procedures, applicability, reporting requirements.	10.17.17
10.17.17	1. Current Committee Members and Authorized Users (2017-18)	Updated committee member list	10.17.17
10.17.17	20. Emergency Procedures	Updated emergency contacts posting	10.17.17
10.17.17	Attachment 9	Updated to include current license (02.12.16)	10.17.17
07.09.18	Entire Document	Reviewed and updated the document date.	N/A
02.12.19	Calendar	Corrected license expiration date	02.12.19
02.12.19	Attachment 1	Updated current committee members	02.12.19
02.12.19	20. Emergency Procedures	Updated emergency contacts posting	02.12.19
02.12.19	Attachment 9	Updated to include current license	02.12.19
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11.2.2021	Entire Document	Update information in plan as it relates to the closure of the materials license.	11.09.21
11.15.2022	Attachment 1, Attachment 10	Update RSCS members. Update storage location of X-ray equipment. Remove authorized users.	11.17.22
09.18.2023	Attachment 1, Attachment 10	Update RSCS members. Add additional X-Ray equipment.	10.19.23

1. PURPOSE AND AUTHORITY

The rules and regulations contained in this document have been established pursuant to the *State of Maine Rules Relating to Radiation Protection* [10-144A CMR 220], for the following purposes:

A. To provide for the protection of the students and staff of Bowdoin College and the general public against radiation hazards associated with the college's possession, use, transportation and disposal of radioactive materials.
B. To provide for Bowdoin College's compliance with applicable regulations of federal, state, and local agencies.

2. ORGANIZATION OF THE COMMITTEE

The Radiation Safety Committee (RSC or the Committee), which is appointed by the Dean for Academic Affairs, will be comprised of the following members:

- Three faculty/staff members representing one of the Science Departments (Biology, Chemistry, EOS, and Physics)
- Radiation Safety Officer (RSO)
- Radiation Support Technician (RST)
- Director of Environmental Health and Safety (EHS)
- Representatives of the Departments in which radioactive materials are used.

Current authorized users will be invited to all meetings of the committee, although they will not be appointed members. A list of the current Committee Members and Authorized Users is attached (*Attachment 1*), and is revised as needed, or at least annually during the program review.

3. RESPONSIBILITIES OF THE COMMITTEE

The responsibilities of the Radiation Safety Committee include:

A. Establishing policies regarding radiation protection at Bowdoin College.

B. Providing direction and advice to the Radiation Safety Officer on matters regarding radiation safety.

C. Ruling on the approval of authorized users when necessary.

D. Receiving and reviewing periodic reports from the Radiation Safety Officer on monitoring contamination and personnel exposure.

E. Reviewing instances of alleged infractions of use and safety rules with the Radiation Safety Officer and the responsible individuals.

F. Conducting an annual audit of the Radiation Safety Program, reviewing the activities of the Radiation Safety Officer, and the records that must be maintained to ensure compliance with conditions of the license [*Maine Rules* 10-144A CMR 220.D.40-50]. The annual audit will be carried out at the last meeting of the Radiation Safety Committee in each academic year. Results of the audit will be included in the minutes of that meeting.

In carrying out these responsibilities the Radiation Safety Committee conducts a program of review and evaluation of proposals for use of radionuclides. The Committee is responsible for continuing surveillance of the use of such materials with a view to maintaining standards of safe handling practice.

The Committee will meet on a quarterly basis as required by regulations when radioactive materials are in

use, and annually otherwise. Meetings will be called by the RSO, who will maintain permanent records of the Committee proceedings in the form of written minutes. A quorum for the purpose of conducting business shall be four members.

4. RESPONSIBILITIES OF THE RSO/RST/EHS

The Radiation Safety Officer and Radiation Support Technician operate under the authority of the Radiation Safety Committee. The Director of EHS operates independently under the authority of the Director of Facilities Management, but may assume the duties of either the RSO or the RST on an as-needed basis.

The RSO is responsible for overall compliance with applicable state and federal mandates regarding use of radioactive materials, including:

A. Implementing policy decisions of the Radiation Safety Committee.

B. General surveillance of all radiation safety activities, including personnel and environmental monitoring.

C. Furnishing consulting services to personnel at all levels of responsibility on all aspects of radiation protection, and maintaining a *Radiation Safety Notebook* for reference.

D. Establishment of procedures for purchase, receipt, and shipment of all radioactive materials coming to or leaving the College.

E. Maintaining records of internal and external personnel exposures and notifying individuals and their supervisors of exposures. The RSO is responsible for recommending appropriate remedial action.

F. Conducting continuing Radiation Safety education programs for students and all levels of personnel.

G. Maintaining an inventory of all radioisotopes at the College and limiting the types and quantities of radionuclides present to those authorized by the license.

H. Supervision of corrective action following radiation exposure incidents and supervision of special decontamination procedures.

I. Maintenance of all required radiation protection records.

The Administration commits to authorizing the RSO to stop any unsafe operation, and that the RSO will commit sufficient time to performing radiation safety duties and responsibilities.

The RST is responsible for providing technical support to the RSO, Committee Members, and Authorized Users, including:

A. Radioisotope laboratory inspection, radiation surveys, and area monitoring as necessary, including handling of test samples.

B. Distribution and processing of personnel monitoring equipment.

C. Supervising the leak testing of sealed sources and maintaining required records.

D. Handling and storage of radioactive materials not in current use, including wastes, and coordination of waste disposal scheduling with the Director of EHS.

E. Servicing and maintenance of laboratory equipment; all survey instruments will be calibrated

according to applicable regulations and/or the manufacturer's specifications, and calibration certificates maintained on file.

In the absence of an assigned RST, the RSO or designee will assume responsibility for these duties.

The Director of EHS is responsible for ensuring compliance with applicable regulatory requirements, including maintaining necessary licenses, registrations, and notifications; and coordination of the waste management program, including the disposal of radioactive wastes and maintenance of manifests and records.

5. AUTHORIZED USERS

A policy of "authorized users" has been adopted within the Radiation Safety Committee's rules. Authorized user candidates must make a formal application (*Attachment 2*) to the Committee and submit HHE Form 851 to the Maine Radiation Control Program for approval and inclusion on the College's radioactive materials license. Those who qualify with regard to experience and who have successfully fulfilled all committee requirements will be granted permission to use radioisotopes on their own responsibility at Bowdoin College (see *Section 8; Attachment 3*). Only authorized users are allowed to requisition byproduct materials, and a current list of such users (*Attachment 1*) will be made available to the Department Coordinator in each relevant academic department. Each authorized user is directly responsible for the safe use of the material, and for the qualifications of those individual users who will operate under their supervision.

Each project in which radioactive materials are used at Bowdoin College must have at least one participant who is an authorized user with full faculty rank.

6. RESPONSIBILITIES OF AUTHORIZED USERS

Each authorized user under whom radioisotope work is being conducted is responsible for the following:

A. Adequate planning of experiments and determination of the type and quantity of radiation or radioactive material to be used. This determination will generally give a good indication of the safety measures required. Experimental procedures must be well outlined to allow adequate review of safety precautions. Where possible, a cold run using the planned procedures is recommended to avoid unforeseen safety problems. In any situation where there is appreciable radiation hazard, the Radiation Safety Officer shall be consulted before proceeding.

B. Undergoing annual training when radioisotope work is active.

C. Instructing personnel and students for whom they are responsible in the use of safe techniques and on the application of approved radiation safety practices and ensuring attendance at required radiation safety lectures.

D. Providing the Radiation Safety Officer with up-to-date data as necessary, relative to the areas in which radioactive materials are stored or handled.

E. Notifying the Radiation Safety Officer of any changes in the listing of personnel or students who may be handling radioactive material or who may be exposed to ionizing radiation during the course of their work or studies.

F. Maintaining an adequate inventory of the amount of radioactive material under his or her control at any one time and establishing an adequate system to ensure that he or she does not possess more than an authorized quantity.

G. Ensuring that radioactive material is disposed of only by authorized means.

H. Using only the radioactive material for which they are licensed, and only for those uses specifically authorized.

I. Informing the Radiation Safety Officer of changes in procedure which may increase the probability of radiation exposure or laboratory contamination.

J. Establishing appropriate procedures to ensure that radioactive materials are properly labeled.

K. Establishing that radioactive materials are properly controlled within his or her project, and that they are properly stored at the end of each workday.

L. Assuring that the laboratory is equipped with adequate survey and/or monitoring equipment to aid in the safe handling of radioactive material and performing routine surveys of work areas as required.

M. Ensuring that maintenance personnel are not permitted to work on equipment, hoods, or sinks in radioactive materials use areas without the presence of a knowledgeable member of the laboratory staff to provide specific information.

N. Complying with proper procedures for termination of work using radioactive materials. The authorized user must return to the Radiation Safety Officer all radioactive materials, including waste, assigned to him or her under the license. Particular care should be exercised to see that specialized equipment such as personnel monitoring devices, survey instruments and shielding materials are returned to the Radiation Safety Officer. A final termination survey is also necessary.

O. Ensuring that the following individual user responsibilities are discharged by those under their control.

P. Know and understand how to use the monitoring tools available in each Department so that information can be collected quickly in the absence of the RSO/RST.

The Administration commits to authorizing the Authorized Users to stop any unsafe operation by individual users.

7. RESPONSIBILITIES OF INDIVIDUAL USERS

Individual users include all radiation workers, including those operating under the direct supervision of an authorized user. Each individual user of radioactive materials is responsible for:

A. Keeping exposure to radiation as low as possible, and specifically below those levels specified for maximum exposure in the Maine Radiation Regulations.

B. Wearing the prescribed monitoring equipment, such as film badges and TLD ring dosimeters, in radiation areas. Personnel who work only with pure alpha emitters or only with pure beta emitters having a maximum energy of less than 0.2 MeV (e.g., 3-hydrogen, 14-carbon, 35-sulfur) will not be required to wear film badges (see *Section 12*; *Attachment 4*).

C. Utilizing all appropriate protective measures such as:

- Wearing protective clothing whenever contamination is possible, and not wearing such clothing outside the laboratory area.
- Wearing protective gloves.
- Using protective barriers and other shields when indicated.
- Using mechanical devices when appropriate to reduce exposure.
- Using pipette filling devices; radioactive solutions shall never be pipetted by mouth.

- Performing radioactive work within confines of an approved hood or glove box unless serious consideration has indicated the safety of working in the open.

D. Not eating, drinking or smoking in areas where radioactive materials are being used, handled, transferred or stored. Refrigerators may not be used jointly for food, beverages and radioactive materials.

E. Maintaining good personal hygiene. Do not work with radioactive materials if there is an open or unprotected break in skin below the wrists. Wash hands and arms thoroughly after working with radioactive materials. Hands, shoes and clothing should be surveyed and decontaminated as necessary before leaving the laboratory. Survey results, positive or negative, shall be recorded with surveys of the work area.

F. Checking periodically for contamination in the immediate areas in which radioactive materials are being used (hoods, benches, etc.). A log record shall be maintained of these surveys including results that are entirely negative (see *Section 12 - Monitoring*). Any minor contamination observed should be decontaminated and checked again. Larger amounts of activity found should be decontaminated under supervision of the Radiation Safety Officer.

G. Keeping the laboratory neat and clean. The work area should be free from equipment and materials not required for the immediate procedure. Keep or transport materials in such a manner as to prevent breakage or spillage (double container) and to ensure adequate shielding (see *Section 16*). Wherever practical, keep work surfaces covered with absorbent material, preferably in a tray or pan, to limit and collect spillage in case of accident.

H. Label and isolate radioactive waste and equipment, such as glassware and pipettes, used in laboratories for radioactive materials. Once used for radioactive substances, equipment should not be used for other work and should not be permitted to leave the area until demonstrated to be free of contamination.

I. Requesting supervision by the Radiation Safety Officer of any emergency repair of contaminated facilities or equipment, either by facilities personnel or commercial service contractors.

J. Reporting accidental inhalation, ingestion or injury involving radioactive materials to his or her supervisor and the Radiation Safety Officer, carrying out their recommended corrective measures, and cooperating in any and all attempts to evaluate his or her exposure.

K. Carrying out decontamination procedures when necessary and for taking the necessary steps to prevent the spread of contamination to other areas.

L. Prompt compliance with requests from the Radiation Safety Officer concerning body burden measurements and the submission of bioassay samples.

8. APPLICATION FOR PERMISSION TO USE RADIOISOTOPES

Each proposed use of radioisotopes must be applied for by an authorized user through the Radiation Safety Committee. This is accomplished by submitting an *Application for Permission to Use Radioactive Materials* (*Attachment 3*), which provides a very brief description of the experiment and its methodology. The application is submitted to the Radiation Safety Officer, and appropriate action taken by the RSO in regard to the proposed use. Records of these proposed uses will be maintained for inspection for the duration of the *General Materials License*.

9. AMENDMENTS TO ESTABLISHED RADIOISOTOPE USE

Application for amendment to an approved application should be made in writing to the Radiation Safety Officer for any change in responsible personnel use or procedure mentioned in the original application for permission to use radioisotopes. The Radiation Safety Officer should be informed in writing of any change in the employees of a project working with radioisotopes. Changes in film badge listings should be requested of the Radiation Safety Officer in writing as soon as possible in order to ensure that each such person receives prompt film badge monitoring.

10. PROCUREMENT AND INVENTORY

Receipt and handling of radiation sources will be conducted in accordance with *Maine Rules* [10-144A CMR 220.D.32].

A. Ordering - In the absence of a receiving facility for the academic departments' package shipments, each Authorized User may place orders for radioactive materials when needed, paying special attention to the current inventory and the license limits. A copy of all purchase orders for radioactive materials must be submitted to the user's Department Coordinator, who will keep an office inventory of orders (*Attachment 4*). Purchase orders for radioactive materials should be clearly marked as a radioisotope order so that purchases may be duly recorded in the office inventory. The RSO will file photocopies of all purchase orders for radioactive materials in the Radiation Safety Notebook as a record of input to inventory.

B. Receipt - When the shipment is received, the Authorized User will check it for content, monitor it for radiation level, check for contamination and complete a receipt form. The authorized user is required to keep an accurate record of each shipment, while it is in his or her possession, and thereby maintain the possession limits for the approved applications assigned to them.

C. Internal Transfer - The transfer of radioisotopes between authorized users is generally discouraged, however when a real need exists, transfers are permitted with the understanding that the new user will adjust the inventory records accordingly.

D. Possession Limits - Each approved request includes a maximum possession limit for the radioisotopes covered in the application. This limit is the maximum which may be possessed by the authorized user for the proposed project and must be adhered to by the user. Observance of such assigned possession limits by all users is essential to ensure compliance with the current *Radioactive Materials License* limits (*Attachment 9*). Inventory records maintained by the authorized user should readily yield information on adherence to possession limits. The user is reminded that all radioactive waste generated must be considered in this inventory until it is disposed or its activity is decayed.

11. STORAGE

Storage and control of radiation sources will be conducted in accordance with *Maine Rules* [10-144A CMR 220.D.25-26].

To ensure security of radioactive materials in use at Bowdoin College, each project must store its own radioisotope stocks in a designated location access to which is limited to the authorized user and participants in the relevant project. These storage areas may or may not be shielded depending on the amount and type of activity to be stored there. The authorized users are responsible for all radioactive materials charged to their care. Storage areas should be kept locked with keys held only by authorized users.

The central stock storage area Druckenmiller 014-has been decommissioned. Keys for this room are held by the RSO, Director of EHS and the Chemical Hygiene Officer.

12. MONITORING

Monitoring will be conducted in accordance with *Maine Rules* [10-144A CMR 220.D.17-18].

Projects using millicurie amounts of radioisotopes are monitored weekly by the Radiation Support Technician. The RST may train a department employee to do the monitoring on a routine basis. Projects using less than millicurie amounts may be monitored less frequently but at least monthly. A record of this monitoring (*Attachment 6*) and of personnel monitoring (film badges – *Attachment 4*)) is kept by the Radiation Safety Officer. Unusually high results or a spill area uncovered in such monitoring will be communicated to the authorized user of the project and decontamination will be requested. Effectiveness of the decontamination will be assessed by the RST.

The monitoring program described above is designed to provide only a broad overview with respect to radiation monitoring. It provides for routine monitoring by a person from outside the project at intervals that would presumably catch any serious spread of contamination or loss of activity before the consequence becomes serious. The program is intended as a supplement to the radiation monitoring that is required of any individual working routinely with radioactive material. It is the prime responsibility of the project personnel to provide whatever monitoring is necessary on a day-to-day or hour-to-hour basis, depending entirely on the procedures involved and the radioisotopes being handled at the time. These individual project records of monitoring will be periodically audited by the Radiation Safety Officer.

Each authorized user must assure that appropriate equipment is available during the course of the project to conduct such surveys, and they are to be conducted at a frequency that is commensurate with the level of radioactivity being handled in the project. Following is a detailed outline of what is expected in this regard:

A. Projects in which millicurie amounts of gamma-emitting or hard beta-emitting radionuclides are routinely handled:

   - Daily close-out surveys of the work area shall be made by a responsible individual. Survey will include a check to be sure that radionuclides are properly identified and secured from unauthorized persons, that areas in which gamma or high energy beta-emitting materials are handled are contamination free (GM survey meter measurements) and that major equipment necessary for the handling of such material (hood, etc.) is functioning. Necessary decontamination should be performed immediately.

   - Weekly surveys of the project work areas shall be a more thorough version of A.1 above and shall include wipe tests of bench areas on which radionuclides are handled. Results of the test should be logged, and the logging of these weekly surveys should include radiation measurements and wipe test results superimposed on a diagram of the room.

B. Projects in which tritium (^{3}H), ^{14}C or lesser amounts of gamma or hard beta-emitting radionuclides are routinely handled.

   - Daily close-out surveys shall be made to determine that radionuclides are properly identified and secured against unauthorized personnel.

   - Weekly surveys of these same laboratories shall include the B.1 procedure above, plus wipe tests of bench areas on which radionuclides are handled. The results of these wipe tests should be recorded on a diagram of the laboratory.

Additional surveys shall be made as necessary, following any unusual procedure or incident in the laboratory which may have resulted in unusual external radiation or contamination levels.

Excessive contamination levels (more than 1000 dpm/100 cm^2) shall be brought to the attention of the RSO, and the area in question shall be decontaminated and resurveyed. Action levels for removable surface contamination are outlined in *Table 1*.

Reports on the surveys shall be reviewed by the RSO and kept on file in the Radiation Safety Notebook. The authorized user of the project shall ascertain that the necessary survey equipment is available to perform the required procedures and that a specific individual is assigned the tasks. The Radiation Safety Officer is available to assist in setting up an appropriate survey program for each project.

TABLE 1
ACTION LEVELS FOR REMOVABLE SURFACE CONTAMINATION

Type of Surface	Alpha Emitters (dpm/l00cm^2)	Beta or X-ray Emitters (dpm/l00cm^2)
Unrestricted areas	22	220
Restricted areas	220	2200
Personal clothing worn outside restricted areas	22	220
Protective clothing worn only in restricted areas	220	2200
Skin	220	220

Averaging is acceptable over non-living areas of up to 300 cm^2 or, for floors, walls, and ceiling, 100 cm^2. Averaging is also acceptable over 100cm^2 for skin or, for the hands, over the whole area of the hand, nominally 300 cm^2.

Any evidence of a sealed source leak, surface release, internal or external exposure, or similar incident must also be reported the RSO and Director of EHS IMMEDIATELY for regulatory reporting purposes pursuant to *Maine Rules* [10-144A CMR 220.D.51-58].

13. WASTE DISPOSAL

Radioactive waste disposal is coordinated by the Radiation Safety Officer, the Radiation Support Technician, and the Director of EHS. Work areas where radioactive waste materials are to be generated will be equipped with radioactive waste containers which are clearly marked "Caution, Radioactive Waste, Do Not Empty." These receptacles are emptied solely by individuals directly involved with the project work as the radiation levels or quantity of materials become significant. All waste material that is contaminated with radioisotopes at any level should be disposed of as radioactive waste.

The volume of waste should be minimized, and kept in an acceptable chemical or physical form prior to ultimate disposal. Material must not be put into radioactive waste collection containers if there is a possibility of a chemical reaction during storage or shipment that may cause the release of radioactive gases, fire or explosion. Volatile or potentially volatile radioactive wastes should be appropriately treated with strong alkali, detergent or acid whenever possible to render radioactive material nonvolatile.

Authorized users must include plans for collecting and paying for the eventual disposal of radioactive wastes in their initial proposal. Legacy materials encountered in the labs will be reported to the RSO for handling and disposal. Laboratory equipment that has been used to store or work with radioactive materials must be

cleaned and tested for contamination before being decommissioned.

Disposal of radioactive wastes will be conducted in accordance with *Maine Rules* [10-144A CMR 220.D.33-39]. The central waste storage area is Druckenmiller 014-I. Keys for this room are held by the RSO, Director of EHS, and Director of Facilities.

DRY SOLID WASTES

A. Wastes with half-lives of less than 120 days can be segregated and stored for decay to background. These stored wastes will be monitored after storage for at least 10 half-lives before being disposed of as part of the normal sanitary waste stream. Monitoring will be done in a low background area, with a low-level GM type survey meter appropriate for contamination surveys, using the most sensitive scale, and with all shielding removed. Inventory records should be corrected to reflect the disposal and any warning labels should be obliterated or removed. The storage areas for decay-based disposal will be under the control of the RSO and RST and should be properly secured from unauthorized access. Wastes should be stored in leak-proof containers that are dated and bearing both the user's name or initials, the isotope involved, and appropriate warning labels. There should be only one form of radioisotope in a storage container.

B. Dry solid wastes which are not amenable to storage for decay (half-life > 120 days) are collected in DOT-approved drums and periodically shipped via authorized carrier for disposal in a licensed disposal site. All applicable requirements set by the NRC, DOT and Agreement States hosting landfill sites are followed when shipments are prepared. Training for this task is provided by review of appropriate regulations and telephone conversations with carrier personnel prior to final packaging and shipment. This assures that all the latest changes are incorporated in shipment practices. Records of the RSO and Director of EHS should include detailed accounts of materials disposed of in this manner (dates, isotope, amounts, etc.). The RSO and RST are responsible for the safe handling and storage of this low-level radioactive material until packaged and removed for disposal by a licensed vendor.

LIQUID WASTES

C. Radioactive waste materials which are soluble or dispersible in water may be disposed of in the sewage system in amounts and concentrations conforming to Maine regulations (*Table 2*). Only designated sinks/drains may be utilized for this disposal. Authorized users must inform the RST concerning designated sinks and work areas and are responsible for assuring that all project participants comply.

TABLE 2
RADIOISOTOPE DISPOAL LIMITS

ISOTOPE	10 CFR 20 Appendix B Table I Col 2 uCi/ml	Calculated MPD uCi/day	ALARA Fraction 10% uCi/day
^{3}H	$1xIO^{-1}$	$6.22x10^{7}$	$6.22xIO^{6}$
^{14}C	$2xIO^{-2}$	$1.24x10^{7}$	$1.24xIO^{6}$
^{32}P	$5xIO^{-4}$	$3.11xIO^{5}$	$3.11x10^{4}$
^{35}S	$2x10^{-3}$	$1.24xIO^{6}$	$1.24x10^{5}$
^{45}Ca	$3xIO^{-4}$	$1.86x10^{5}$	$1.86x10^{4}$
^{125}I	$4xIO^{-5}$	$2.48xIO^{4}$	$2.48xIO^{3}$

Overall release will be evaluated in accordance with *10-144A CMR 220.D, Appendix B.*

No more than 5-times the amount of material specified in *Table 2* (calculated ALARA fraction uCi/day) will be disposed of in any one work day. The quantity of radioactive material released in any one month, if diluted by the average monthly quantity of water released, will not result in an average concentration exceeding 10% of the limits set by Maine regulations. The gross quantity of licensed and other radioactive material, excluding 3-hydrogen and 14-carbon released into the sanitary sewer system will not exceed 1 Curie per year.

The quantities of 3-hydrogen and 14-carbon released into the sanitary sewer system will not exceed 5 Curies per year for 3-hydrogen and 1 Curie per year for 14-carbon. Records will be maintained of all such disposal, indicating dates, isotope and quantities. Disposal records will be noted on the running inventory in each authorized user's laboratory area.

D. Disposal of larger amounts, or of liquids that are not soluble in water, must be done under the supervision of the Radiation Safety Officer. Insoluble or high level liquid waste must be neutralized (pH 6.5-7.5), collected in inert polyvinyl chloride containers, and the Radiation Safety Officer notified. All iodine liquid waste should be made strongly alkaline. Contents of polyvinyl chloride bottles should be liquid only. Bottles should be stored in plastic dishpans or metal trays lined with absorbent material to catch spillage or leakage. This material will ultimately be stored for decay and appropriate disposal, or solidified and stored for shipment to a licensed disposal site.

ANIMAL CARCASSES

E. Disposition of radioactive carcasses should be referred to the RSO and the Animal Laboratory Supervisor.

14. CONTROL OF RADIATION EXPOSURE

Under all circumstances exposure to ionizing radiation shall be kept at the lowest practical level. The external and internal total exposure from sources of radiation shall be controlled in such a way as to assure that no individual shall receive a total dose in excess of the following values [*Maine Rules;* 10-144A CMR 220.D.6-13]:

A. Maximum permissible doses for persons who are Authorized Users:

1) annual limit, which is the more limiting of:

- The total effective dose equivalent being equal to 5 rem; OR
- The sum of the deep dose equivalent and the committed dose equivalent to any individual organ or tissue other than the lens of the eye being equal to 50 rem.

2) annual limits to the lens of the eye, to the skin, and to the extremities which are:

- An eye dose equivalent of 15 rem; AND
- A shallow dose equivalent of 50 rem to the skin or to any extremity.

B. Maximum permissible doses for minors (including those persons under 18 years of age who are working in radioisotope laboratories) and for persons who are not registered as radiation workers are 10% of the values listed above.

C. Maximum permissible doses to declared pregnant workers with respect to the fetus shall be no more than 0.5 rem for the period of the pregnancy.

D. Operations shall be conducted so that the total effective dose to individual members of the public

does not exceed 0.1 rem per year.

E. The above values are in addition to natural background radiation exposure and to radiation administered for medical reasons.

F. The dose that an individual may be allowed to receive in any year shall be reduced by the amount of occupational dose received while employed by any other institution.

Internal exposure is controlled by minimizing airborne release of radionuclides through the proper utilization of hoods, closed reaction systems, temperature control, mechanical pipetting devices and/or any such appropriate mechanism. Research procedures requiring the use of volatile or gaseous radioisotopes are restricted to the fume hoods approved for such use by the RSO.

Procedures are reviewed by the Radiation Safety Officer whenever assays of excessive exposure indicate any positive results. Results that indicate the presence of 10% or more of a permissible body or organ burden will lead to a thorough investigation by the Radiation Safety Committee and additional procedural restrictions will be adopted as indicated.

Access to radiation work areas will be restricted to authorized users and individuals under their supervision.

The Radiation Safety Officer and Director of EHS shall be notified immediately of any of the following circumstances is known or suspected to have occurred:

- Exposure to external radiation in excess of the stated maximum permissible exposure values.
- Exposure to inhalation, ingestion, or accidental injection of radioactive materials.
- Accidental release or radioactive materials into the campus atmosphere, drains or ventilation systems or onto surfaces.

15. INFORMATION AND TRAINING FOR INDIVIDUALS WORKING IN OR FREQUENTING RESTRICTED AREAS

Occupationally Exposed Workers. It is the responsibility of the authorized users to provide instruction for those individual users (employees and/or students) under their control in the application of approved radiation safety practices, and to ensure attendance at required radiation safety lectures. The RSO or RST will provide instruction that fulfills initial and annual refresher requirements for radiation safety. Records of attendance at instructional forums will be maintained by the RSO. Training topics to be covered will include:

- Characteristics of ionizing radiation;
- Radioactive contamination;
- Radiation dose-equivalent limits;
- Background radiation;
- Acute and chronic radiation effects on humans, including the effects on fetuses;
- Modes of exposure-internal, external;
- Estimation of dose equivalent;
- Basic protective measures - time, distance, shielding, contamination control, protective clothing, and work place design;
- Responsibilities of employees and students;
- Interaction with the RSO and the RST;
- Warning signs and labels;
- Radiation monitoring programs and procedures; and
- Emergency procedures.

All individuals who in the course of their employment are likely to receive an occupational dose in excess of 100 millirem per year will be instructed in the following [10-144A CMR 220.J.3.A];

- Proper storage, use, and transfer of radioactive materials;
- Health protection issues associated with exposure to radiation or radioactive materials for individuals or potential offspring;
- Precautions and procedures to minimize exposure;
- Functions of any protective devices used;
- Applicable provisions of the Maine Rules [10-144A CMR 220.D] associated with exposure protection;
- Responsibility to report to the licensee any condition which may constitute, lead to, or cause a violation of the Rules, or unnecessary exposure;
- Proper response to warnings or conditions that may involve exposure, and emergency procedures;
- Availability of employee monitoring and exposure reports.

Occasionally Exposed Workers. Individuals who do not routinely work with radioactive material, but whose duties may bring them into areas where radiation exposure may occur, are given radiation safety instruction specific to their circumstances initially and on an annual basis.

Students and Visiting Professionals. Students and visiting scientists engaged in educational activities are given appropriate radiation education prior to being permitted to work with radioactive materials. Visiting scientists to be working at Bowdoin College for an extended period of time (more than two weeks) will additionally be trained in a manner comparable to regular employees.

Notices and Postings. Current copies of the following documents, OR a notice describing the location and availability of same, shall be posted in each work area:

- Regulations pursuant to 10-144A CMR 220.D and J;
- Agency Form HHE-845, *Notice to Employees*;
- The current license and amendments;
- Operating procedures applicable to activities covered by the license; and
- Any notices of violation, penalties, or orders issued pursuant to 10-144A CMR 220.A.

Exposure Reports. If medical monitoring has been conducted for exposure control, individual exposure reports shall be made available to the worker in writing, within 30-days upon request or at least annually, pursuant to 10-144A CMR 220.J.4.

16. TRANSPORTATION OF RADIOACTIVE MATERIALS

The Bowdoin College Radioactive Materials License includes no provision for the transportation of radioactive material outside of the College premises. Under no circumstances should any user pick up radioactive material from a supplier, return an improper shipment to the supplier, borrow radioactive material from another licensee in the area, or in any way transport radioactive material in a private vehicle. Such transportation of material must be by licensed vendors, and in compliance with Department of Transportation regulations.

The transportation of radioactive materials within campus facilities (hand carrying from laboratory to laboratory) shall be done in such a manner as to assure a minimum chance of contamination accidents. All material must be doubly contained, and must never be left unattended. Under no circumstances should the dose rate on the surface of the container being carried exceed 100 millirem/hour, nor should the dose rate one meter from the surface of the carrying container exceed 10 millirem/hour.

17. CAUTION SIGNS AND LABELS

Each laboratory or work area storing or using radioactive material shall be posted with appropriate signs, in

conformity with *Maine Rules* [10-144A CMR 220.D.27-30] and OSHA workplace requirements, which will contain the words “CAUTION, RADIATION AREA”. These postings shall be installed or removed only by or with the approval of the Radiation Safety Officer. Additionally, the authorized user in each project should post each laboratory or work area with sufficient emergency notification information so that a knowledgeable member of the project staff could be contacted in the event of an emergency during nonworking hours.

Each container in which radioactive material is to be stored for a period of time must be labeled in conformance with appropriate regulations. Specifically, the label must contain the words "CAUTION, RADIOACTIVE MATERIAL" along with information regarding the quantity, kind of radioactive material in the container, and date of assay. It is also useful to include the user's initials on the warning labels. Labeling is not required for laboratory containers such as beakers, flasks, and test tubes used only transiently in the laboratory in the presence of the user.

Quantities of individual radioisotopes requiring labeling are outlined in *Maine Rules* [10-144A CMR 220.D, Appendix C].

18. LEAK TESTING OF SEALED SOURCES

Leak testing will be conducted in accordance with *Maine Rules* [10-144A CMR 220.D.16]. The College possesses a Varian 450-GC, listed under its General License, containing a sealed source of Nickel-63 (Ni-63) that decays by beta emission.

Sealed Sources:

Non-exempt sealed sources shall be wipe tested by the RST. Sensitivity of the assays will be such that activities equal to 5 nanocuries can be detected. The RSO shall develop and maintain a complete inventory of all non-exempt sealed sources.

- For non-exempt, beta or photon emitting sealed sources, six-month wipe (leak) tests are required. The Department of Health and Human Services granted the College permission to conduct leak tests every 36 months per the manufacturer’s recommendations of the Varian 450-GC.
- For non-exempt, alpha emitting sealed sources, 3-month wipe (leak) tests are required.

Records for test for leakage or contamination of sealed sources shall be kept in units of Becquerel or microcurie and maintained for inspection by the Agency for 5-years after the records are made.

The following shall be considered evidence that a sealed source is leaking:

- The presence of 185 Bq (0.005 µCi) or more of removable contamination on any test sample.
- The presence of removable contamination resulting from the decay of 185 Bq (0.005 µCi) or more of radium.

The leaking sealed source will immediately be withdrawn from use, and actions will be taken to prevent the spread of contamination. The leaking sealed source shall be repaired or disposed of in accordance with the Maine Rules. A report of such contamination will be filed within five days to the State of Maine Radiation Protection Program. The report shall include the equipment involved, the test results, and the corrective actions taken.

19. USE AND HANDLING OF LABORATORY ANIMALS

Requests for in vivo radioisotope studies must be submitted to the Chair of the Research Oversight Committee (*Attachment 7*), and conducted according to the stated procedures (*Attachment 8*).

20. EMERGENCY PROCEDURES

These procedures have been posted in all areas where isotopes are used or stored (see EXAMPLE below). Contact personnel and telephone numbers are included with these postings for after-hours emergencies.

EMERGENCY CONTACTS (RADIATION CONTAMINATION)

Laboratory Supervisor: Office_____Home_____

Radiation Safety Officer: Office_ Cell:

Director of EHS: Office 207-798-4132 Cell: 207-385-7993

CONTACT SECURITY 24-HOURS AT x3500

MINOR SPILLS

1) Notify persons in the area that a spill has occurred.

2) Cover the spill with absorbent paper to prevent spreading of radioisotopes.

3) Clean up spill, using disposable gloves and tongs or with dressing forceps by careful placement of absorbent paper in plastic bags. Dispose of clean-up materials in appropriate radioactive waste container.

4) Survey clean-up area, clothing, shoes and hands with low-range GM survey meter or by filter paper wipes and appropriate beta or gamma counting.

5) Wash hands after clean-up and report the incident to the Radiation Safety Officer.

MAJOR SPILLS

1) Notify all persons not involved in the spill to clear the area.

2) Cover spill with absorbent paper, confine the movement of all personnel potentially contaminated to prevent the spread and notify the RSO.

3) Shield the spill, but ONLY if this can be done without further contamination or significantly increasing radiation exposure.

4) Close the room and prevent personnel entry.

5) Remove contaminated clothing and save for evaluation by the RSO.

6) Thoroughly wash all areas of skin that were potentially or actually exposed to the radioisotope spill.

21. REFERENCES

Reports of the National Council on Radiation Protection and Measurements:

NCRP Report No. 22 - Maximum Permissible Body Burdens and Maximum Permissible Concentrations of Radionuclides in Air and in Water for Occupational Exposure. (1959) (Formerly NBS Handbook 69).

NCRP Report No. 30 - Safe Handling of Radioactive Materials (1964). (Formerly NBS Handbook No. 92).

NCRP Report No. 39 - Basic Radiation Protection Criteria (1971).

NCRP Report No. 48 - Radiation Protection for Medical and Allied Health Personnel (1976).

NCRP Report No. 50 - Environmental Radiation Measurements (1976).

NCRP Report No. 53 - Review of NCRP Radiation Dose Limit for Embryo and Fetus in Occupationally Exposed Women (1977).

NCRP Report No. 54 - Medical Radiation Exposure of Pregnant and Potentially Pregnant Women (1977).

NCRP Report No. 55 - Protection of the Thyroid Gland in the Event of Releases of Radioiodine (1977).

NCRP Report No. 57 - Instrumentation and Monitoring Methods for Radiation Protection (1978).

NCRP Report No. 58 - A Handbook of Radioactivity Measurements Procedures (1978).

ATTACHMENT 1. CURRENT COMMITTEE MEMBERS (2023-2024)

Radiation Safety Committee Members

Name	Department	Contact Number
Phil Camill (Chair)	Earth & Oceanographic Science	207-721-5149
Karen Topp	Physics and Astronomy	207-725-3611
Charly Wojtysiak (RSO)	Facilities Management	207-798-4132
Rene Bernier	Chemistry	207-725-3162
Martha Mixon (RST)	Biology/Instrument Support Technician	207-725-3588
Ken Dennison	Physics/Electronics Lab Instructor	207-798-4315

ATTACHMENT 2. APPLICATION FOR AUTHORIZED USER STATUS – NRC LICENSE (Training + Experience)

(Completed form to be submitted to Radiation Safety Officer)

1. Name of Applicant _____ Position _____

2. Proposed work location _____ Application Date _____

3. Has the applicant been licensed previously for use of radioactive material? Yes ( ) No ( )

4. Type of radiation training:

	Where Trained?	Duration of Training?	On the Job / Formal Course (circle answers)	
Principles and practices of radiation protection	_____	_____	Y/N	Y/N
Radioactivity measurement standardization and monitoring techniques and instruments	_____	_____	Y/N	Y/N
Mathematics and calculations basic to the use and measurement of radioactivity	_____	_____	Y/N	Y/N
Biological effects of radiation	_____	_____	Y/N	Y/N

5. Experience with radiation (actual use of radioisotopes or equivalent experience):

Isotope	*Maximum Amount*	*Where Experience was Gained*	*Duration of Experience*	*Type of Study*

Signature of Applicant _____ Date _____

( ) RSO Approval _____ Date _____

ATTACHMENT 3. APPLICATION FOR PERMISSION TO USE RADIOACTIVE MATERIALS

(Completed form to be submitted to Radiation Safety Officer)

Name of Applicant _____ Application Date _____

Staff Position _____ Tel. No. _____

1. Describe purpose for which radioactive material will be used:

2. Material, Procedure and Storage Information:

Radioactive Material	*Requested Possession Limit (mCi) Maximum Amount on hand at any one time*	*Chemical and/or Physical form*

Material will be stored at: Building: _____ Room: _____

Material will be used at: Building: _____ Room: _____

3. Is any of the radioactive material used as a label for potentially biohazardous materials, toxic chemicals, or carcinogenic/mutagenic material? Yes ( ) No ( )

   If yes, explain below:

APPLICATION FOR PERMISSION TO USE RADIOACTIVE MATERIALS (con't)

4. List equipment for handling isotope. (NOTE: dry smears, using filter paper and counted in a liquid scintillation counter, should be utilized in surveying work areas and equipment for radioactive contamination resulting from work with 14-carbon, 3-hydrogen and 35-sulfur).

Hood	( )	Appropriate Warning Signs and Labels	( )
Shielding	( )	Waterproof-backed absorbent material for	
Disposable Gloves	( )	bench and floor coverings	( )
G.M. Survey Meter	( )	Appropriate Monitoring Devices	( )
Mechanical Pipette	( )	Handling Tongs	( )
Stainless Steel Sink	( )	Air Sampling Equipment	( )
Shielded Storage Containers	( )	Glove Box	( )
Beta or gamma counters	( )	Lab Coats	( )

Other Special Equipment or Facilities:

5. Waste Disposal:

   a. Soluble low level liquid waste into sink in Building: _____ Room: _____

   b. Dry solid waste into labeled container in Building: _____ Room: _____

   c. Will there be other wastes generated (animals, insoluble liquids, scintillation fluids, etc.)?

      Yes ( ) No ( )

      If yes, outline description and disposal method below:

6. The following list of persons who will use or be exposed to radiation under this authorization, will receive instruction by the Authorized User or Radiation Safety Officer in the appropriate precautions to minimize exposure associated with the requested isotope.

   Principal users: _____

   _____

   Others: _____

   _____

7. Signature below affirms that the Authorized User/Applicant has read and will comply with the Rules and Mode of Function of Bowdoin College Radiation Safety Committee:

   Authorized User/Applicant _____ Signature Date _____

   Radiation Safety Officer _____ Review Date _____

ATTACHMENT 4. REGISTRATION AND RADIATION BADGE REQUEST FORM

1. Full Name: _____

   Date of Birth: _____ Social Security No: _____

   Sex: Male ( ) Female ( ) Date of Request: _____

2. ISOTOPES AND AMOUNTS: Please list the different isotopes that you will be working with, with respective amounts in millicuries, in any one month.

   _____

   _____

3. Authorized User with whom you will be working: _____

   Building: _____ Room: _____ Phone: _____

4. PREVIOUS EMPLOYMENT AT BOWDOIN COLLEGE: Yes ( ) No ( )

   a. Department: _____

   b. Dates of Employment: From _____ To _____

   c. Type of radiation monitor worn (if any): _____

5. PREVIOUS EXPOSURE HISTROY OTHER THAN AT BOWDOIN COLLEGE:

   a. Have you been enrolled in a film badge program before? Yes ( ) No ( )

   b. Have calculations and/or analysis been made of external radiation received, and/or radioisotopes deposited in your body? Yes ( ) No ( )

   c. If the answer to either question above is “YES”, please list the name of the institution(s) involved and dates you participated in the monitoring program there.

      Institution where exposure received: (Name and complete address) Dates:

      _____

      _____

6. RELEASE STATEMENT:

   Under the provisions of Title 10 CFR, Part 20.404, I authorize the release of my radiation records to the Bowdoin College Radiation Safety Officer.

   Signature: _____ Date _____

   Badge No. _____ Date Issued _____

ATTACHMENT 5. RADIOISOTOPE RECEIPT LOG

Isotope _____ Date of Receipt _____

Amount _____ Lot Number _____

Vendor _____ Purchase Order Number _____

Exposure rate at 1 meter: _____ mR/hr

Exposure rate at surface: _____ R/hr

Wipe Results: _____ cpm

Packaging intact? Yes ( ) No ( ) Inner label legible? Yes ( ) No ( )

Final container intact? Yes ( ) No ( ) Packing material ok? Yes ( ) No ( )

Comments:

Checked in by: _____

ATTACHMENT 6. RADIATION SITE MONITORING LOG

Name: _____ Date: _____

Location: Building: _____ Room: _____

Exact location(s) in room: _____

_____

_____

Check one: ( ) Suspected spill

( ) Routine monitoring

Survey meter: _____ mR/hr

Wipe results: _____ cpm

ATTACHMENT 7. REQUEST FOR IN VIVO RADIOISOTOPE STUDIES

TO: Chairman, Research Oversight Committee
FROM: Radiation Safety Officer
SUBJECT: *IN VIVO* Radioisotope Studies

DATE: _____

The following information is provided to notify you that protocols have been approved and you may provide cages and space for the following in vivo radioisotope study.

AUTHORIZED USER: _____

DESIGNATED ASSISTANT(S): _____

ISOTOPE USED: ACTIVITY (uCi per animal): _____

ANIMAL SPECIES: NUMBER OF ANIMALS: _____

PLANNED STARTING DATE: _____

NUMBER OF DISPOSABLE CAGES REQUIRED: _____ DURATION OF USE: _____

ANIMALS TO BE MAINTAINED IN:

a. Investigator's Lab (Maximum of 24 hrs) - Building: _____ Room: _____

b. Animal Housing Facility - Building: _____ Room: _____

SPECIAL INSTRUCTIONS/HANDLING REQUIREMENTS: _____

SPECIAL ANIMAL CARE MATTERS: _____

INTERVAL TO FIRST CAGE CHANGE: _____

SUBSEQUENT CAGE CHANGES: _____

NOTES:

APPROVAL OF RADIATION SAFETY OFFICER _____ DATE _____

ATTACHMENT 8. PROCEDURES FOR RADIOISOTOPE STUDIES IN VIVO

INITIATION OF RADIOISOTOPE STUDIES IN VIVO

Prior to the start of radioisotope studies in vivo, an investigator must be an Authorized User of Radioisotopes under our N.R.C. License, and:

1. Submit a protocol to the Radiation Safety Committee for approval of the specific in vivo work planned.

2. Request cages and/or space in the Animal Housing Facility, through the Research Oversight Committee (ROC) using the form provided by the Radiation Safety Officer. The Radiation Safety Committee will review and forward this request to the ROC for notification and animal health consideration.

CLOTHING

All personnel working where radioisotope treated animals are housed must wear a long sleeved gown, disposable gloves, and prescribed radiation monitoring devices. Clean gowns are available in the Animal Housing Facility. Soiled garments are deposited in the designated bag at the end of each working day. Under certain circumstances additional protective clothing such as shoe covers, caps and masks may be required.

RESPONSIBLITIES FOR ANIMAL CARE

Authorized isotope users or appropriately trained members of the approved project, are responsible for the primary care and maintenance of the involved animals. This includes:

- changing cages
- feeding and watering animals
- appropriate disposal of both contaminated and other cage and bedding materials
- compliance with all applicable rules for radioactive materials usage

Janitorial staff and/or untrained animal care personnel are not to be involved with in vivo radioisotopes animal care, facilities or equipment until conditions and monitoring by trained project members, in conjunction with the Radiation Safety Officer, indicate full clearance for unrestricted use and interaction.

ANIMAL CARE, PROCEDURES AND EQUIPMENT

When experiments are for more than 24 hours, radioisotope treated animals are to be housed in the specific animal room designated by the chairman of the Research Oversight Committee (ROC). Animals may be taken to an investigator's laboratory in order to inject radioisotopes or use specialized equipment only as outlined in the approved project request. No animals, used or unused, that were brought to the radioisotopes animal room for the experiment can be transferred to another animal room without permission of the Radiation Safety Committee and Chairman of the ROC.

Instructions for Maintaining Radioisotope Treated Animals:

1. Radioisotope treated animals must be housed in disposable cages unless the Radiation Safety Officer authorizes their housing in non-disposable caging systems. Limits on the number of animals per cage may be set by the Radiation Safety Officer and/or the ROC.

2. Each cage must have a cage card that has a radioactive materials label which indicated the radioisotope used, amount per animal, date of administration and the Authorized Users name.

3. Cage changing schedules will be individually designed for each experiment by the Authorized User. However, cages, water bottles and bedding must be changed at least once a week.

4. Handling animals in disposable cages:

    a. Cover bench top with absorbent paper before opening cages. Decontaminate all equipment such as forceps and forceps jar with Count-Off or Radia-wash. All waste materials are to be properly packaged and labeled for transfer to the radioactive waste storage area.
    b. Cages containing radioisotope contaminated bedding are emptied into the receptacle provided and isotope/activity/date/user logged on the attached waste disposal card.
    c. Disposable cages are placed in bags, similarly labeled and arrangements made through the Radiation Safety Officer for proper disposal. **Disposable cages may NOT be washed and reused.**
    d. Water bottles, which have been dedicated for excusive use in the radioisotope animal room, cage lids and any non-disposable cages are washed in the Animal Housing Facility on a separate schedule with appropriate segregation and monitoring by the Radiation Safety Officer.
    e. Authorized Users or their assistants are expected to clean up bench tops, vacuum or damp mop the floor if food or bedding is spilled, and maintain all other animal room housekeeping standards.

5. In the case of long term studies (over 1 week) animals may be transferred from disposable to non-disposable cages after the majority of the radioactive material has been excreted and levels in bedding are essentially background. Per Radiation Safety review.

MONITORING OF THE WORK AREA

The Authorized user or his/her assistant are to complete monitoring responsibilities commensurate with other radioactive materials use during the course of the in vivo study. Positive wipe test or survey meter results will be reported to the Radiation Safety Officer at the conclusion of the in vivo study. The animal room or wash area will not be used for any other purpose until such monitoring indicates an unrestricted status.

USE AND HANDLING OF LABORATORY ANIMALS

Long term (overnight) studies using live animals treated with radioisotopes require the use of the designated radioisotope use animal room in the Animal Housing Facility. Specific cages, water bottles and other associated equipment have been designated for exclusive use in radioactive materials experiments. Both the wash area and animal room will be monitored for contamination after any use involving radioactive materials, prior to release for unrestricted use.

Facilities and equipment for maintenance of such animals must be requested in writing to the Radiation Safety Officer and approved by both the Radiation Safety Committee and the department in which the work is to be carried out. The animals may be taken to the investigator's laboratory for brief periods of time I order to perform whole body counts or other metabolic and physiological studies requiring the use of specialized equipment located elsewhere in the facility. If such movement of the animals is necessary, it will be outlined in the protocol and appropriate monitoring and labeling requirements will be met.

Contaminated cages, bedding and animal carcasses which result from in vivo isotope use all processed in the department in which the work has been carried out. Proper procedures are outlined in appendix material maintained by the Radiation Safety Officer.

ATTACHMENT 9. RADIOACTIVE MATERIALS LICENSE

Janet T. Mills
Governor

Jeanne M. Lambrew, Ph.D.
Commissioner

Maine Department of Health and Human Services
Maine Center for Disease Control and Prevention
11 State House Station
286 Water Street
Augusta, Maine 04333-0011
Tel; (207) 287-8016; Fax (207) 287-9058
TTY: Dial 711 (Maine Relay)

July 1, 2020

Michael Halko, RSO
Bowdoin College, Dept. of Biology
3800 College Station
Brunswick, Maine 04011

Dear Mr. Halko:

Please find enclosed the amendment to your State of Maine Materials License number **05205 Amendment #16** terminating your radioactive materials license with the State of Maine. If there are any errors or questions, please notify the Radiation Control Program at 287-5676, so that we can provide appropriate corrections and answers.

Sincerely,

Thomas C. Hillman
Asst. Environmental Engineer
Radiation Control Program

STATE OF MAINE
MATERIALS LICENSE

Supplementary Sheet

Bowdoin College
Department of Biology
3800 college Station
Brunswick, Maine 04011

In accordance with a Certificate of Disposition dated June 2, 2020 and June 26, 2020, your Radioactive Materials License number **05205** and file have been terminated effective this date.

Date: July 1, 2020

Thomas C. Hillman
Radioactive Materials License Reviewer
Radiation Control Program
Division of Environmental Health

ATTACHMENT 10. X-RAY MACHINE MANAGEMENT

The College maintains a number of licensed benchtop analytical x-ray machines (Teltron® Tel-X-Ometer 2580/2581) that are stored in Searles Room 216. The physics laboratory in Room 216 is where the devices are used intermittently by students for no more than 30 hours per year for a specific course of instruction. An additional tabletop cabinet x-ray machine (Rigaku Miniflex 6G) is used in a faculty research lab located in Cleaveland Hall room 254.

The following management measures will be employed regarding these instruments, pursuant to Part H of the Maine Rules Relating to Radiation Protection (MRRRP):

1. They will be stored in a locked and labeled area when not in use or being maintained/inspected.

2. The instrument licenses, Form HHE-845 “Notice to Employees”, and a CAUTION: X-RAYS IN USE sign will all be posted in the laboratory when the instruments are in use or being maintained/inspected.

3. Prior to use, students will be provided instruction specific to the use of the instruments according to the manual provided by the manufacturer, and will demonstrate competency with same to the satisfaction of the instructor.

4. The individual action keys associated with the instruments will be removed when not in use, and secured in a locked location. Only instructors will be allowed access to the keys on request.

5. General maintenance will be conducted by the department as needed and/or as recommended by the manufacturer, in coordination with the RST.

6. The instruments will be inspected visually and with a survey meter at least annually by the RST, and receive a full compliance inspection biennially by a Maine Qualified Expert.

7. Provide documentation of maintenance and records to the Director of EHS and RSO for the file.

RADIATION SAFETY PROGRAM CALENDAR

1. **Daily** close-out surveys of work areas by the Authorized User to secure the radioisotopes in use, and monitor the work area and personnel for contamination, a log of these surveys to be kept in the Radiation Safety Notebook assigned to the project.*

2. **Weekly** monitoring by the PI or RST of active work areas using radioisotopes, in addition to any regular monitoring to be performed by the Authorized User as part of their work, a log of this monitoring to be kept in the Radiation Safety Notebook assigned to the project.*

3. **Quarterly** meetings (January, April, July, and October*) of the Radiation Safety Committee while materials are in use, otherwise annually at the beginning of the Fall semester, with meeting minutes to be maintained for 5 years. Committee agenda will include at a minimum: current applications for authorized use of materials; status of required documentation and inspections; and reports of exposures, incidents, or issues of noncompliance with the program.

4. **Semiannual** inventory by the RSO of all sources and materials stored under the license (January and July), with records to be maintained for 5 years.

5. **Annual** review of the status of the Radiation Safety Program, its documentation and postings, to be conducted at the beginning of the Fall semester in coordination with the minimum-required annual Committee meeting.

6. **Annual** fee for the 5-year Radioactive Materials License to be administered by the Director of EHS, including updating the names of Authorized Users and the designated Radiation Safety Officer, and/or changes to licensed materials, with appropriate supporting documents by July 1.*

7. **Annual** fees for and renewals of the x-ray Registrations and General License to be administered by the Director of EHS, including updating information for licensed equipment as necessary, with appropriate supporting documents by January 1.

8. **Annual** servicing of radiation monitoring/surveying equipment by the RST, with certifications to be maintained for 5 years.

9. **Annual** check of benchtop x-ray machines by the RST.

10. **Biennial** inspections and recertification of benchtop x-ray machines by a Maine Qualified Expert.

11. **Three-year** leak detection testing on Varian GC-450 Ni-63 sealed source.

12. **Five-year** renewal of radioactive materials license is required upon date of issue. Target the new fiscal year in July that allows for a 90 day processing period, due the last day of September. *

    (*) These items are only required when there are materials in use and a Radioactive Materials License is active.