MANUAL FOR THE SAFE HANDLING

OF RADIOACTIVE SUBSTANCES

AT THE

STATE UNIVERSITY OF NEW YORK

COLLEGE OF ENVIRONMENTAL SCIENCE

AND FORESTRY

Revised January 1998

Dr. Gregory L prepared this manual. Boyer, subcommittee head of the training and education, with the advice and direction of the SUNY-CESF Radiation Safety Committee. While questions regarding radiation safety may be directed to the Radiation Safety Officer or any member of the Radiation Safety Committee, specific questions and or improvements to the manual itself should be directed to Dr. G. Boyer, 320 Jahn Laboratory, for incorporation into later revisions.

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ADDRESSES AND TELEPHONE NUMBERS

In the event of an emergency, Public Safety, the Radiation Safety Officer, and/or the Chairman of the Radiation Safety Committee should be notified immediately. If none of the above individuals are available, a member of the Radiation Safety Committee should be notified.

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INTRODUCTION

WHAT ARE RADIOISOTOPES?

Radioisotopes and radioactive materials are defined by the Nuclear Regulatory Commission as any material capable of producing ions or ionizing radiation. Radioisotopes are now common in the scientific laboratory. They find widespread use as chemical tracers in biology, as chemotheraputic agents in medicine, and as integral components of many of the analytical instruments (called "sealed sources") used in chemistry and soil science. The low levels or small amount of radioisotopes that you will encounter at the College of Environmental Science and Forestry are safe to work with provided precautions are used to prevent accidental exposure of equipment and personnel. These precautions, and the necessary legal and reporting requirements, are described in this manual to ensure that you and the College are following the proper procedures. If you have any questions concerning these procedures, do not hesitate to contact the Faculty member in charge, the Radiation Safety Officer, or the Chair of the Radiation Safety Committee.

Use of a radioisotope or other radiation sources at the College of Environmental Science and Forestry requires a license from the New York State Department of Health Bureau of Environmental Radiation Protection (NYSDOH-BERP). CESF currently has a site license that covers all users. Keeping this license is contingent upon each individual strictly adhering to the regulations. Without cooperation of all users, we risk losing the license, a consequence that would jeopardize many of the operations at CESF. The Radiation Safety Committee (RSC) is responsible for our proper use of radioisotopes and other radiation sources at CESF and has an authority to approve or disapprove a use by members of CESF. The Radiation Safety Officer (RSO), a member of the RSC, is responsible for direct supervision/safeguard in radiation-related matters. Normal communications with Radiation Safety Committee is made through RSO. To ensure safety and adherence to the law, please read the following booklet carefully and follow these steps when you work with a radioisotope or radiation source.

SECTION 1

PERSONNEL AND TRAINING:

For the purposes of radiation safety, the different people who will come in contact with radioactive isotopes are classified into several broad categories depending on the amount of interaction they are expected to have with radioisotopes. These different use levels may require different levels of training as explained below.

DEFINITIONS:

RADIATION SAFETY COMMITTEE (RSC): The RSC is a standing committee appointed by the college administration and approved by the NYSDOH-BERP. Members of the Radiation Safety Committee are generally certified users and charged with setting campus radiation policy within the confines of New York State law. Their role is further defined in section 3.

RADIATION SAFETY OFFICER (RSO): The Radiation Safety Officer, an employee of the College, is charged with overseeing the implementation of radiation safety at CESF by monitoring compliance with rules and regulations, license conditions, safe laboratory practices, and any specific conditions of project approval as specified by the RSC. The RSO provides a direct liaison between the College and the New York State Bureau of Environmental Radiation Protection. Included in these responsibilities are the application for, and any necessary amendments to, our radiation site license.

RADIATION PROJECT DIRECTOR (RPD): The Radiation Project Director is defined as a principal investigator (or surrogate supervisor) of a research project or a Professor (or surrogate instructor) in charge of a course, teaching laboratory or other project (including both regular and special offerings) in which radionuclides or a radiation source is used. They are generally full time faculty/staff members at CESF. It is highly recommended that all faculty members whose work involves the use of radioisotopes complete an approved training course and be certified as the radiation project director for the handling of radioisotopes. If a given faculty member, principle investigator or Professor is not certified for the handling of radioisotopes at CESF, then a certified surrogate radiation project director must be appointed by the Radiation Safety Committee. The function of this surrogate RPD will be to approve and supervise all matters regarding the handling of radioactive materials for that project.

PROJECT USERS: Project users are defined as personnel who are members of a project that involves the use of radioisotopes or radiation sources. This group includes graduate students, postdoctoral researchers, technicians, project directors and professors who are engaged in the use of radioisotopes / radiation sources. All project users are required to take and satisfactorily complete a short course on safe procedures for the handling of radioactive materials and radiation sources before starting their work. Depending on their particular project, additional training may be required by RSO/RSC if they feel more specialized techniques and or training is required. FCH 520 "Nuclear and Radiation Chemistry" and FCH 521 "Nuclear Chemical Techniques" are offered in the spring semester and highly recommended for those users whose work involves these more specialized techniques. Under certain limited circumstances, and the approval of the RSO and RSC, a project may be allowed to commence following a provisional training of users by the RSO. It should be understood that this does not satisfy the requirements for the formal training of the users and a suitable training course must be taken at the earliest possible opportunity in order to continue the work.

INCIDENTAL USERS: College Work-study students and other students engaged in a course or project employing radioisotopes or radiation sources but who are not involved in either the purchase and or disposal of the isotopes may be classified by the RSO/RSC as Incidental Users. Incidental Users also require training on the safe handling of radioisotopes though not as rigorous as that necessary for Project Users. This training may be provided by satisfactorily completing the radiation safety short course, special training provided by the RSO or, with the RSO's approval, special training provided by the RPD or a designated faculty member certified in the use of radioisotopes. It should be emphasized that Incidental Users are only certified for the use of radioisotopes in specified conditions and under the immediate supervision of a certified Project User. This is not a blanket approval for the handling of

radioisotopes. If their involvement and/or use of radioisotopes greatly expands during the course of the project, they may be required by the RSO/RSC to upgrade their certification to "Project User" status as described above.

NON-USERS: Non-users (Custodians, maintenance workers, work-study personnel) who enter the space where radioisotopes are used, but who are not directly involved with the handling of radioisotopes, radiation sources, and equipment/apparatus that is involved with the handling of radioisotopes or radiation sources, must also be informed of special hazards in which they may come in contact. This information will be provided through special training sessions conducted by appropriate personnel as part of the College-wide training in worker safety.

REQUIREMENTS FOR DOCUMENTATION:

As required by the New York State Bureau of Environmental Radiation Protection, a biographical file will be established for all Radiation Project Directors, Project Users, and Incidental Users. These files are open to inspection by members of the NYSDOH Bureau of Environmental Radiation Protection and other qualified personnel. Included in that file will be;

1. The background and previous experience of that user in the handling and use of radioisotopes or radioactive materials. Included will be a record of any previous radioactive exposure that may place limits on the users safe exposure levels.

2. The current training status of that employee, including the date when the user completed his or her certification for radioisotope use at CESF through completion of an approved training module. Additional training, (FCH 521 Nuclear Chemistry Techniques, etc.) will also be included in this file.

3. A brief description of those applications and isotopes for which the user has been approved by the RSO/RSC will be entered in the file. In addition, any special circumstances and or requirements set by the RSO/RSC for approval of the application for radioisotope use will be recorded.

4. The results from any required personal radioactivity monitoring (e.g. film badge reports).

Copies of the following information will also be provided to each radioisotope user including;

1. State of New York NOTICE TO EMPLOYEES, Standards for Protection against Radiation.

2. CESF Regulations for radioisotope use in the laboratory (including this booklet).

3. A list of the Radiation Safety Committee members and whom to contact in case of an emergency.

SECTION 2

CAMPUS RESPONSIBILITIES FOR THE USE OF RADIOISOTOPES:

To insure the safe handling of radioactive materials and sources, the College of Environmental Science and Forestry has adopted a multi-tiered approach towards radiation safety. The campus-wide Radiation Safety Committee has primary responsibility for the recommendation of campus policy and the approval of individual projects. The Radiation Safety Officer provides information to the individual user and ensures that CESF meets New York State and Federal regulations for the safe handling of radioactive materials. However, it is up to the individual users to ensure that radioactive materials are used in a safe manner. The details of this multi-tiered approach are further delineated below.

DUTIES AND RESPONSIBILITIES OF THE RADIATION SAFETY COMMITTEE (RSC):

The Radiation Safety Committee is appointed by the College Administration and consists of a chair and representatives chosen from each faculty in the various campus units that use radioactive materials. Members of the Radiation Safety Committee are generally certified users and charged with setting campus radiation policy within the confines of New York State law. The RSC must approve all applications for radioisotope usage at CESF (including all College properties) and oversees the radioisotope, radiation and radiological safety programs. The responsibility for carrying out the details of these programs is delegated to the Radiation Safety Officer.

DUTIES AND RESPONSIBILITIES OF THE RADIATION SAFETY OFFICER (RSO):

The duties of the Radiation Safety Officer are to handle the day to day operations concerning the use of radioisotopes and radioactive sources under the control of the College of Environmental Science and Forestry. The RSO is responsible for coordinating the RSC's review and safety evaluation of all proposed uses of radioactive material. The RSO also oversees all activities involving radioactive materials, including conducting routine monitoring and special surveys of all areas in which radioactive material is used. The RSO generally conducts periodic surveys of work areas to supplement and audit routine monitoring by authorized users. The RSO is responsible for determining compliance with rules and regulations, license conditions, safe laboratory practices, and any specific conditions of project approval as specified by the RSC. In addition, the RSO is responsible for conducting training programs and otherwise instructing personnel in the proper procedures before they are allowed to use or come in contact with radioactive material. This includes not only radioisotope users but also others such as clerical, custodial, and maintenance personnel. The RSO furnishes consulting services on all aspects of radiation safety to personnel at all levels of responsibility and is responsible for supervising any decontamination of facilities and/or equipment required in case of radioactive accidents.

The RSO is also responsible for providing a direct liaison between the Campus and the New York State Bureau of Environmental Radioactive Protection. The RSO maintains an inventory of all radionuclides at the institution and is responsible for limiting the quantities of radionuclides to the amounts authorized by our license. The RSO is responsible for supervising and coordinating the radioactive waste disposal program, including keeping waste storage and disposal records, and monitoring of effluents. The RSO also maintains other records not specifically designated above, such as records of surveys, radiation monitoring and disposal, receipts and transfers of material to and from the college, and is directly responsible for the distributing and processing of personnel monitoring devices as required by safe radioisotope practices and State law. The RSO keeps records of personnel exposures and bioassays; notifying individuals and their supervisors of individual exposures that are approaching maximum permissible amounts.

DUTIES AND RESPONSIBILITIES OF THE RADIATION PROJECT DIRECTOR:

The Radiation Project Director, working in concert with the Radiation Safety Officer, is charged with insuring safe handling practices of all radioisotopes and radiation sources in his or her individual laboratory. For the purpose of promoting informed supervision and to ensure safe handling practices in the use of radioactivity, projects, which involve the use of radioisotopes and or radiation sources, require a certified Radiation Project Director. When a Principal Investigator or Professor is not certified, approval of a project will only be given by the RSC if a certified

surrogate supervisor for those matters involving the use of radioisotopes and radioactive sources is appointed and approved for that project.

The Radiation Project Director is responsible for ensuring the equipment, facilities, space, and security necessary for the safe handling and storage of radioactive materials involved in that project are available. The RPD, in concert with the RSO, is also responsible for ensuring that Project Users and Incidental Users under his or her supervision are familiar with any required procedures and what is expected of them in regards to the safe handling and disposal of radioactive substances.

The Radiation Project Director is responsible for supplying the RSO with any needed information so that the RSO may keep the College records up to date and comply with New York State and Federal reporting requirements. This may include, but is not limited to: the background and training record of the individual radioisotopes user, an inventory of radioisotopes under the direct control of the Radiation Project Director, and the means of disposal for any isotope that is no longer in inventory and should be removed from the college records.

Finally, it is the responsibility of the Radiation Project Director to make certain that the RSO, or if he or she is not available, then the chair of the RSC, is immediately informed of any spill or potential hazard that may have arisen through the use of radioisotopes. The RPD should assist the RSO as needed to ensure that any accident involving the use of radioactive materials is immediately cleaned up and the area safely decontaminated.

DUTIES AND RESPONSIBILITIES OF THE PROJECT USERS:

The Project User is expected to have the most contact with the radioactive materials and or sources. Therefore it is his or her responsibility to ensure that safe laboratory practices for the handling of radioisotopes are followed at all times. The Project User must be certain that they are familiar and comfortable with all procedures requiring that they handle radioactive material prior to actually starting the procedure. They are strongly encouraged to discuss with their Radiation Project Director and/or the RSO any changes in protocol that would improve radiation safety. They should make certain that, before starting any work involving radioactivity, the Radiation Safety Officer has a complete history of all prior exposure to ionizing radiation so that he or she can properly evaluate their safe exposure limits. This includes exposure from radioactive sources and X-ray machines but does not include medical and dental X-rays.

It should be emphasized that permission to use radioactive materials and/or sources in education or research at the College of Environmental Science and Forestry is a privilege granted to the Radiation Project Director and Project User by the RSC in consultation with the RSO. It is based upon their belief that the RPD and Project Users are qualified and will use the material in a safe and approved manner. It is not a "right" of the individual based upon their acceptance of College employment or as being part of a College degree program. Information that causes the RSC and RSO to question if radioactive materials and or sources are being used in an approved and safe manner may result in a suspension of these privileges at any time.

SECTION 3

RULES FOR THE SAFE USE OF RADIOISOTOPES:

Most rules and suggestions for the safe usage of radioisotopes are simply an extension of the safe laboratory practices that you should observe when handling any potentially dangerous chemical. Radioactivity has the added hazard in that it is invisible; spills and leaks are not readily apparent unless one specifically checks for them. CESF is required to follow the ALARA (As Low As Reasonably Achievable) mandate issued by the State of New York in regards to radiation exposure. The Radiation Project Director in charge, working in conjunction with the RSO, is responsible for ensuring a safe location for the use and handling of radioactive materials. The individual user must take precaution to protect themselves (through the use of gloves, lab coats, etc.) And they're fellow workers from accidental or unnecessary exposure.

GOOD HOUSEKEEPING AND SAFETY CONSIDERATIONS:

1. Radioactive material signs must be posted on all doors of rooms containing radioisotopes. Refrigerators and cabinets containing radioisotopes must also have a radioactive material sign posted near the opening handle. If at all possible, a specific area in the laboratory should be set aside and clearly posted that it is for radioisotope use only. Non-radioactive work should not be conducted in the same space as radioactive work.

2. All bottles, beakers or other containers containing radioisotopes will be labeled with a radioactive material sign or tape and the following information will be present on the label:

1. Type of radioisotope, (C-14, H-3, P-32, Co-60, etc.)
2. The amount of radioactivity, (uCi, mCi, cpm, Bq, etc.)
3. Date the container was labeled.

In the case of a tray of liquid scintillation vials, one label on the tray will be sufficient. If individual vials are to be removed from the tray for use other than counting, a radioactive material label must be attached with the proper data. During the monthly inspections by the RSO and staff, improperly labeled containers will be brought to the attention of the user or removed by the RSO for disposal.

3. Unnecessary materials are not to be brought into the laboratory where radioisotopes are in use. Eating, drinking, smoking, the storage of food and drink in the refrigerators, and the use of cosmetics in the radioactive laboratory is specifically prohibited.

4. Laboratory protective clothing, such as plastic gloves and lab coats should be worn at all times when handling radioactive materials. This protective clothing shall be left in the radioisotope laboratory and shall not be worn to the reading, seminar, or coffee rooms. Once gloves have been worn to handle radioactive materials, they should be disposed of in a clearly marked radioactive disposal container. Do not use the same gloves to handle non-radioactive materials, open doors, leaf through notebooks, turn off the light switch, etc.

5. While every effort should be taken to prevent radioactive spills and accidents, a small amount of precaution taken prior to an accident can go a long way in minimizing any possible damage. Do not work with radioactive chemicals on the laboratory bench unless they are contained within a spill tray. The Analytical and Technical Services stockroom has large plastic lipped trays that easily will contain an accidental spill. The old fashion slate lab benches are very absorbent and extremely difficult to decontaminate once impregnated with a radioisotope. Different types of laboratory absorbent paper (e.g. Lab Mat™) are available and recommended for use with radioactive materials. If you are using this type of material as a protection against spills, make certain the paper is taped to the bench to prevent accidental movement.

6. When transferring radioactive liquids, never pipette or perform of any similar operation by mouth. Most micropipettors are or can be equipped with automatic tip ejectors. These should be used to remove radioactive tips. Remember that such tips have come in direct contact with radioactive liquids and may be extremely hot. Good laboratory practices suggest that you separate these "hot" items (pipette tips, empty original shipment vials, etc.) from

other much less radioactive items such as used gloves.

7. Modest amounts of shielding can go a long way in protecting the individual user (and his/her laboratory co-workers) from exposure to radiation. H-3 beta particles are extremely weak and cannot penetrate latex gloves. Similarly a 9-mm piece of Plexiglas will effectively shield the user from the beta particles emitted by C-14, P-32 and S-35. Working behind a small shield and storing your microfuge tubes in Plexiglas blocks is considered good laboratory practice and strongly encouraged for all beta emitters. Shielding is especially important if you are working with P-32. A beta particle from P-32, with its greater penetrating power, will travel approximately 20 feet through air. It is >99.9% absorbed by a 9-mm Plexiglas shield. These safety shields are readily available from a number of scientific supply sources. Talk with your RPD or the RSO for more information on where you can obtain these shields.

8. Before leaving the radioisotope laboratory, the gloved hands should be washed first, then checked with a beta-gamma survey meter if available. The lab coat and gloves are then be removed and the hands washed and checked with the meter again. Contamination remaining after washing shall be reported to the faculty member or radiation project director in charge and the Radiation Safety Officer.

9. If, in the course of work with radioisotopes, personal contamination is suspected, a survey with a suitable beta-gamma survey meter or wipe tests (if working with H-3 and C-14) must be made immediately, to be followed by the required decontamination. The incident must also be reported to the RSO. Project Users should also make precautionary surveys of their work areas on a regular schedule. This involves making filter paper wipe tests of areas for C-14 and H-3 contamination and counting these wipes in a liquid scintillation counter. The Radiation Safety Officer will also conduct monthly wipe tests and inspections as a check for contamination. These results will be posted in the laboratory for your information. However, these monthly monitoring do not replace the need for careful and routine testing for spills on the part of the individual users.

10. No person should work with radioactive materials, while having breaks in the skin on the hands, without using rubber or plastic gloves. All such breaks in the skin must be reported to the Radiation Project Director in charge before work begins.

SPECIAL PROBLEMS:

11. Radioactive Gases; If you are working with a radioactive substance that is likely to cause a release of an aerosol, vapor or gas, you must check with the Radiation Safety Officer prior to starting any work. The minimal requirement for handling such materials is to work in a spill tray in a certified fume hood. The RSO will test your fume hood to see if it meets acceptable standards (generally 100 linear ft/min with the sash at the working height). In some cases, special filter systems for the use, storage, or disposal of radioactive material may be required. The hood air flow measurements will be checked every six months by the RSO and records of these measurements and filter maintenance are kept on file for inspection by the Bureau of Environmental Radiation Protection. If you are using very high energy isotopes (e.g. I-125) or high levels of a low energy isotope (e.g. 3-H water) you may be required to work in a high flow fume hood such as that found in the nuclear chemistry laboratory. Exhaust fans in hoods where radioactive material is used or stored should not be turned off except under extremely unusual circumstances. When the hood is turned off, or if there is no air flow in the hood due to a mechanical problem, close the hood and keep it closed until the air flow is restored. All hood malfunctions in which radioactive materials are being used must be reported to the RSO immediately.

12. Film Badges for Radiation Exposure. Under certain circumstances the RSO may require that individual users wear film badges. These badges will be provided by the RSO when necessary. The weak beta particles from H-3 and low levels of C-14 or S-35 will not register on the film badge; therefore film badges are not necessary when these isotopes are used in millicurie amounts. When other beta emitters such as P-32 and Cl-36 are used, the film badge requirements will be discussed with the RSO to determine the correct procedure. Film badges will be worn at all times when gamma emitters such as Cr-51, Co-60, Cs-137, I-125, and I-131 are used and by any X-ray machine operators. When not in use, film badges are to be kept in a cool dry non-exposed area. Do not wear or place your film badge on or near a television or CRT screen. Accidental exposure of your film badge will be treated as a radioactive exposure and may result in your being prohibited from entering the radioisotope laboratory.

13. Use and Operation of Sealed Sources; In most cases, individual sealed sources should be treated like any other analytical instrumentation. Do not open these sources for any reason unless you have first checked and received

approval of the Radiation Safety Officer. All gas chromatographs using radioactive source detectors, such as, Ni-63 and H-3, must be checked every six months for the proper cut off temperature. The H-3 is adsorbed on metallic foil and is readily desorbed at high temperatures, escaping into the room and creating a radiation hazard. Records will be kept on file, by the RSO, for inspection by the Bureau of Environmental Radiation Protection.

WHAT TO DO IN THE CASE OF A SPILL:

If you were following good laboratory practices, the spill should already be contained within a spill tray. The best approach is to prevent the spill in the first place. However in the event of such an accident, the following general procedures should be followed. More detailed information is given in Section 8 "What to do in Case of an Emergency".

1. If the spill is small less than 0.05 microcuries (ca 2 kBq):

   Blot up any liquid up with a Kimwipe™ or other absorbent paper. Make certain you are wearing rubber or plastic gloves. Dispose of all materials contaminated by the spill and it's clean up in a radioactive disposal trashcan or clearly labeled plastic bag.

   Mark the area of the spill and label with the type of radioactivity, C-14, H-3, P-32, etc. Report the exact location of the spill to your Radiation Project Director as the Radiation Safety Officer will need to check the area to see that it is free of contamination.

2. If the spill is larger up to 1 mCi or 37 MBq;

   Follow the same procedures for the smaller spills with the exception that the Radiation Safety Officer must be notified immediately. Make certain “helpful” co-workers do not spread the extent of the spill.

3. For larger spills over 1 mCi or 37 MBq;

   If a spill of over 1 mCi or 37 MBq takes place the laboratory must be evacuated. Public Safety and the Radiation Safety Officer must be notified immediately. Inform Public Safety that it is a radiation emergency and where you can be found to help in understanding the problem. Do not try to clean up such a hot spill by yourself unless under the specific instructions of the Radiation Safety Officer. The College has personnel specially trained for the clean up of high radioactivity spills.

Remember that you work in the area and you do not want to carry radioactivity throughout the building and into your home or apartment. It is your health and the health of your friends and coworkers. HIDING A SPILL IS FOOLHARDY TO SAY THE LEAST and such action may result in appropriate disciplinary action.

SECTION 4

ORDERING, RECEIVING AND STORAGE OF RADIOACTIVE CHEMICALS:

ORDERING OF RADIOACTIVE CHEMICALS:

All radioactive materials used in projects and or classes under the jurisdiction of the College of Environmental Science and Forestry, regardless if the project is conducted on the Syracuse Campus or one of the allied properties, must be ordered through the Radiation Safety Officer (RSO). The RSC/RSO and a radionuclide acquisition request (Form C in the appendix should approve the project) on file with the RSO prior to ordering of radioactive material. The purchase orders for radioactive materials for approved projects should be delivered in person or by mail to the Radiation Safety Officer (RSO), Baker 163 for entry into the radioactive material records. At this time, the College's Radioactive Material License Number will be typed on the purchase order along with an OK to order as shown by the signature of the RSO. For easy recognition, a yellow radioactive material label will be placed on the original copy of the purchase order. This will serve to notify the Business Office that this is an order for radioactive material. The Business Office will attach a similar yellow label to the copy of the official order going to Receiving. The Business Office will not process any order for radioactive materials not signed by the RSO. Suppliers or vendors of radioisotopes, under State and Federal Regulations, cannot ship radioactive material unless they have a copy of the College's New York State Radioactive Material License on file. The RSO will provide copies of the license for all vendors. This license requirement is also necessary when receiving a radioactively labeled compound as a gift from industry or another University.

RECEIPT AND DELIVERY OF RADIOACTIVE CHEMICALS:

The yellow radioactive material label attached to the outgoing purchase order will notify Receiving that a shipment of radioactive material is due. When the item arrives at CESF, it is immediately delivered unopened to the nuclear chemistry laboratory in 163 Baker Laboratory. There the package is opened, inspected for damage, and its contents checked against the outgoing purchase order. The packing slip is sent to receiving so that they may notify purchasing what was received. By delivering the packages unopened to the Nuclear Chemistry Lab, any accidental spillage of radioactive material due to damage in shipping will be confined to an area, which can be readily decontaminated. Investigators and or users who receive radioisotopes directly from an industry or another University as a gift should have contacted the RSO prior to the shipping of the item. If this has not been done, the RSO must be contacted immediately upon receipt of the item so that the necessary information can be obtained. Failure to do so is a violation of the College Radiation License and may be cause for disciplinary action by the New York State Bureau of Environmental Radiation Protection.

Once the radioactive material has been inspected and certified as undamaged by the RSO, it is ready for distribution to the individual researcher. A CESF item number is placed on the label at this time and all the information available is entered into the radioactive material records. The owner of the material is notified by telephone and arrangements made for pickup. When the material is picked up by the Radiation Project Director, it may be necessary to provide any missing information on the description of the proposed radioisotope use, persons involved in this project, and the laboratories where the material will be used. The Bureau of Environmental Radiation Protection will keep the completed Form C on file for inspection.

STORAGE OF RADIOISOTOPES:

New York State requires that all isotopes be stored in a safe and secure location. Items not in active use must be stored under the direct control of the Radiation Safety Officer. Facilities are available in the Nuclear Chemistry Laboratory for long term storage or to store high level samples (either high-energy isotopes such as Fe-59 or large quantities of 14-C, 3-H, etc.) under the RSO's direct control. One should contact the RSO directly for further information. Low level isotopes and compounds regularly used in the course of the individual user research can be stored in the individual research laboratory. New York State requires that the storage space, as far as practicable, be fire resistant. The room should also be locked at all times to prevent deliberate or inadvertent entry by unauthorized personnel. It is recommended that source containers containing the radioisotopes be locked separately. The room must

be clearly marked with a large (5") sign indicating the radioisotope(s) used and stored within. (These signs are available from the RSO and are normally posted at the entrance to the room at the time the project is approved by the RSC). Individual items in a controlled area must be shielded such that radiation exposure levels in the room are maintained below 100 mrem/week. The College of Environmental Science and Forestry, as part of our license, must meet the ALARA requirements. Use and or storage of radioactivity must done so that exposure to radiation is as low As Reasonably Achievable.

All storage containers, bottles, etc. shall be marked with a "Radioactive Material" label indicating the activity and nature of the radioisotope, the date, and the name of the owner. Where gases or aerosols may be emitted, unsealed sources must be stored in a properly ventilated and approved area such as a fume hood. Liquids should be stored in double containers to prevent the possibilities of a spill. Good laboratory practices suggest radioactive and non-radioactive samples should not be stored together. However if they are required to be stored together in the same enclosure, such as a refrigerator, the radioactive compounds should be stored on the bottom shelf to prevent accidental contamination of nonradioactive materials through leakage or spillage.

It is the responsibility of the Radiation Project Director to ensure the safe and secure storage of all radioactive materials under his or her supervision. New York State Law requires that these compounds be kept in a locked and secured area. Any loss or theft of radioactive material must be immediately reported to the Radiation Safety Officer and Public Safety.

TRANSPORT OF RADIOISOTOPES WITHIN THE COLLEGE:

In general, radioactive materials and contaminated wastes are to be retained within the laboratory and at specific places within the laboratory as approved by the RSC. Except for properly enclosed samples being taken to the counting room, no transfer of radioactivity shall be made without specific instructions from the faculty member or radiation project director in charge who in turn will have notified the Radiation Safety Officer. The Radiation Safety Officer will then inspect the new arrangement, and if approved, post new radiation signs and changes the College radioisotope location records.

TRANSPORT OF RADIOISOTOPES TO AND FROM COLLEGE PROPERTIES:

For the purpose of New York State Regulations, the associated properties of the College of Environmental Science and Forestry are consider as a part of the Syracuse campus and, as such, fall under the jurisdiction of the Radiation Safety Committee and Radiation Safety Officer. Specific problems occur when it is necessary to transport materials between College properties via public roads. A copy of the College Radiation license must be carried with all radioactive materials. Certain labeling requirements may also need to be met. Individuals must check and receive approval of the Radiation Safety Officer prior to moving any materials off the main campus.

TRANSPORT OF RADIOISOTOPES TO LOCATIONS SEPARATE FROM ESF:

Transport of radioactive materials to locations outside of the CESF campus and to areas outside of New York State is governed by regulations of both the Federal and New York State Departments of Transportation along with the appropriate licensing agencies. The Radiation Safety officer must have a copy of the license of the recipient prior to shipment of any materials stating that they are capable of receiving the item. The item must also be removed from the CESF inventory. All materials for shipment via a public carrier must be packed in an approved container. The package must be scanned for external radiation to decide what type of labeling requirements is necessary. Shipments of radioactive items from CESF are done through the RSO's office and generally go by Federal Express.

SECTION 5

MANAGEMENT AND DISPOSAL OF RADIOACTIVE WASTES:

In general, radioactive materials and contaminated wastes should be retained at a confined location within the laboratory until pick up for disposal by the Radiation Safety Officer. Except for properly enclosed samples being taken to the counting room, no transfer of radioactivity shall be made without specific instructions from the faculty member in charge who in turn will have notified the RSO. The best procedure for the disposal of radioactive wastes is not to generate them initially. All radioactive users are required to participate in ESF's waste reduction efforts by clearly separating radioactive from nonradioactive material. In addition, the use of such items as biodegradable and nontoxic scintillants is strongly encouraged where possible.

The Radiation Safety Officer (RSO) is responsible for the safe transportation of radioactive wastes to the RSO's laboratory for eventual disposal. At the RSO's discretion and in consultation with the project supervisor, this task may be delegated to knowledgeable an consenting individuals; under no circumstances may these individual(s) further delegate this task with the express consent of the RSO. Users of radioactive materials are responsible for consulting with the RSO regarding the disposal procedures, the safe storage of the wastes with the designated space until disposal, and for preparing and packaging the wastes in a form appropriate for transportation. All users are expected to cooperate with the RSO to ensure the safe and prompt removal of wastes from the use site.

LIQUID WASTES:

In dealing with radioactive liquid wastes, it is necessary to keep in mind that these wastes often pose both a radioactive and chemical hazard. This is especially true for scintillation fluid, where the chemical hazard of the xylene/dioxane based fluors is often greater than the radioactive hazard of the samples.

Our license allows us to dispose of low levels of water-soluble radioactive substances via the County Sanitation System. Items should be placed in sinks that are designated for this purpose and flushed down with copious amounts of water. As an added precaution, flushing with clean water should continue for a reasonable length of time to prevent the settling out or concentration of the radioactive materials in the pipes and traps. Disposal of radioactive items in this manner does not alleviate the need for proper reporting and removal from our inventory records. For these reasons, the material should be sent to the Radiation Safety Officer for disposal unless otherwise stated in the project approval record.

Many liquid scintillation counter fluids are flammable and toxic as well as being slightly radioactive and must be disposed of by the RSO. All counting vials are to be emptied into the marked plastic containers that are used for other flammable radioactive liquids. The disposal tag is filled out and the RSO contacted for pick up service and disposal. In special cases, it may be necessary to gel or solidify liquids before disposal. It is very difficult to ship radioactive liquids for disposal and any such requirements will need to be discussed with the Radiation Safety Officer.

Any attempts to accumulate significant quantities of liquid waste in labs should be discouraged especially where such liquids could cause other problems (e.g., a fire hazard). Organic radioactive liquid wastes should never be dumped into the standard laboratory drain or mixed with other nonradioactive liquid wastes. These radioactive materials must be collected in a suitably labeled container and transported to the Nuclear Chemistry Laboratory, Baker 163, for proper disposal by the RSO.

Laboratory apparatus can not be washed in the public water sewer system unless it has an insignificant level of radioactivity, as shown by a beta-gamma survey meter or, in the case of H-3 or C-14, by a wipe or rinse test counted in a liquid scintillation counter. If the apparatus does not rinse to insignificant levels of contamination, it may be soaked in a cleaning solution, which in turn must be disposed of as outlined above for radioactive liquid wastes. If the apparatus cannot be cleaned or it is of the disposable type, it may be disposed as radioactive solid wastes or stored to await decay of a significant number of half-lifes. These and other modes of disposal must be discussed with and approved by the Radiation Safety Officer prior to implementation.

SOLID WASTES:

Radioactive solid wastes and contaminated materials must be placed in "Radioactive" labeled trash containers with a plastic liner. Once full, the Radiation Safety Officer is contacted and the solid radioactive wastes transported to The Nuclear Chemistry Lab for commercial disposal. Radioactive solid waste can not be placed in the normal disposal system where the radioactivity could be scattered in a landfill. Items that were once radioactive but have since been decontaminated must have their radiation labels removed prior to disposal. Under no circumstances can a piece of trash or glassware bearing a radiation sticker be picked up and disposed of through the normal trash.

Users are strongly encouraged to separate high level from low level solid wastes in that this facilitates disposal by the RSO. In addition, Radioactive wastes for short lived isotopes such as P-32, Cr-51, and S-35 and any other isotope a half-life of less than S-35 ($t_{\frac{1}{2}}$ = 87.2 days) must be separated from other waste so it may be stored by the RSO for 10 half-lives and then disposed of as non-radioactive waste.

Disposal of gamma emitters will usually require some shielding material that must be provided by the Project User or Radiation Project Director. Special containers such as paint cans, which can be sealed shut, may be necessary. Sealed Sources also have special disposal requirements and must be removed from the College inventory. You should contact the Radiation Safety Officer prior to disposal of any of these items.

In summary, radioactive solid waste are stored in specially marked containers until full. At that time, the Radiation Safety Officer should be notified. The material will then be monitored and arrangements will be made for its disposal. The lab personnel working in conjunction with the RSO, not the custodial staff, are responsible for proper packaging and removal of the waste from the lab to the Nuclear Chemistry Lab. When a specific radioactive item is used completely, notify the Radiation Safety Officer, Baker 163, extension 6848, so that the item can be removed from the College's active file.

GASES:

It should be the practice in all radioisotope laboratories to use fume hoods or glove boxes for all operations that are likely to cause a release of aerosols, vapors or gases. The storage of liquids that are likely to release airborne components should also be in fume hoods wherever this is practical. All releases to the atmosphere must, of course, meet all New York State Departments of Health limits on such discharges and may require additional monitoring.

BIOLOGICAL WASTES:

Animal or vegetable matter that has been injected with short-lived isotopes such as Phosphorus-32 or Iodine-131 should be held for radioactive decay before disposal. Biological wastes (such as animal carcasses) involving low levels of H-3 or C-14 may be considered exempt and can be incinerated after consultation with the RSO. All such wastes must be securely wrapped in a double layer of plastic material and handled in the same manner as other biological wastes. For other radioisotopes, reference must be made to our radioisotope license. A written record must be kept of the disposition of all radioactive materials and the manner in which they have been disposed.

SECTION 6

REQUIRED FORMS AND THE IMPORTANCE OF RECORD KEEPING

As part of our license, the College is required to maintain accurate and up-to date records regarding the purchase, disposal, transfer, and usage of radioactive materials. Quarterly reports must be filed by the Radiation Safety Officer with the Radiation Safety Committee and are available to any inspecting authority upon request. The New York Bureau of Environmental Radiation Protection does conduct periodic safety inspections of the campus and its allied properties. For the benefit of Radiation Project Director, a brief summary of this paperwork trail follows below. Blank copies of all required forms are available in Appendix A or from the RSC webpage at http://www.esf.edu/radsaf/.

1. Prior to the purchase of radioisotopes and the start of any project, a brief project description must be filed with the RSO and RSC for approval (Form A). Project Users must register and get approval by RSC (Form B). The RSO will review safety and disposal requirements for the individual project at that time. In addition, the form entitled "Background and training record of the individual radioisotope user" must be completed and on file in with the Radiation Safety Officer prior to starting any work using radioactive materials. This record will be kept on file for inspection by the N.Y. State Bureau of Environmental Radiation Protection. A radionuclide acquisition request form (Form C) is required to be on file prior to the purchase of radioactive materials and any necessary training should be completed prior to the actual start of the work (Form D). When a project is terminated, a termination form (Form F) must be filed with the RSC to ensure proper disposal of radioactive materials.

2. During the course of the project, the Radiation Safety Officer or a designated assistant is required to conduct monthly inspections of areas where radioisotopes are in active use. A survey meter will be used to check for spills of radioisotopes other than H-3, C-14, and S-35. In the case of these weak beta emitters, filter paper wipe tests will be made of laboratory benches, floors, hoods, refrigerators and any other area that may be contaminated. These wipe tests will be counted in a liquid scintillation counter and the results communicated to the Radiation Project Director. Any radioactivity over 2 times background will be brought to the RPD's immediate attention for clean up. The surveys and wipe tests results will be posted in the individual laboratories and are kept on file for inspection by the Bureau of Environmental Radiation Protection.

3. The Radiation Project Director, working in conjunction with the Radiation Safety Officer, is also responsible for maintaining inventory record of all radioactive materials on hand in the laboratory. This should include the name of the person responsible for each quantity of radionuclide, where it will be used or stored, and the date the quantity was delivered to that person. Communication between the RSO and the RPD will occur on a semesterly basis to ascertain that all records are up to date (Form E). When items are removed from the inventory, either through use or disposal, the record must be updated to show the eventual fate of the radioactive material. In most cases, this record keeping will be automatically being taken care of by the RSO as part of the normal purchase, receiving and disposal procedures. However it is the responsibility of the individual faculty member or RPD to inform the RSO of any acquisition and or disposal of radioactive materials that occurs outside these normal channels. Any loss or theft of radioactive material shall be promptly reported to the Radiation Safety Officer.

4. In addition to these normal reporting requirements, additional record keeping may be required depending on the nature of the project. For those projects requiring the use of film badges, the RSO will distribute and collect badges as required. Any exposure over background will be discussed with the individual film badge wearer and corrective action taken as needed. Film badge records of each individual are maintained indefinitely (permission for their disposal must be obtained from NYSDOH-BERP) so that this radiation exposure data is available for future requests from an employer of the individual.

5. The College Radioactive Material License requires that leak tests be performed every three months on alpha sealed sources and every six months on beta and gamma sealed sources. Sealed sources are used for calibration of survey meters, soil density and moisture gauges, irradiation sources, gas chromatography detectors, paper density gauges, etc. The leak test consists of wiping the sealed source with filter paper or washing with a suitable solvent. The test samples are then counted using the liquid scintillation counter for alpha and beta contamination and the NaI detector system for gamma contamination. The over-temperature shutoff on all gas chromatographs equipped with electron capture detectors must also be checked every six months. These tests are routinely conducted as part of the RSO's normal duties and do not require any direct action of the part of the RPD and/or individual users. Any abnormalities will be immediately brought to the attention of the Radiation Project Director and /or affected personnel.

SECTION 7

EXPOSURE LIMITS AND THE MONITORING OF RADIOACTIVITY

UNITS OF EXPOSURE:

The most widely used unit of radiation exposure, the roentgen (R), is defined as the quantity of gamma or x-radiation that will cause 0.258 millicoulombs worth of ionization per kilogram of dry air. By definition, roetogens only refer to photon interactions with air and not tissues. For absorption of energy by biological tissues, the units of measure are the RAD. (In SI units, it is the GRAY where 1 Gray = 100 Rad). A Rad is defined as an exposure to ionizing radiation such that 100 ergs of energy are dissipated in 1 g of matter. The radiation damage caused by this exposure is both dependent on the type of tissue and the type and energy of the ionizing radiation. These concepts form the basis of the common unit of radiation exposure for humans; the REM (Roentgen Equivalent Man). A rem is the absorbed dose in rads multiplied by a quality factor called the relative biological effectiveness (RBE). The RBE for a gamma ray or beta particle is generally equal to 1. However some radiation sources (e.g. alpha particles or fast neutrons) are more effective in causing tissue damage than others cause and the RBE is higher (RBE for alpha particles is 20). The use of the RBE concept allows the potential for tissue damage by a given radiation exposure to be normalized to that caused by a standard radiation source. Most regulations governing exposure of humans to ionizing radiation are expressed in terms of rems. In the future, this may be replaced by the SI unit, the Sievert (Sv), where 1 Sv = 100 rem.

MAXIMAL ALLOWED OCCUPATIONAL EXPOSURE:

NONCONTROLLED AREAS: Current Federal and State regulations limit the exposure of an average worker to 0.5 rem cumulative whole body exposure in any given 52 week period. Further more, an individual can not receive more than two millirem in any given hour or 100 millirem in seven consecutive days. Our license is actually more stringent than these regulations. The College follows the ALARA policy and all occupational exposure to radiation at CESF must be As Low As Reasonably Achievable. The College strives to have none of its employees receive a measurable dose of radiation.

CONTROLLED AREAS: Under certain conditions, the RSO/RSC can designate special areas at the College as "Controlled Areas". In these areas, a higher exposure to radiation is legally permitted. For workers over 18 years of age, whole body exposures must be limited to 3 rem per 3 month period or 5 rem in any 52 consecutive weeks. A dose to the hands and forearms may be as high as 25 rem per 3-month period or 75 rem in any 52 consecutive weeks. Currently, ESF has only one permanent controlled area. This is the Nuclear Chemistry Lab in 163 Baker Lab. The radioisotope laboratory in Jahn lab (Rm 342D) is under consideration as a second controlled space. Access to controlled areas is limited and any work in them requires special approval by the RSO/RSC. Constant monitoring of individual exposure through such items as film badges may be necessary. Other specific areas may be designated as a controlled area if the situation so requires. Most of the laboratories in which radioactive materials are used at CESF are noncontrolled areas and are subject to the more stringent exposure limits. Both noncontrolled and controlled areas at CESF must follow the ALARA policy and make all reasonable attempts to limit the exposure of personnel to ionizing radiation.

POLICY WITH REGARDS TO MINORS AND PREGNANT FEMALES:

Minors, defined as personnel under the age of 18, are not permitted by the College to work in a controlled area. While the College has no formal requirement with respect to pregnant workers using radioactivity, common sense should prevail. Current Federal regulations limit the exposure of a person known to be pregnant to less than 1 rem during the remaining period of pregnancy. However it is the recommendation of the RSC that exposure does not exceed that of the population at large, namely 0.5 rem. Female personnel are encouraged to disclose to their Radiation Project Director or the RSO, in confidence, at the earliest possible date, all pregnancies or suspected pregnancies. The RPD and RSO will promptly review of her schedule and workload to ensure that radiation exposures shall be kept to a minimum. It is the choice of the female worker to decide if she wishes to continue to work with radioactive nuclides or ionizing radiation after she has been made fully aware of the risks involved.

TECHNIQUES FOR THE MONITORING OF RADIOACTIVITY:

MONTHLY INSPECTIONS: The RSO or his assistant is required to make monthly inspections of areas around the College where radioisotopes are in active use. A survey meter is used to check for spills of radioisotopes other than H-3, C-14, and S-35. In the case of these weak beta emitters, filter paper wipe tests are made of laboratory benches, floors, hoods, refrigerators and any other area that may be contaminated. These wipe tests are then counted in a liquid scintillation counter and any radioactivity over 2 times background brought to the attention of the RPD in charge. These surveys and wipe tests results are kept on file for inspection by the Bureau of Environmental Radiation Protection.

While the RSO checks all areas in which radioactive materials are used for contamination each month, individual users are strongly recommended to check his or her individual work area for contamination on a more frequent basis. Several methods are available for such checks, depending on the energy and decay mode of the isotope used. Appendix 4 gives energy and decay mode for most of the common isotopes found at the College of Environmental Science and Forestry.

LOW ENERGY BETA EMITTERS (<200 keV): These radionuclides include 3-H, 14-C and 35-S and are the most common isotopes used on campus. The proper method of monitoring depends on the isotope and quantity in question. While a thin-window Geiger Mueller survey meter can be used detect carbon-14 and sulfur-35, the poor counting efficiency for these isotopes limit its usefulness to the detection of gross contamination. The very low energy betas emitted by tritium do not penetrate the window and enter the counter so this isotope must be determined by liquid scintillation counting. In practice, wipe tests are the method of choice for all three radionuclides. In a wipe test, a portion of the bench is wiped with a piece of filter paper (wet or dry) and the paper is inserted into a scintillation vial. Counting cocktail is then added directly to the vial and it is counted on the liquid scintillation counter with the windows set wide open. A background count is determined using a clean piece of paper into a new vial and any area registering more that 2 times background should be immediately cleaned up.

HIGH ENERGY BETA EMITTERS (> 200 keV): These radionuclides include such isotopes as P-32 and Cl-36. These isotopes have a much greater penetrating power than the low energy beta described above and can be counted using a standard survey meter equipped with a Geiger Mueller detector. Liquid scintillation counting will also work to detect these isotopes.

GAMMA AND X-RAYS: For high-energy gamma rays (>100 keV), the area should be checked with a survey meter equipped with a NaI scintillation detector. This type of detector is much more sensitive to gamma rays of this energy than a Geiger-Mueller detector. Removable radiation can be checked by wiping the area with filter paper (wet or dry) and checking the radiation on the wipe with a NaI detector or by liquid scintillation counting. Some common isotopes in this energy region are Co-60, Cs-137, K-40, Al-26, and Na-22.

For gamma and X-rays of intermediate energy (10 keV to 100 keV), several types of survey meters are available. The most sensitive is a survey meter equipped with a special low energy NaI scintillation detector. The disadvantage of this system is the high cost of the detector. The second choice would be a meter equipped with a Geiger-Mueller detector. This system is less sensitive but is lower in cost and readily available at the College. Removable radiation can be checked with a filter paper wipe and counting on a liquid scintillation counter or using a gamma counter. Some common forms of radiation in this energy range are X-ray emitting devices and Cd-109.

X-rays with energies of less than 10 keV can not be detected efficiently with any standard detector unless the x-ray flux is very high (x-ray diffraction units). When working with radioactive materials that only give off low energy x-rays (less than 10 keV), the best way to monitor the work area is to use filter paper wipes with liquid scintillation counting. The only low energy x-ray emitter used at CESF is Fe-55.

ALPHA PARTICLES: Due to the risk of internal exposure and their high RBE's, the work area where alpha particle emitters are used should be checked at least twice per day. Area surveys can be made using either a gas flow proportional counter or a survey meter equipped with a solid alpha scintillation detector. Both these detectors are very sensitive to gross contamination hence wipe tests must usually be done at the same time. Common alpha emitters include Ra-226 and U-238. While we are licensed to handle small quantities, there are no alpha emitters currently in use at CESF.

SEALED RADIOACTIVE SOURCES: The College Radioactive Material License requires that leak tests be performed every three to six months on sealed irradiation sources. The leak tests consist of wiping the exposed source with filter paper or washing with a suitable solvent and counting the test samples by liquid scintillation counter. At the same time, the thermal cut off is checked on all gas chromatographs equipped with Ni-63 or H-3 detectors. These services are routinely done as part of the duties of the RSO. Records are kept on file for inspection by qualified personnel.

MONITORING OF PERSONAL EXPOSURE:

GENERAL COMMENTS: In some projects, it may be required that the project user wear a personal monitoring device to quantitate individual exposure to ionizing radiation. Film badges are the most common forms of personal monitoring device when using radioisotopes other than H-3 and C-14. These values are then recorded in the individuals record book. Some isotopes are not easily detected by film badges or pocket dosimeters. In these cases, urine analysis may be required. These personal monitoring regulations are for the safety of the radioactive material user. Failure to satisfy them requires the College assume the User has received maximal exposure to radiation and therefore he or she cannot be allowed to continue work with radioisotopes.

FILM BADGE SERVICE FOR RADIATION EXPOSURE: The Radiation Safety Officer will notify the RPD in charge of a film badge requirement, however it is the RPD and Project Users responsibility to see that the film badges are used. The weak beta particles from H-3 and low levels of C-14 and S-35 will not register on film badges; therefore, they are not necessary when these isotopes are used in millicurie amounts. When other beta emitters are used, such as P-32 and Cl-36, the film badge requirements will be discussed with the RSO. Film badges must be worn at all times when gamma emitters such as Cr-51, Co-60, Cs-137, I-125, and I-131, are used and by X-ray machine operators. When required, the RSO will provide the film badge and collect the exposed badges for processing. Any exposure over background will be discussed with the individual film badge wearer. Film badge records of each individual are maintained so that this radiation exposure data is available for future requests from an employer of the individual. When not in use, film badges are to be kept in a cool dry non-exposed area.

BIOASSAYS OR URINE ANALYSIS: Individuals involved in operations using Iodine-125 or more than 100 mCi of H-3 (other than sealed sources) must have periodic bioassays to determine biological uptake. The exact nature of the bioassay will be determined by the RSO after consultation with the NYSE-DOH. However typically a urine analysis is performed. A urine sample is collected from each person involved, the data recorded by the RPD in charge, and the samples sent to the RSO for analysis. The sample will be counted and the microcuries per liter will be calculated after correcting for counting efficiency. If necessary, the RSO will forward urine samples to a qualified commercial laboratory for analysis. Any necessary reporting required by our license is the responsibility of the RSO.

SECTION 8

WHAT TO DO IN THE CASE OF AN EMERGENCY

"GOOD HOUSEKEEPING" should be maintained at all times. The best procedure for emergencies is to prevent them from happening in the first place. Spillage should be prevented or at worst contained by working in a lipped spill tray. In the event of such accidents the following procedures should be followed. Realize that circumstances may dictate the proper order in which the initial emergency operations will be carried out. The two objectives to bear in mind are (a) protection of personnel and (b) prevention of the spread of contamination. If in doubt, the user should error on the side of caution. It will never hurt to treat a minor spill as more serious than it actually may be.

MINOR SPILLS

If the spill is small less than 0.05 microcuries (2 kBq);

a. The liquid should be blotted up with a paper towel or other absorbent paper. Wear rubber or plastic gloves.

b. All disposable materials contaminated by the spill and cleaning, should be placed in a radioactive disposal trash can or clearly marked plastic bag.

c. Mark the area of the spill and label the type of radioactivity, C-14, H-3, P-32, etc.

d. Report the exact location of the spillage to the Radiation Project Director in charge. Before any work can be started in the area of the spill the Radiation Safety Officer must check the area to see that it is free of contamination.

INTERMEDIATE SPILLS

If the spill is between 0.05 uCi (2 kBq) and up to 1 mCi (37 MBq):

a. The same procedures for the smaller spills will be followed with the exception that the Radiation Safety Officer must be notified immediately. If the RSO is not available, then the chair of the Radiation Safety Committee or a member of the College-wide Emergency Response Team should be notified.

b. Isolate the contaminated area from all unauthorized laboratory personnel. This may involve closing and locking the laboratory door and or taping off a section of the hallway if the spill occurs in the corridor. Spills of this magnitude are easily cleaned up if localized and contained. Coworkers, while their intentions are good, may track the material to uncontaminated areas and increase the magnitude of the problem.

MAJOR SPILLS

For larger spills over 1 mCi (37 MBq):

a. Evacuate the affected lab or area. To ensure that contamination does not spread to other areas, monitor all personnel, especially their footwear, at the exit to the laboratory. Remove contaminated items of clothing and leave them behind in the laboratory.

b. Immediately contact Public Safety. Inform them that there is a radiation emergency and where you can be found to help in understanding the problem. Lock the lab door and post notices to prevent inadvertent entry into the contaminated area.

c. Do not do attempt to clean up the spill. The Radiation Safety Officer and or members of the Emergency Response team will soon arrive to evaluate the situation. Until that time your responsibilities are to prevent exposure to other personnel and, if possible, prevent the spread of the contamination.

RADIOACTIVE SPILL COMBINED WITH A MEDICAL ACCIDENT

a. Medical accidents that also involve radioactivity require special attention. As in any emergency, the saving of human life and prompt treatment of injuries must be accorded first priority. Open wounds are especially dangerous in that they may provide an entry for radioactive substances into the body. Flush thoroughly with water any skin areas that may have become contaminated.

b. In the case of serious injury, do not move the person unless there is a life-threatening situation. Call Public Safety at extension 6666 and give your name, and location. Report that you have a medical emergency that involves radioactivity. Give as much information as possible regarding the nature of the injury, whether the victim is conscious, and advise if an ambulance is needed. Return and remain with the victim until medical personnel and the Radiation Safety Officer have arrived.

RADIOACTIVE ACCIDENTS INVOLVING FIRE

a. Upon discovering a fire, immediately sound the building fire alarm. Next contact Public Safety at extension 6666 and give your name, department, and location of the fire. State that the fire involves radioactivity and that the fire department and Radiation Safety Officer must be informed.

b. Good judgment must prevail when prompt decisions must be made with respect to saving valuable property or equipment. If the fire is small, you may wish to fight it with a fire extinguisher. Any fire-involving radioactivity has the very real possibility of ingesting radioactive smoke or particulates. Do not attempt to extinguish the fire unless you can safely do it without a threat of radioactive contamination to yourself or others.

c. If the fire is very large, very smoky, or rapidly spreading, evacuate the building immediately. Inform others who may or may not have responded to the fire alarm to evaluate also. Public Safety will soon arrive on the scene. You should notify them that the fire involves radioactivity. The firemen and others, who must enter a radioactive laboratory in an emergency, will do so only after donning the approved type of respiratory equipment.

d. Following a fire, the affected area or lab must be locked or barricaded until such time as the Radiation Safety Officer can carry out a radiation and contamination survey.

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