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Hunter College Radiation Safety Program

ALARA program

I. Administrative Commitment.

- A. The Administration of Hunter College is committed to the program described in this paper for keeping individual and collective personnel exposures and all releases of radioactive materials as far below the limits of Article 175 of the New York City Health Code as is reasonably achievable (ALARA). In accordance with this commitment this document describes the administrative organization for radiation protection as well as procedures and instructions, which foster the ALARA concept within the College. This organization includes a Committee on Radiation and a Radiation Safety Officer.
- B. The Administration conducts an Annual Review of the Radiation Safety Program including ALARA considerations. These include reviews of operating procedures, past exposure records, inspections and consultation with the Radiation Safety Officer.
- C. Modifications to operating and maintenance procedures and to equipment facilities are made where they will reduce exposures unless the cost in our judgment is considered to be unjustified.
- D. In addition to maintaining doses to individuals as far below the applicable permissible dose limits as is reasonably achievable the total collective dose received by all exposed individuals will be maintained at the lowest practicable level.

II. Radiation Safety Committee (RSC).

The Radiation Safety Committee, reviews the qualifications of each applicant for each use of radioactive material and reviews the efforts of the applicant to maintain exposures ALARA.

The Radiation Safety Committee delegates authority to the Radiation Safety Officer for oversight of the ALARA concept. The Radiation Safety Committee will support the Radiation Safety Officer in this function.

The Radiation Safety Committee encourages all users to review current procedures and develop new procedures, as appropriate, to implement the ALARA concept.

The Radiation Safety Committee will perform a review of occupational radiation exposure with particular attention to instances where investigational levels are exceeded. The principal purpose of this review will be to assess trends in occupational exposure as an index of the ALARA program quality and to decide when and if action is warranted. The investigational levels are set forth in Attachment 1 (“Occupational Radiation Dose Equivalent Guidelines”).

III. Radiation Safety Officer.

A. The Radiation Safety Officer performs an annual review of the Radiation Safety Program for adherence to ALARA concepts. Reviews of specific procedures are conducted on a more frequent basis.

The Radiation Safety Officer and Environmental Health and Safety reviews at least quarterly the external exposure of authorized users and workers to determine that their exposures are in accordance with the provisions of the Radiation Safety Program as outlined in this document.

B. Educational Responsibilities.

1. The Radiation Safety Officer participates in briefings and educational sessions for all occupational workers to ensure that their exposures are maintained ALARA.
2. The Radiation Safety Officer participates in programs for workers and instructs them regarding the commitment of management and the Radiation Safety Committee to ALARA.

C. Cooperative Effort.

1. The Radiation Safety Officer is in close contact with all users and workers in an attempt to develop and improve allowed procedures for working with radioactive material.
2. The Radiation Safety Officer receives and acts upon requests and suggestions from individual workers for improving health physics practices and encourages these suggestions.
3. The Radiation Safety Officer investigates all known deviations from good, allowed practice and, if possible, determines the cause of these deviations. When these causes have been determined the Radiation Safety Officer will recommend changes in the program, which will maintain exposures ALARA.

IV. Licensees.

1. Licensees consult with and receive the approval of the Radiation Safety Officer during planning stages for any new radioactive material to be used in their laboratories.
2. The licensee will evaluate all procedures before using radioactive materials to ensure that all exposures will be kept ALARA.
3. The licensee is responsible for explaining to his staff the importance of maintaining exposures as low as reasonably achievable and insures that all persons under his supervision are trained and educated in good health physics practices.

V. Occupational Radiation Workers/ Radiation monitoring.

Those persons who are deemed to have the possibility of receiving radiation exposure in excess of the permissible levels for non-occupational workers will be informed of the ALARA concept and its relationship to working procedures and conditions. These workers will be informed as to what resources are available to improve the ALARA program, if such improvement is deemed necessary.

The exposures shall not exceed the occupational radiation dose equivalent limits presented in table 1 under normal conditions, when exceeded will initiate review by the Radiation Safety Officer. The Radiation Safety Officer uses records received from an external processor of the results of personnel monitoring. The following actions may be taken, based upon the investigational levels as stated in the tables.

A. Quarterly exposure to individuals less than Investigational Level 1 will require no action on the part of the Radiation Safety Officer unless it is deemed by the Officer that such an investigation is warranted.

B. Personnel exposures greater than Level 1 but less than Investigational Level 2: The Radiation Safety Officer will review the exposure of each individual whose quarterly exposures equal or exceed Investigational Level 1. Based upon their review, The Radiation Safety Officer may recommend certain actions to the Radiation Safety Committee. Recommendations for action as well as the action requested by the Committee will be recorded in the Committee minutes.

C. Exposures equal to or greater than Investigational Level 2: The Radiation Safety Officer will investigate, where necessary, the causes of personnel exposures exceeding Investigational Level 2 and, if warranted, take action. A report of the investigational actions taken will be presented to the Radiation Safety Committee at the first Committee meeting following completion of the investigation. The details of these reports will be reported in the Committee minutes. These minutes are also available for review by personnel of the New York City Department of Health Bureau for Radiation Control.

D. In cases where a worker or group of workers need to exceed Investigational Level 2, a new higher Investigational Level 2 may be established, based on good ALARA practices for that individual or group. Justification for this level will be documented in the procedures of the Radiation Safety Office.

Hunter College Radiation Safety Program

Radiation Safety Committee

The New York City Department of Health requires that a licensed institution, which names more than one person as individual users, appoint a Radiation Safety Committee.

The Radiation Safety Committee is responsible for:

1. Ensuring that all individuals who work with radioactive material have sufficient training and experience to enable them to perform their duties safely and in accordance with regulations and the conditions of the license.
2. Ensuring that all use of radioactive material is conducted in a safe manner and in accordance with regulations and the conditions of the license.

The Radiation Safety Committee shall:

1. Be familiar with all pertinent New York City Health Department regulations, the terms of the license and information submitted in support of the request for the license and its amendments.
2. Review the training and experience of all individuals who use radioactive materials and determine that their qualifications are sufficient to enable them to perform their duties safely and in accordance with regulations and the conditions of the license.
3. Be responsible for monitoring the College's program to maintain individual and collective exposures as low as reasonably achievable (ALARA).
4. Review semi-annually, with the assistance of the Radiation Safety Officer, Occupational radiation exposure records of those individuals working with radioactive material.
5. Establish a table of investigational levels for occupational radiation exposure, which when exceeded, will initiate an investigation and consideration of action by the Radiation Safety Officer.
6. Review and approve all requests for use of radioactive material within the College.
7. Review the College radiation safety program at least annually to determine that all activities are being conducted safely and in accordance with regulations and the conditions of the license.
8. Recommend remedial action to correct any deficiencies identified in the radiation safety program.
9. Maintain written records of all Committee meetings, actions, recommendations and decisions.

10. Ensure that the radioactive materials license is amended, when necessary, prior to any changes in facilities, equipment, policies, procedures, radioactive material, possession limits and personnel, as specified in the license.

Radiation Safety Committee Meetings:

1. The Radiation Safety Committee shall meet as often as necessary to conduct its business, but not less than once in each semester.

Hunter College Radiation Safety Program

Radiation Safety Officer

Section 175.04 of the New York City Health Code requires that a radiation safety officer (RSO) be appointed to be responsible for the day-to-day operation of the radiation safety program in the College. The RSO or an authorized assistant shall be responsible for:

1. General surveillance over all activities involving radioactive material, including routine monitoring and special surveys of all areas in which radioactive material is used. This will be monitored by the Radiochemistry Research Associate and the RSO.
2. Determining compliance with rules and regulations, license conditions and the conditions of project approval specified by the radiation safety committee.
3. Furnishing consulting services on all aspects of radiation safety to personnel at all levels of responsibility.
4. Distributing and processing personnel monitoring equipment, determining the need for bioassays, keeping personnel exposure and bioassay records, and notifying individuals and their supervisors of exposures approaching maximum permissible amounts and recommending appropriate remedial action. This will be monitored for Environmental Health and Safety.
5. Conducting training programs and instructing personnel in the proper procedures for the use of radioactive material prior to use, at periodic intervals, and as required by procedures, equipment or regulations. This will be monitored by the RSO, the Radiochemistry Research Associate and Environmental Health and Safety.
6. Supervising and coordinating the radioactive waste disposal program, including keeping waste storage and disposal records, and monitoring effluents. This program is supervised by the department of Environmental Health and Safety.
7. The authority to terminate immediately a project that is found to be a threat to health or property. Additionally, the authority to remove authorized users from the Hunter College Radioactive materials license if annual refresher training cannot be documented.

Hunter College Radiation Safety Program

Personnel Training Program

The Radiation Safety Officer or his/her assistant shall establish and conduct a personnel training program for individuals with access to or proximity to ionizing radiation.

Personnel will be instructed:

1. Before assuming duties with, or in the vicinity of radioactive material.
2. Annually as a refresher course (This includes authorized users that do not currently work with ionizing radiation but are currently listed on the license).
3. Whenever there is a significant change in duties, regulations or in the terms of the license.

Instructions for individuals in attendance will include the following subjects:

1. Applicable regulations and license conditions.
2. Areas where radioactive materials are used.
3. Potential hazards associated with radioactive material.
4. Appropriate radiation safety procedures.
5. Each individual's obligation to report unsafe conditions to the Radiation Safety Officer.
6. Appropriate response to emergencies or unsafe conditions.
7. Workers right to be informed of occupational radiation exposure and bioassay results.
8. Locations where licensee has posted or made available notices, copies of pertinent regulations, and copies of pertinent license conditions as required by Section 175.10 of the NYC Health Code.

Records of all personnel training sessions will be maintained for a period of five years and will include:

1. The name of the individual who conducted the training.
2. The names of the individuals who attended the training
3. The dates and duration of the training session.
4. A list of topics covered.

Hunter College Radiation Safety Program

Personnel Monitoring

1. Personnel monitors are routinely supplied to all departments and sections using significant quantities of radioactive materials and/or using radiation producing equipment.
2. The decision as to which personnel require monitors shall be in compliance with the applicable sections of the New York City Health Code, Section 175.05.
3. The decision as to the appropriate type of monitor is that of the Radiation Safety Officer. In general, the following types of monitors are available:

Dosimeter	Code	Beta	Photons		Neutron	
			X	Gamma	Fast	Fast
Luxel+	Pa	Yes	Yes	Yes		
Luxel+	Ja	Yes	Yes	Yes	Yes	
Luxel+	Ta	Yes	Yes	Yes		Yes
Luxel+ Escort	Pa		Yes	Yes		
Ring, Single TLD	U or S	Yes	Yes	Yes		

4. The use of pocket ionization chambers as the primary personnel monitor is not acceptable. The aforementioned could be used along with an official dose record passive type of dosimeter. This is required when the RSO wants to know what the specific exposure is, either cumulative or for the specific activity being monitored is, and does not want to wait until the passive dosimeter is processed.
5. The personnel monitoring number assigned to each employee is unique. The badge should only be used by the person whose name appears on the badge. Numbers are assigned by Radiation Safety personnel during monthly film badge Change periods.
6. Badges are changed Quarterly. The previous quarter's badge should be returned **within 20 days** of the new monitoring period. Distribution of the monitors to the various departments or sections is the responsibility of the Radiation Safety Service staff.
7. Any exposure to the monitor which may result in an erroneous reading should be reported to the service as soon as possible. A new replacement monitor will be issued by Radiation Safety.
8. Report of the results of personnel monitoring evaluations are sent to the Laboratory

Monthly/quarterly. A copy of the report sent will be placed in the service files and permanently maintained.

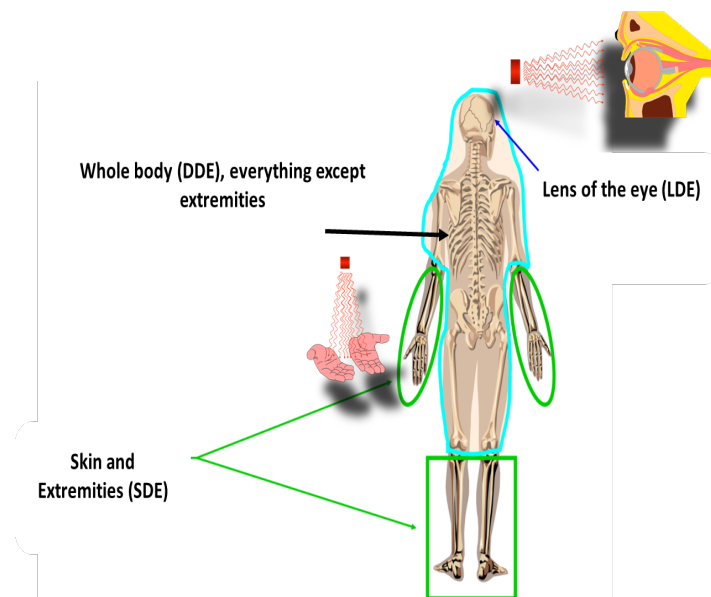
9. It is the right of any employee to consult privately with Radiation Safety personnel about the results of personnel monitoring. Personnel monitoring records are permanently available in the Radiation Safety office.
10. Personnel may also request a yearly report of their cumulative radiation exposure. Such requests must be submitted in writing to the Radiation Safety Office. These reports will be sent to the employee within 30 days of the receipt of the request.
11. All new personnel will be asked to complete a questionnaire about any additional exposure which may be received from employment outside of Hunter College which involves radiation exposure.
12. All new employees must provide the names and addresses of previous employers so that a cumulative record of radiation exposures may be maintained.
13. Radiation Safety personnel will respond to requests from other employers for the cumulative radiation exposure records of previous Hunter College personnel.
14. The supplier chosen for film badge supplies shall be approved by the Hunter College EHS.

Hunter College Radiation Safety Program

Maximum Permissible Dose

Occupational Radiation Dose Equivalent Guidelines

Category	HC Annual Limit		Federal/ State Annual Limit
	Level I (mrem/year)	Level II (mrem/year)	mrem/year
Whole Body	500	1500	5,000
Lens of the eye	1200	4800	15,000
Skin and extremities	7500	22500	50,000
Declared Pregnant Worker	120	160	500
Youth Worker <18	10% of the above Federal/ State, HC and ALARA adult limits		



Hunter College Radiation Safety Program

Guidelines for ALL Users of Radioactive Materials at Hunter College

This document presents the guidelines for all persons using radioactive materials. Adherence to these rules is strictly required. These guidelines represent minimum standards of good practice required of all licensees and persons working with radioactive materials

1. Mouth pipetting is never permitted. Remote pipettes, syringes or other pipetting aids are to be used.
2. Eating or smoking in any laboratory using radioactive materials is never permitted.
3. Storage of food in refrigerators is prohibited.
4. Gloves are to be worn at all times when working with radioactive materials. Gloves are to be removed immediately after working with radioactive materials and hands should be checked for any contamination.
5. Hands should be washed thoroughly before leaving the laboratory.
6. Any item contaminated with radioactive materials should be placed in the containers provided and be labeled with "radioactive materials" signs.
7. Radioactive materials are to be transported in a manner that prevents spillage or breakage. When liquids are in a glass container, the container should be kept within a second non- breakable vessel. This vessel should be large enough to contain all of the liquid from the glass container.
8. All bench tops are to be covered with an absorbent covering or work should be done within a tray that will contain any spills.
9. All work with volatile compounds is to be done in an appropriate hood.
10. The door to the laboratory, work and storage areas is to be posted with the appropriate "radiation precaution" signs. These signs are available from commercial suppliers or may be obtained from the Safety office
11. In the case of emergency, contact Environmental Health and Safety, Ext. 4462. During off hours or weekends call Security 772-4444.

RSO must be informed before 10 days about any receiving radioactive material shipment. When a package containing radioactive material is opened, a check is to be made to determine if there is any physical damage to the package, contamination of the packing material or the vial in which the material is contained.

12. A secure area is to be provided within the laboratory for storage of radioactive materials, which provides sufficient shielding to maintain exposure levels ALARA, and which prevents release of the material.
15. All laboratories containing radioactive materials are to be locked when authorized personnel are not present.
16. All containers that no longer contain radioactive material are to be checked for contamination before disposal. If free of contamination, signs are to be defaced before disposal.
17. Laboratories using high energy beta or gamma radiation are to have a survey meter available. This survey meter is to be calibrated yearly.
18. Emergency procedures are to be posted in each laboratory. It is the responsibility of the licensee/laboratory head to see that employees are familiar with these procedures.
19. The "Notice to Employees" document of the New York City Department of Health is to be posted in every laboratory.
20. Contamination checks of all working areas are to be performed at least monthly. The results must be kept on record in the lab and a copy of the results must be sent to the RSO.
21. If personnel monitors are provided to the laboratory, they are to be worn at all times in the laboratory. Personnel monitors are to be stored in an area where radiation is not present. Personnel monitors are to be returned on a timely basis.
22. Persons under the age of 18 are not to be employed to work with radioactive materials.
23. Any female employee who is pregnant or thinks she may be pregnant should contact the Radiation Safety Office for instructions about continuing work with radioactive materials and modification of her work situation if necessary. Workers who have declared their pregnancy in writing will be issued an extra dosimeter for fetal monitoring.
24. Inventory records of radioactive materials are to be maintained in the laboratory on the forms provided. These records are to include each receipt, use, transfer or disposal of radioactive material.
25. The amount of radioactive materials stored in the laboratory cannot exceed the maximum possession amount shown on the license.
26. Any accidental introduction of radioactive material into the body, e.g. ingestion, contaminated wounds, or injection, must be reported immediately to the Radiation Safety Officer and Environmental Health and Safety, Ext. 4462.

Hunter College Radiation Safety Program

EMERGENCY PROCEDURES

All laboratory personnel should read these procedures prior to commencing work

There are two types of spills that requires a different response at Hunter College.

A. **MINOR SPILLS.** The spill doesn't present an immediate health hazard or risk of widespread contamination

1. Notify all other persons in the room.
2. Restrict number of persons in the spill area.
3. Confine spill immediately.

Liquid Spills (see detailed cleanup instructions)

- a. Wear appropriate gloves and booties / shoe covers.
- b. Drop absorbent paper on spill.

Dry Spills

- a. Wear appropriate gloves and booties / shoe covers.
- b. Place damp absorbent paper over spill. Take care not to spread contamination.
- c. Decontaminate as necessary.
- d. Permit no person to resume work in the area until a survey has been made.

B. MAJOR SPILLS. This presents an immediate health hazard or widespread contamination. This requires RSO assistance.

1. Notify all persons to vacate the room at once.
2. If a liquid spills, right the container (have hands protected with gloves).
3. If spill is on skin, flush thoroughly.
4. If spill is on clothing remove at once.
5. Turn off all fans or ventilation, if possible.

6. Leave the room.
7. Notify Radiation Safety through the Environmental Health and Safety Ext. 4462
8. Decontaminate personnel involved as per Radiation Safety instructions.
9. Decontaminate area as per Radiation Safety instructions.
10. All persons involved must be monitored.
11. Permit no person to resume work in the area until a survey by Radiation Protection is made.

C. RADIOACTIVE DUSTS, MISTS, FUMES, GASES, ETC.

1. Notify other persons to vacate room.
2. Hold breath, close valves, turn off air-circulating devices, as time permits.
3. Vacate room.
4. Close all doors - post area.
5. Notify Radiation Safety through the Environmental Health and Safety Office, Ext. 4462
6. Report suspected inhalations of radioactive material.
7. Detain all persons suspected of being contaminated.
8. Decontaminate as instructed by Radiation Safety.
9. An air survey must be performed before work can be resumed.

D. INJURIES INVOLVING RADIATION HAZARDS

1. Wash minor wounds immediately, under running water, spreading edges of wound.
2. Notify Radiation Safety through the Environmental Health and Safety Dept, Ext. 4462
3. Have employee proceed to Radiation Protection or a Health Service.
4. In the case of traumatic injury, contact the Emergency Medical Services

E. FIRES INVOLVING POSSIBLE RADIATION HAZARDS

1. Sound alarm.
2. Call operator and report location.
3. Notify Radiation Safety through the Environmental Health and Safety Dept, Ext. 4462
4. Close all doors & windows.
5. Extinguish the fire, if possible.
6. Decontaminate may be necessary before work is resumed in the area.

PERSONNEL DECONTAMINATION

- Contaminated clothing should be removed and stored for further evaluation by the Radiation Safety Officer.
- If the spill is on the skin, flush thoroughly with lukewarm water and then wash with a mild soap.
- If contamination remains, induce perspiration by covering the area with plastic.
Wash the affected area again to remove any contamination that was released by perspiration

Hunter College Radiation Safety Program

Pregnant Employees and Radiation

Hunter College has adopted the policy of maintaining the dose of ionizing radiation to the fetus at less than 500 mrem during the gestation period. The College has further defined that this dose should be received at a dose rate of less than 120 mrem/year. These recommendations are in lower and in accord with the recommendations in Report Number 91 of the National Council on Radiation Safety and Measurements (NCRP).

If an employee works in an area where the anticipated dose is less than 120 mrem to the fetus over the gestation period, the employee can continue to work without further restrictions. However, the radiation safety officer may make certain recommendations regarding the work assignment of the employee to further reduce the dose to the fetus, particularly during the first trimester.

Employees are asked to inform the RSO in writings soon as the employee believes she may be pregnant. This information will be held confidential at the request of the employee.

Based on past experience, there are relatively few areas identified in Hunter College which would be considered likely to result in a dose to the fetus exceeding 120 mrem, provided established radiation safety procedures are followed. If a situation is identified in which the dose to the fetus over the gestation period would be over 120 mrem, there are three alternatives possible:

- 1) The employee may be assigned to another area involving less exposure to ionizing radiation.
- 2) The employee may continue to work in the area with certain restrictions to limit dose to the fetus to less than 120 mrem (based on recommendations of the radiation protection officer). In nearly all cases, the work environment will require slight modifications to ensure that the dose to the fetus does not exceed 120 mrem.
- 3) If the employee is unwilling to accept this level of radiation exposure, the employee may request reassignment to an area involving less exposure to ionizing radiation. Hunter College will make a good faith effort to accommodate the request in accordance with the general policy

for reassignments. Any reassignment may possibly result in a change of work hours and pay. If it is not possible or practicable to grant the request of the employee after a good faith effort has been made, the employee may be laid-off or placed on a leave of absence in accordance with the College's general policies.

Individuals who are pregnant are not prohibited from working in or frequenting radiation areas. During pregnancy, the employee is expected to perform her duties within the restrictions applied by the radiation safety officer. The employee is encouraged to monitor her exposure by means of checks on the personnel monitoring reports distributed to the various departments. The employee is always free to discuss these reports with radiation protection personnel.

Report No. 53, "Review of NCRP Radiation Dose Limit for Embryo and Fetus in Occupationally Exposed Women" of the National Council on Radiation Protection and Measurements will be made available to any employee who requests further information.

Hunter College Radiation Safety Program

Procedure for Medical Follow-Up of Radiation Exposure

This procedure is intended to provide a guideline for the medical evaluation of radiation exposures to employees. It is highly unlikely that employees will receive doses of radiation in excess of the occupational guidelines; however, in such cases, this guideline does not fully address all aspects of follow-up medical care. It is intended to assist in the evaluation of the doses received and possible actions to be taken in the short term by the physician. This policy excludes all routine radiation exposure to personnel received during their employment as a result of exposure to radioactive materials and radiation producing equipment.

IN ALL RADIATION ACCIDENTS, THE FIRST STEP SHOULD BE TO NOTIFY THE RADIATION SAFETY SERVICE, EXT. 4462, SO THAT PROPER EVALUATION OF THE PERSONNEL EXPOSURE CAN BE INSTITUTED. AFTER HOURS, CALL THE HUNTER COLLEGE OPERATOR AND ASK FOR RADIATION SAFETY ASSISTANCE.

An incident report must be filed in all cases and an evaluation must be done by The Public Safety Office. Cases involving traumatic injury should be brought to the Emergency Room at a local hospital. Based on the circumstances of the accident, it is possible that the employee may be contaminated with radioactive materials as well as exposed to radiation. Treatment of traumatic injury should take precedence over all considerations of contamination. The Emergency Room should be notified, in advance if possible, that the employee may have radiation exposure and/or contamination in addition to trauma so that they can institute their radiation emergency plan.

The following categories of conditions may exist:

1. Known or suspected radiation exposure - Dose unknown

An immediate baseline blood count shall be ordered and preferably obtained within 2 hours of exposure. The personnel monitor of the individual shall be sent for emergency monitoring. Based on the history of incident, Radiation Protection personnel shall make an evaluation of the possible dose received.

2. Known or suspected radiation exposure below 100 mrad.

No action is warranted.

3. Known or suspected radiation exposure between 100 mrad and 1000 mrad of penetrating radiation:

Blood counts may be repeated in three weeks, if, in the judgment of the physician, they are warranted.

4. Known or suspected radiation exposure between 1000 mrad and 25 rad of penetrating radiation:

Proceed as in section 3 above; however, a longer follow-up may be indicated.

5. Known or suspected radiation exposure to greater than 25 rad and less than 100 rad of penetrating radiation:

Blood counts should be performed at days 1, 3, 5 and 7 following exposure. It is possible for an area of local radiation exposure to exist which may require special care. In this range of exposure, chromosome analysis may be of benefit in documenting any radiation injury and in assessing the dose received. The physician should decide, based on symptomatology, whether the patient may require hospitalization for observation. Any evidence of prompt vomiting or diarrhea should be taken as evidence that a higher dose level may have been received and the patient should be hospitalized for observation.

6. Known or suspected exposures above 100 rad:

An immediate emergency blood count should be ordered. The patient must be hospitalized for evaluation. Doses in this range require expert medical evaluation. One of the designated "radiation emergency physicians" should be consulted immediately for assistance. Chromosome analysis should be performed as stated above. In the case of doses approaching the LD₅₀ range, viz. 200-400 rad of penetrating radiation to the whole body, consideration should be given to possible infectious processes which would adversely affect survival.

7. Contamination of the employee:

Each of the cases described above may be accompanied by contamination of the employee by radioactive materials that may be on his/her person or clothing. It is important to obtain as much information as possible on the type of radioactive material which may have been involved in the incident. Decontamination usually will require expert evaluation. The employee's exterior clothing, including shoes, should be removed and held in a plastic bag for checks by Radiation Safety. The employee should be provided with hospital gowns and held for evaluation unless the treatment of traumatic injury dictates otherwise.

It may be that the contamination of the employee is confined to one body area; however, unless this is known with certainty in advance, it should be assumed that the contamination is more widespread until shown otherwise.

Hunter College Radiation Safety Program

LABORATORY SURVEYS

A laboratory survey is conducted at least yearly by the Radiation Safety Officer in each laboratory in which radioactive materials are used. This survey is in addition to the surveys required monthly of each licensee. This survey will include, but is not limited to:

- a) inspection of inventory records;
- b) inspection of records of contamination checks;
- c) checks of posting of N.Y.C. or N.Y.S. notices;
- d) posting of emergency procedures;
- e) inspection of safe practices in the laboratory;
- f) calibration of survey meter, if appropriate;
- g) use of radioactive materials stickers in correct locations;
- h) adequate training of laboratory staff.

The survey will also ascertain if the list of users under the license is current. He will compare the use of radioactive materials in the laboratory with the amounts on the license and recommend that the license be amended if necessary. He will also interview laboratory personnel to ensure that they are aware of safety precautions to be followed in their area.

Hunter College Radiation Safety Program

Area Surveys

1. Laboratory areas where radioactive materials are used will be surveyed by laboratory personnel on a monthly basis.
2. Waste storage areas will be surveyed by the RSO or a designated assistant on a monthly basis.
3. These surveys will consist of:
 - a. A measurement of radiation levels with an appropriate survey meter with a sensitivity to detect 0.1 mR/hr.
 - b. A series of wipe tests to measure contamination levels. The method for performing wipe tests will be sensitive enough to detect 100 dpm/100 cm² for the contaminant involved.
 - c. Laboratory areas and all adjacent areas where radioactive materials are used or stored shall be monitored with a survey meter to ensure that radiation levels are acceptable and in compliance with regulations for each area.
4. A permanent record of all survey results, including negative results. The record will include:
 - a. Location, date and identification of equipment used.
 - b. Name of person conducting the survey.
 - c. Identification of area surveyed by each wipe.
 - d. Measured exposure rates for each wipe.
 - e. Detected contamination levels.
5. The area will be cleaned if the contamination level exceeds 100 dpm/100 cm².

Hunter College Radiation Safety program

Sealed source leak testing

1. Prepare a separate wipe sample for each source. A cotton swab, injection prep pad, filter paper or tissue paper is suitable.
2. For small sealed sources, wipe the entire accessible surface area, paying attention to seams and joints.
3. For larger sealed sources and devices, wipe near the radiation port and on the activating mechanism.
4. If you are testing radium sources they should also be checked for radon leakage. This can be done by submerging the source in a vial of fine grained charcoal or cotton for 24 hours. Remove the source and analyze the adsorbent material as described below.

Sample analysis:

1. Select a suitable detector that is sufficiently sensitive to detect 0.005 microcuries. For beta sources, a liquid scintillation counter or thin-end-window GM survey meter may be appropriate.
2. Assay a check source that has the same isotope as the sealed source and whose activity is certified by the supplier or use a certified source with a similar spectrum in order to estimate the detection efficiency of the analyzer used to assay the wipe samples.
3. Assay the wipe sample with the same geometry relative to the detector as was the certified check source.
4. Calculate the estimated activity in microcuries on the wipe sample.
5. Continue the same analysis procedure for all wipe samples.
6. If the wipe sample activity is 0.005 microcuries or greater, notify the Radiation Safety Officer. The source must be withdrawn from use to be repaired or disposed.
7. Record the wipe sample results on the list of sources, sign and date the list.

Posting of Notices to Employees

The attached "**Notice to Employees**" from the New York City Department of Health Bureau for Radiation Control is to be posted in all areas where radioactive materials are used and in an area where it can be viewed by staff. These postings will follow the guidelines required by the New York City Health Code. Verification of the posting shall be part of routine laboratory surveys. (Attachment 4)

Laboratory postings

The door to each laboratory, storage area, refrigerator or hood in which radioactive materials are in use or in storage shall bear the sign: "**Caution - Radioactive Materials**" in the standard colors and with the standard radiation symbol.

Hunter College Radiation Safety Program

Procedure for ordering and accepting delivery of radioactive material

To insure the control of all ordering and receipt of radioactive material:

1. When radioactive orders are placed, the laboratory head must fill out and forward the Radioactive Materials Form (Attachment 2) based on Hunter College's Standard Operating Procedures (Attachment 3) to notify the Radiation Safety Officer of any radioactive material order or delivery.
2. A system of ordering and receiving radioactive materials will be established and maintained. The system will consist minimally of the following:
 - a. Written records will be used that identify the isotope, compound, activity levels and supplier.
 - b. The written records will be referenced when opening or storing radioactive materials.
 - c. It is essential that written records be maintained for all ordering and receipt procedures.
3. During normal working hours, carriers will be instructed to deliver radioactive materials directly to each laboratory.
4. During off duty hours, security personnel will not accept delivery of radioactive packages, and carriers will be instructed to return at an appropriate date and time.

Procedure for opening packages containing radioactive material

For all packages, the following procedures for opening packages will be carried out:

1. Gloves will be worn to prevent hand contamination.
2. Package will be visually inspected for any signs of damage or dampness.
3. The outer package is to be opened and the packing slip removed.
4. The inner package is to be opened and the contents verified to be in agreement with the packing slip.
5. The integrity of the final source container is to be checked for:
 - a. broken seals.
 - b. loss of liquid.
 - c. discoloration of the package material.

If contamination is suspected:

1. A wipe test of the external surface of the final source container is to be done.
2. An assay of the wipe is to be performed with an appropriate survey meter and the amount of removable activity is to be recorded (i.e., dpm/100 cm², etc).
3. Precautions must be taken to contain the spread of contamination.
4. Monitor the packing materials and packages for contamination before discarding
 - a. if contaminated, treat as radioactive waste.
 - b. if not contaminated, obliterate radiation labels before discarding in regular trash.
5. Maintain a record of each package check with the receipt records.

Hunter College Radiation Safety Program

Hood Survey

DATE _____

TO _____ DEPT. _____

FROM Radiation Safety Service DEPT. Environmental Health

SUBJECT Radioactive Hood Airflow Check

The hood airflow in Room _____ was checked by
_____ of the Radiation Safety Service, on
_____. The minimum requirement is 80
linear fps for isotope hoods.

Our readings were:

Hood #1: _____ ft./minute

Hood #2: _____

Hood #3: _____

Hood #4: _____

The airflow is adequate _____ Inadequate for isotope work _____

If airflow is inadequate, please notify this Service in writing within 30 days of corrective action taken.

Recommendations:

- a. Hood window should be closed way below user's face level (as low as practicable) during procedure.
- b. Remove all unnecessary materials from hood that cause a reduction in airflow.
- c. Keep hood windows closed all the way down when not in use.

Hunter College Radiation Safety Program

Low Level Radioactive Waste Disposal

There are four commonly used methods of waste disposal: release to the environment through the sanitary sewer system, decay in storage (DIS), transfer to a burial site, and release to in house waste.

General Guidance

1. All radioactive labels must be defaced or removed from containers and packages that no longer contain radioactive material before disposal as in-house waste.
2. Non-radioactive waste such as leftover reagents, boxes and packing material should not be mixed with radioactive waste.
3. Review all new procedures to ensure that waste is handled in a manner consistent with established procedures.
4. Consider the entire impact of various available disposal routes. Consider occupational and public exposure to radiation, other hazards associated with the material and routes of disposal, and the expense.

Disposal of liquids and gas

Liquids may be disposed of by release to the sanitary sewer system by Radiation Safety.

1. Regulations for disposal in the sanitary sewer system appear in Section 175.109 of the New York City Health Code. Material must be readily soluble in water. A record must be made of the date, radionuclide, estimated activity that was released, and of the sink at which the material was released.

Disposal by Decay in Storage

Short lived materials (physical half life less than 120 days), may be disposed of by DIS. Material will be separated according to half-life and labeled with a tag that shows the date that the container was sealed and the longest-lived radionuclide in the container. The daughter radionuclide must be stable and not radioactive.

1. The material must be decayed for at least ten half lives.
2. Monitor all surfaces of each container.
3. Discard as in house waste only those containers that cannot be distinguished from background. Check to be sure that all radiation labels have been removed or obliterated.

4. Containers that can be distinguished from background radiation levels must be returned to the storage area for further decay or transferred for burial.

Transfer for Burial

Hunter College packages radioactive waste for transportation to approved disposal sites. The packaging and transportation of this waste must meet the requirements of :

- a) New York City Health Code, Article 175
- b) New York State Department of Energy
- c) New York State Department of Environmental Conservation, Part 38
- d) United States Department of Transportation, Title 49
- e) United States Nuclear Regulatory Commission, Title 10, Part 61
- f) **State of Washington regulations**
- g) **State of South Carolina regulations**

The cost to Hunter College for disposal of radioactive waste is significant and can be expected to increase. It is important that the waste placed in drums for disposal as radioactive waste is indeed contaminated. Radioactive waste drums should not be used for disposal of general trash or waste that is not contaminated.

The drum used for waste disposal will have on it the standard magenta and yellow sign bearing the words, "Caution - Radioactive Materials" and the standard radiation symbol. Care should be exercised that housekeeping personnel do not accidentally empty these drums. These drums should be kept in a discrete area and housekeeping staff informed about their location and meaning of the signs. This information is to be given by the individual laboratories in addition to the information supplied by Radiation Protection staff.

Drums in various sizes are kept by Radiation Safety in which radioactive waste materials are stored. Storage of drums in corridors is strictly forbidden. All drums must be maintained within a secure space. Waste is segregated into various types. The following general regulations govern these types:

1. Liquid scintillation vials (LSV)

Vials must be intact with the top of the vial in place. LSV waste cannot be mixed with any other form of waste. Cards on the top of the drums are to be marked "LSV". The licensee is to identify to radiation protection staff the nature of the liquid scintillating material. Vials containing only H-3 and C-14 are to be segregated from other vials in separate drums. No radioactive materials other than H-3 and C-14 are to be added to these drums.

2. Dry Waste

No liquid is allowed in these drums. Tags on the drum should be marked "dry". Examples of dry waste include syringes, test tubes, pipettes, centrifuge tubes, wet paper, etc.

3. Solidified Liquids

Poly jugs containing cement mixtures are available for solidification of free liquid. These jugs will hold about 1500 ml. of free liquid. The pH of the liquid should be neutral so that the jug will not be deformed by the addition of liquid. Only approved solidification materials are to be used in these jugs.

4. Solid Packs

A drum called a solid pack is supplied where a large amount of free liquid is used. This drum will hold up to 12 gallons of free liquid.

Each drum supplied has a tag affixed to the drum. Disposal into the drum must be accompanied by completion of the tag. Drums for which the information requested on the tag is incomplete will not be collected.

No waste will be accepted if the packaging requirements listed above are not met. All drums are inspected prior to collection. Drums not meeting the criteria above must be re-packed by laboratory staff.

Each drum is checked for surface contamination prior to delivery to the waste broker. Drums collected from laboratories and found to be contaminated will be returned to the laboratory generating the waste for decontamination.

Hunter College views its responsibility regarding the generation and disposal of radioactive waste in the most serious terms. Violations of the criteria governing waste disposal may lead to revocation of the license of the laboratory.

Hunter College Radiation Safety Program

Low Level Radioactive Waste Disposal (Specific Guidelines)

All radioactive waste must be brought to room 928 North for disposal at the following times:

****By appointment only****

1. All radioactive labels must be defaced or removed from containers and packages that are no longer radioactive before disposal as in-house waste.
2. Non-radioactive waste such as leftover reagents, boxes and packing material should not be mixed with radioactive waste.
3. Review all new procedures to ensure that waste is handled in a manner consistent with established procedures.

Radioactive waste must be segregated by:

1. Radionuclide (i.e. H-3, P-32, C-14 etc.)
2. Form
 - dry waste
 - liquid waste
 - liquid scintillation vials (LSV). Vials must be intact with the top of the vial in place. LSV waste cannot be mixed with any other form of waste. Vials containing only H-3 and C-14 are to be segregated from other vials

Hunter College views its responsibility regarding the generation and disposal of radioactive waste in the most serious terms. Violations of the criteria governing waste disposal may lead to revocation of the license of the laboratory.

Hunter College Radiation Safety Program

Management of Animals Containing Radioactive Material

Prior to beginning work with radioactive material in animals, laboratory supervisors must obtain approval from the Institutional Animal Care and Use Committee (IACUC) and the Radiation Safety Committee. Radioactive animals can only be housed in areas approved by IACUC.

All hands-on care of animals containing radioactive material must be provided by the laboratory research personnel performing this research. These researchers must have training in the general use of radioactive material by the Environmental Health and Safety Office and specific training related to radioactive animal care by the laboratory's radioactive materials supervisor. This training must include specific instructions requiring the laboratory staff to:

- perform all feeding and cleaning of animals;
- perform regular contamination surveys to prevent the spread of contamination, and to ensure that radiation levels are maintained as low as reasonably achievable;
- clean and decontaminate cages and facilities;
- autoclave all paper and plastic animal-contaminated waste prior to placing this material in Radiation Protection Office radioactive waste containers;
- place radioactive animals, animal waste and animal tissue into zip-lock plastic bags. The bags must be indelibly labeled with "Caution—Radioactive Material", and with the radionuclide, activity, date, supervisor's name and the mass of the contents. To facilitate storage, this radioactive waste must then be frozen in the smallest practical container.

A personnel monitoring badge provided by the radiation safety office must be worn when working with radionuclides other than H-3. A ring badge will be issued when working with P-32. Gloves must be worn when working with radionuclides or radioactive animals.

Cages

Any cage that houses animals containing radioactive materials must bear a label displaying:

- the radioactive symbol
- the name of the radionuclide
- the activity administered per animal
- the date of administration
- the name of the authorized user
- a contact phone number in cases of emergencies

The *research* staff must perform all cage changes according to the required change schedule. All cages are appropriately wipe tested and decontaminated by the *research* staff before being reused.

Excreta

Liquid excreta must be absorbed or solidified prior to disposal as radioactive waste. Absorbent pads, and other wastes associated with the experiment should be segregated, clearly labeled and refrigerated until disposal as radioactive waste. All cages used to house radioactive animals must be decontaminated.

Carcasses

Animal carcasses and tissues containing radioactive materials must be handled and disposed of as radioactive.

Carcasses and tissues should be placed in a yellow radioactive waste bag with a completed radioactive waste tag attached and clearly identified as "animals" or "biohazardous waste."

The bags are to be maintained frozen and kept in locations approved by the Radiation Safety Office.

Area Requirements

Prior to administering radionuclides to animals, the work surface should be covered with plastic backed absorbent paper to contain spills.

Sharps are placed in sage containers, labeled as "Radioactive", located in the room. Filled sage containers must be brought to Radiation Safety for disposal.

Wipe tests must be performed at least monthly in areas where radioactive materials are stored, and weekly in areas where radioactive animal areas are housed. Records of all area surveys must be kept by the investigator.

The door to the laboratory as well as work and storage areas must be posted with the appropriate caution sign.

Waste Disposal

Disposal of all radioactive animal carcasses will be arranged through the Radiation Safety Office in the Department of Environmental Health and Safety at Hunter College. A licensed commercial waste vendor will be used to collect and transport this waste.

Hunter College Radiation Safety Program

Alpha Radiation Safety

The alpha radiation safety program at Hunter College is to ensure the safety of the workers those manipulating alpha radionuclides emitters and the work place in compliance with applicable regulatory requirements. As its mentioned in page 7, the Radiation Safety Officer (RSO) and Environmental Health and Safety will be directly responsible for the safety programs. This program includes: licensing, personal training, laboratories safety audits and radiation surveys, calibration and maintenance of radiation survey meters and radioactive wastes managements. The regulation in this program will be applied for the alpha radionuclides emitters especially the artificial transuranium nuclides.

Restricted areas: The manipulation of the alpha emitter should be performed in a radiation secured area where the individual could receive less than 2 mR/hour. The area should be controlled by locked doors and posted with a radiation caution sign.

Personal training program: the program (page 7) will be extended to include the training on manipulation, handling, taking PPE, survey and monitoring of alpha radionuclides emitter. The worker must pass the radiation safety training and must take a refresher each year.

Radiation Survey, manipulation and shielding: Most of the radionuclides emits beta or gamma in addition to alpha particles. The survey will be performed by using LB124 SCINT contamination monitor which can measure alpha, beta and gamma. The LB124 SCINT must be in operation during any alpha manipulation or handling. To ensure the absence of any possible contamination, assessment and monitoring of the radionuclides at the end of each experiment should be performed. This could be done by using wipe test and liquid scintillation counter.

The radioactivity of all nuclides in different stock, intermediate and experimental radioactive solutions / sources will be counted using instruments listed below. The exposure dose from the latter will be monitored periodically using RO 20 ion chamber survey meter to determine the appropriate shielding. Thus we will minimize and eliminate any possible radiation exposure. Appropriate shielding of lead or Plexiglass will be used based on the radiation nature (alpha, beta or gamma) and level. Before each exist, hand and foot monitoring must be applied using the counter presented in the intermediate buffer zone.

During manipulation, personal protection equipment's including Booties, lab coats, goggles, gloves and Sleeves must be applied. ALARA "as low as reasonably achievable" is a regulatory requirement that will be followed by the worker to minimize the external radiation exposure. The practicing of good hygiene, controlling of contamination, airborne hazards and uses of proper PPE will eliminate any internal radiation exposure. The ionizing radiation exposure monitoring for worker during manipulating radioactive materials will be measured using thermoluminescent dosimeter (TLD) body and rings badges. An investigated experimental safety plan will be prepared before exposure to any unsealed radioactive source. The absorption dose will be calculated prior to the manipulation using RO 20 AA and the time planed for the exposure. Shielding will be applied to eliminate the radiation exposure.

Radioactive wastes management: The radioactive wastes will be separated and segregated based on their half-life range, physical, and chemical medium composition. These can be stored in the appropriate drums in the radioactive waste storage room at Hunter College where the radioactive waste from all of the labs conducting research with radioactive materials is stored. The radioactive waste can be shipped for disposal by our radioactive waste contractor.