Albert Einstein College of Medicine

Radiation Safety Manual

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I. Purpose

Essential elements of the College's Radiation Safety Program are presented in this Radiation Safety Manual. The Safety Program has been created to assist radiation users to work with radiation sources in a manner that meets their safety responsibilities in as efficient and unintrusive manner as possible.

Radiation safety philosophy and regulatory requirements focus on the objective of ensuring that all radiation exposures are to be reduced to levels that are as far below regulatory limits as can reasonably be achieved. Albert Einstein College of Medicine ("Einstein" or "College") strongly supports this "As Low As Reasonably Achievable" (ALARA) safety goal. The policies and procedures found in this manual were designed to promote and achieve this goal.

Einstein is authorized by New York City's Office of Radiological Health to use radioactive material in education, research, and development activities. The College's Radiation Safety Committee authorizes individuals to possess and use radioactive material. Prospective users must submit an application to use radioactive material to the Radiation Safety Officer for review and consideration of approval by the Radiation Safety Committee. If approved, the user must abide by all regulations pertaining to the use of radioactive material set forth by the City of New York, the Nuclear Regulatory Commission, and Einstein.

This Safety Manual provides the basics of radiation safety and points of information required for all Einstein faculty, staff, and students as well as incubator laboratories renting space at Einstein who may work with or come into contact with radiation.

II. Scope

The procedures outlined herein apply to all Einstein faculty, staff, students, and incubator laboratories.

III. Procedure

III.A. Responsibilities

Einstein is committed to providing a healthful and safe work environment for all employees, students, and visitors. Einstein established the Environmental Health and Safety (EH&S) Department and faculty committees to provide a healthful and safe work environment. Einstein delegates to EH&S, the Radiation Safety Officer (RSO), and the Radiation Safety Committee (RSC) the task of implementing and maintaining an appropriate radiation safety program that ensures licensed activities involving radiation are conducted properly. The Radiation Safety Committee represents management when reviewing licensed activities. Any problems relating to radiation safety which the Committee cannot address are referred to upper management.

III.A.1. Radiation Safety Committee

The RSC is responsible for establishing policies governing the procurement, use, storage and disposal of radioactive material and radiation producing devices. The Committee includes individuals experienced in the use of radioactive material in research at the College. The Committee consists of a Chairperson, RSO, representatives of management and Principal Investigators (PIs) knowledgeable in the use of radioactive material.

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The Committee will:

1. Meet as often as necessary to conduct business, but no less than quarterly.
2. Conduct periodic reviews and audits of the Radiation Safety Program and devote sufficient time, to review quarterly compliance inspections of authorized laboratories, reports from the RSO, results of The New York Office of Radiological Health inspections and written safety procedures. Examples of program reviews include, but are not limited to, the following:
   - Establish procedures to ensure compliance with the rules and regulations for Radiation Safety and recommend corrective actions for problems.
   - Periodic review of protocol or user permits issued by the RSC (e.g., review of each permit at three-year intervals).
   - Review of letters of agreement with offsite emergency response agencies.
   - Review of procedures for controlling and maintaining inventories, procurement of radioactive material, individual user and institutional cumulative possession limits, transfer of radioactive materials within the institution, and transfer of radioactive material to other persons or licensees.
   - Review of audit findings (of RSC-approved users and facilities) by the radiation safety office staff.
   - Conduct radiation safety evaluations of proposed users and uses.
   - Develop procedures and criteria for annual training and testing each category of worker.
   - Establish methods for maintaining records of the committee's proceedings and radiation safety evaluations of proposed users and uses of radioactive materials.

III.A.2. Radiation Safety Officer

Einstein makes, through EH&S, the RSO responsible for the day-to-day activities of the Radiation Protection Program established by the RSC. The RSO communicates with the RSC and senior management regarding program implementation and compliance status and is available to provide advice and assistance on all radiological safety matters. The RSO reports directly to the Associate Vice President of the EH&S Department.

The RSO is responsible for radiation protection at the College. This includes the general surveillance of all activities involving radioactive material and all areas where materials are used. Other responsibilities include ensuring compliance with activities that are associated with New York City regulations and license conditions. The Radiation Safety staff provide a wide range of radiation protection services such as personnel monitoring, waste disposal, maintenance of required records, and consultation on the safe use of radioactive materials.

All applications for internal radioactive material licenses and license amendments including changes in location, procedures, and possession limits, are reviewed by the RSO. The RSO submits applications to the RSC for its consideration of approval. The RSO may approve amendments to existing authorizations for the Radiation Safety Committee. Any projects that are found to be a threat to health or property may be immediately suspended by the RSO.

Other responsibilities include the investigation of over exposures, accidents, spills, loss or thefts, unauthorized receipt or transfer, disposal, and any other deviation from approved radiation safety practice.

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The RSO is also responsible for implementing all written policies and procedures relating to radiation safety and implementing corrective actions as necessary.

The RSO will:

1. Maintain surveillance of all activities involving the use of radioactive material (i.e., monitoring and surveying all areas in which radioactive materials are used).
2. Regulate compliance activities that support the rules, regulations and license conditions authorized by the City of New York.
3. Monitor and maintain the use, storage and disposal of radioactive material.
4. Provide necessary information on all aspects of radiation protection to personnel at all levels of responsibility.
5. Oversee the proper delivery and receipt of all shipments of radioactive material arriving to or leaving from the institution.
6. Distribute and process of personnel radiation monitoring equipment.
7. Determine the need for and conducting of bioassays, monitor personnel radiation exposure for trends or high exposures, question individuals and their supervisors about radiation exposures approaching maximum permissible amounts and recommended appropriate remedial action.
8. Conduct training programs and otherwise instruct personnel in the proper procedures of working with radioactive material. Provide refresher training and make changes in procedures and equipment as required.
9. Supervise and coordinate the radioactive waste program, including effluent monitoring and record keeping of waste storage and disposal records.
10. Provide for the storage of radioactive materials that are not in current use.
11. Perform, or arrange for, leak tests on all sealed sources.
12. Ensure the timely calibration of all radiation survey instruments.
13. Maintain an inventory of all radioisotopes at the institution and limit the quantity of radionuclides to the amounts authorized by the license.
14. Immediately suspend any activity that is found to be a threat to public health, safety, or property.
15. Supervise decontamination and recovery operations.
16. Maintain additional records not specifically addressed above, i.e. records on receipts, transfers and surveys.
17. Hold periodic meetings with the RSC and provide reports to licensee management.
18. Maintain the in-house licensing program for radioisotopes.
19. Respond to and remediate all radiological emergencies.
20. Assist the RSC in the performance of its duties.

III.A.3. Licensed Principal Investigator

A licensed principal investigator is a principal investigator (PI) who has received in-house approval to work with radioactive material by the RSC. Licensed PIs are responsible for ensuring that students and staff using radioactive materials under their license are trained in safe laboratory practices, are familiar with the terms of the license, and are complying with Einstein policies and applicable regulations. The Radiation Safety Office offers periodic training sessions to assist the licensed PI in this regard.

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Laboratory responsibilities ultimately fall on the PI. These laboratories must comply with the rules and regulations set forth by Einstein and any applicable city/state/federal agencies. It is recommended that the laboratory has a dedicated researcher or manager who ensures that all radiation responsibilities are being met to assist the PI. If non-compliance is found while EH&S completes laboratory inspections, the PI will be contacted to correct any issues. If the licensed laboratory is continuously in non-compliance and does not make efforts to correct the issues, the PI's Radioactive Materials License may be reviewed by the Radiation Safety Committee and may be temporarily placed on hold or be terminated.

III.B. Regulatory Requirements

The U.S. Nuclear Regulatory Commission (NRC) is an independent agency of Congress which licenses and regulates the Nation's civilian use of radioactive materials to provide reasonable assurance of adequate protection of public health and safety, to promote the common defense and security, and to protect the environment. Title 10 of the Code of Federal Regulations (10 CFR) addresses energy related topics which covers the use of radioactive materials. 10 CFR Part 19 – Notices, Instructions, and Reports to Workers and 10 CFR Part 20 – Standards for Protection Against Radiation are of particular importance as it covers many of the regulations which are applied at Einstein.

Under the Atomic Energy Act, the NRC can relinquish its authority over certain radioactive materials to state governments that sign agreements with the agency. New York is an "agreement state" which has identified the Department of Health as the state agency to regulate the protection of workers against radiation. The New York City Department of Health and Mental Hygiene (NYCDOHMH) regulates the possession and use of radioactive material in New York City on behalf of the NRC. The Office of Radiological Health has established radiation protection regulations which are compatible with Title 10 CFR and can be found in New York City Health Code Article 175. The NYCDOHMH also regulates radiation producing equipment such as x-ray machines. Radiation producing equipment requires a Certificate of Registration to be renewed every two years.

The New York State Department of Environmental Conservation (DEC) has issued 6 NYCRR Part 380 – Prevention and Control of Environmental Pollution by Radioactive Materials which regulates the disposal and release of radioactive material to the environment. This may include discharges to water and emissions to air at Einstein. Specific release permits may be needed dependent upon the concentrations of the releasable radioactive material.

III.B.1. Occupational Exposure Limits

The Nuclear Regulatory Commission (NRC) has established radiation dose limits for occupational radiation workers, minors, the embryo/fetus of declared pregnant workers, and members of the general public. Following ALARA practices, the goal at Einstein is to reduce exposures to within 10% of the regulatory limits. At Einstein, our goal is to stay below the ALARA limits.

The NRC's annual occupational exposure limits as well as the ALARA limits are presented below.

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Occupational Exposure Limits		
Affected Part of Body	**NRC's Annual Dose Limit**	**ALARA Annual Dose Limit**
Total Effective Dose Equivalent (whole body)	5 rem (5,000 mrem)	0.5 rem (500 mrem)
Any organ or tissue	50 rem (50,000 mrem)	5 rem (5,000 mrem)
Skin	50 rem (50,000 mrem)	5 rem (5,000 mrem)
Extremity (hands/feet)	50 rem (50,000 mrem)	5 rem (5,000 mrem)
Lens of Eye	15 rem (15,000 mrem)	1.5 rem (1,500 mrem)

While occupational exposure at a medical research institution is negligible, the possibility that an exposure could occur does exist. For this reason, all research staff, custodial services staff, certain Engineering staff, Mailroom and Receiving staff may wear dosimeters. A dosimeter badge is a means of detecting and measuring radiation exposure.

Exposures may occur to the hands of individuals working with larger quantities of high-energy beta and gamma radiation. This may result from a researcher's hand being in close proximity to a P-32 container. For this reason, a ring dosimeter is required for individuals using large quantities of P-32 and I-125, as well as other select radioisotopes (see section III.I, Radiation Dosimetry, for more information).

III.B.2. Exposure Limits to Minors

The annual occupational dose to minors is limited to 10% of the occupational dose for adult workers listed in section III.B.1, Occupational Exposure Limits. A minor is considered to be someone under the age of 18 years old. Minors are not allowed to work with radioactive materials at Einstein. Occasionally there are High School programs that allow students to enter select laboratories. If the laboratory is a licensed radiation lab, the students may shadow Einstein researchers, but must not handle any radioactive material. Please contact the Radiation Safety Officer if a minor will be in a laboratory licensed to work with radioactive material. Depending on the laboratory, the minor may be required to wear a monthly dosimeter badge.

III.B.3. Occupational Exposure Records

For each individual who may enter the licensees or registrant's restricted area and is likely to receive, in a year, an occupational dose requiring monitoring, the licensee or registrant shall:

1. Determine the occupational radiation dose received during the current year; and
2. Request, in writing, the records of lifetime cumulative occupational radiation dose.

Individuals applying for a dosimeter who have documented exposure at another institution must sign a form authorizing the release of exposure records to Einstein. See section III.B.8, Dosimetry Requirements for more information on obtaining dosimetry.

III.B.4. Exposure Limits to Pregnant Employees

The dose to the embryo/fetus during the entire term of the pregnancy shall not exceed 500 mRem due to occupational exposure for a declared pregnant employee (see Appendix E). To become a "declared pregnant employee", the pregnant worker must declare their pregnancy in writing with the Radiation Safety Officer. The licensee shall review exposure history and adjust worker conditions to ensure that the monthly dose to

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a declared pregnant employee does not exceed 50 mRem. The dose to the embryo/fetus shall be the sum of the dose to the deep dose equivalent to the pregnant employee and the dose to the embryo/fetus from radionuclides in the embryo/fetus and radionuclides in the declared pregnant employee. If by the time the employee declares pregnancy to the licensee the dose to the embryo/fetus has exceeded 450 mRem, the licensee shall be deemed in compliance with the Code if the additional dose to the embryo/fetus does not exceed 50 mRem during the remainder of the pregnancy.

A researcher who suspects or knows they are pregnant should request a fetal dosimeter badge from radiation safety. This includes researchers who work with radioactive material and those who work in radioisotope laboratories. Radiation Safety will provide instructions regarding fetal exposure to radiation and issue the individual a monthly dosimeter badge to track fetal exposure for the term of the pregnancy.

III.B.5. Exposure Limits to the General Public

The total effective dose to individual members of the public shall not exceed 100 mRem in a year, which is exclusive of any background radiation contributions. The dose in any unrestricted area from external sources shall not exceed 2 mRem in any one hour. These exposure limits apply to any individual not affiliated with Einstein who enters a laboratory, e.g., a vendor, a visitor, a relative, etc.

III.B.6. Leak Testing Sealed Sources

All beta/gamma and neutron sealed sources (greater than 100 microcuries) in active use will be tested for leakage at intervals not to exceed six months. All sealed sources in use (greater than 10 microcuries) designed for the purpose of emitting alpha particles will be tested at intervals not to exceed three months. Ni-63 foil sources in use (greater than 100 microcuries) will be tested at intervals not to exceed six months. Testing methods for leakage of sealed sources shall be capable of detecting the presence of 0.005 uCi of radioactive material on a test sample.

III.B.7. Monitoring Radiation

Surveys shall be conducted to determine radiation levels, concentrations, or quantities of radioactive material and the potential for radiological hazards that could be present. Instruments and equipment used for quantitative radiation measurements are to be calibrated at least every 12 months. Calibration services are offered through EH&S for a fee to be paid in iLab. See section III.N, Radiation and Contamination Monitoring, for monitoring requirements at Einstein.

III.B.8. Dosimetry Requirements

The Licensee is required to supply personal monitoring devices (dosimeters) to individuals working with radioactive material if:

1. An adult is likely to receive, in 1 year from an external source, a dose in excess of 10% the limits in section III.B.1, Occupational Exposure Limits.
2. A minor or declared pregnant employee who is likely to receive, in 1 year from an external source, a dose in excess of 10% the limits in section III.B.2, Exposure Limits to Minors, and III.B.1, Occupational Exposure Limits, respectively.
3. An individual entering a high, or very high radiation area.

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All dosimetry issued by the EH&S Office must be provided by a company certified by the National Voluntary Laboratory Accreditation Program (NVLAP) of the National Institute of Standards and Technology.

Personal dosimeters are worn for a period of three months (1 quarter). The dosimeters are returned to Radiation Safety at the end of the quarter when the laboratories receive their new dosimeters. All dosimeters are then forwarded to a vendor who will process them to determine individual exposures, document the exposures, and send copies to the Radiation Safety Office.

Records of individual exposures are kept on file by Radiation Safety and are available to the individual upon written request. See section III.I, Radiation Dosimetry, for information on obtaining a dosimeter. Late fees are applied to dosimeters which are returned past the deadline or that are unreturned.

III.B.9. Engineering Controls

The Licensee must use procedural or engineering controls, such as containment or ventilation to control the concentration of radioactive material in air. For a research laboratory this may involve the use of a fume hood or glove box for work with I-125 or tritiated water. Other engineering controls may include shielding, interlock systems, alarms, and warning signals.

III.B.10. Posting Requirements

The Licensee is required to post areas and rooms in which there is used or stored radioactive material in excess of quantities specified in the Rules of the City of New York.

The Licensed PI is also required to label containers of radioactive material in which the amount of material exceeds quantities specified in the Rules of the City of New York. The label must contain information regarding the radioisotope, an estimate of the amount of material in the container, and the date the amount was estimated. See section III.K, Posting and Labeling for Radioactive Material, for posting and labeling requirements at Einstein.

III.C. Radiation Safety Inspections

Laboratories with an active Radioactive Materials License are to be inspected quarterly (every 3 months) at a minimum by the Department of Environmental Health and Safety. These laboratories are inspected to ensure that safety requirements are being met and to make sure that the laboratory is in compliance with applicable city/state/federal regulations. Radiation safety inspections will be conducted by either the Radiation Safety Officer or the Senior Safety Technician.

The inspector will check the following:

- Monthly wipe tests are being conducted and the results are in disintegrations per minute (dpm).
- Radioisotope inventory records are being completed and filed in the radiation safety binder.
- Training records are up to date for all laboratory staff.
- The laboratory survey meter has been calibrated in the last year (if applicable to laboratory).
- Lab coats, gloves, and dosimeters (if applicable) are being worn.
- Is the correct shielding being utilized?

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- Evidence of any eating or drinking in the laboratory.
- Sink disposal log is posted. Any records will be reviewed.
- Is there waste stored in the laboratory? What is its condition?
- Proper signage and labelling is displayed appropriately.
- The Notice to Employees and the Emergency Procedures are posted within the laboratory.

Periodically outside regulatory agencies such as the Department of Health will also conduct inspections. These inspections are similar to the quarterly audits that EH&S conducts; however, they are more in depth and include the radiation safety program as a whole. They will inspect both the laboratories and the Radiation Safety Officer's records.

III.D. Exposure Action Levels

As indicated in section III.B, Regulatory Requirements, the City of New York sets annual occupational exposure limits that must not be exceeded. To ensure that these limits are met, Einstein sets action levels as follows.

Level I

Effective exposure above 125 mRem and below 375 mRem in a period of three months:

- The person is notified in writing of the amount of radiation they had received during the period in question.

Level II

Effective exposure above 375 mRem in a period of three months:

1. The person is notified in writing of the exposure
2. The person is visited by the Radiation Safety Officer who will make a report of their findings
3. The employee will:
   a. describe how they received the exposure
   b. discuss ways of reducing future exposures

All radiation exposure should be kept as low as reasonably achievable (ALARA).

III.E. Obtaining Authorization to Work with Radioactive Materials

The PI wishing to work with radioactive material must submit a Radioactive Material License Application Form with a copy of their CV and a map of the laboratory (see Appendix A). The authorization request is forwarded to the RSO who will review it and forward it to members of the RSC if he finds it complete and accurate. The Committee members will review the authorization request and notify the RSO of their decision on the request. The approval may include stipulations that the PI uses additional precautions or provides additional information. The authorization is good for 3 years after which the RSO will notify the PI that they must renew their authorization to continue to use the material. A Radioactive Material License Renewal Form requesting an update on the original application will be completed. The PI will be asked if they wish to renew the authorization, terminate it, or place the authorization on an "inactive status". While

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on “inactive status”, the laboratory is not authorized to order or work with radioactive materials. Any orders would be rejected until the lab becomes active again. If the PI prefers to go on “inactive status”, they will need to notify the RSO in writing or e-mail to reinstate their license to be able to order and work with radioactive materials.

III.F. Amendment to Radioactive Materials License

The PI may wish to change the conditions of their authorization, which may include the addition of a radioisotope, the increase in total limits for a radioisotope, or to add a laboratory or a new procedure. A Radioactive Material License Amendment Request must be submitted to the RSO requesting a change to the PI’s authorization (see Appendix A). If the amendment request requires the college to alter Einstein’s broad scope Radioactive Materials License, the PI must pay an amendment fee in iLab. The PI’s amendment request will be reviewed by the Radiation Safety Committee.

III.G. Terminating Authorization to Use Radioactive Material

If a PI terminates their license to work with radioactive material, they must:

- Notify the RSO of the termination and make arrangements to turn over all radioactive material and waste.
- Survey and decontaminate all potentially contaminated equipment and document the results of the final survey indicating the equipment is acceptable for release.
- Perform a thorough survey of the laboratory and decontaminate as required to bring contamination levels below 200 dpm/100 cm2 beta/gamma.
- Document the results of the survey and provide a copy to the RSO.
- Dispose of all radioactive material properly with a request in iLab.

III.H. Radiation Safety Training

Individuals who wish to work with radioactive material must receive hands-on training in working with the material in the laboratory and attend the Radiation Safety Training offered by the RSO. An individual in the laboratory knowledgeable in the use of the particular radioisotope and experimental technique to be used by the new researcher should provide the training to new users. The RSO will offer Radiation Safety Training on a bi-monthly basis or as needed. The PI is responsible for ensuring that all new staff members attend the training. All laboratory members in a licensed radioactive materials lab must take Radiation Safety Training, regardless of if they are to handle radioactive materials or not. Refresher training is required on an annual basis.

III.I. Radiation Dosimetry

Radiation Safety issues dosimetry to new research staff upon request by the PI. The staff member or PI must request the dosimeter in iLab (see Appendix A). They may call x2243 to have the dosimeter mailed to them, or the dosimeter may be picked up in the EH&S office. The researchers are issued dosimeters which are to be worn for three months on the wearer’s chest to measure the wearer’s whole body radiation exposure. At the end of the three months (quarter) the dosimeter should be returned to Radiation Safety on receipt of a replacement. It is important that the used dosimeters are returned promptly after receiving the

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new dosimeter badges to ensure that they are delivered to the vendor in a timely manner for analysis. Dosimeters can still be read after a long period of time, therefore, if an old dosimeter is found please send it to the Safety Office for processing. Late fees will be charged in iLab for dosimeters not returned on time or not returned at all.

Individuals who have previously worn dosimeters at other institutions prior to Einstein will need to complete and sign a form to their previous employer requesting their radiation exposure records from that institution. Previous exposure records must be sent to Einstein's Radiation Safety Officer.

The most frequent exposure to a researcher is to their hands from high energy beta emitters such as P-32, gamma radiation from I-125, or exposures from x-ray equipment. Therefore, an individual working with these radiation sources may be required to wear a finger/ring dosimeter on their hand depending on the radioisotope's activity.

If the researcher is working with P-32 or I-125 in amounts greater than 500 uCi, they are required to wear a ring dosimeter. A researcher may request a ring dosimeter in the same manner as requesting a personal dosimeter in iLab. The Radiation Safety Officer may also recommend a researcher to obtain a ring dosimeter depending on the radioisotopes that they work with and the activities that they handle. Work with radioisotopes such as F-18, Lu-177, In-111, and Cu-64 would require ring dosimetry as well.

III.I.1. Wearing Dosimetry

Dosimeters are to be worn at Einstein only. Dosimeters must not be brought off of campus as the exposure will alter one's occupation exposure results. Personal dosimeters are typically worn on a quarterly basis on the chest area of one's body. Ring dosimeters are typically worn on the dominant working hand that handles radioactive material, with the rings label facing the interior of the worker's hand. And an embryo/fetus dosimeter is to be worn near the waist area by a declared pregnant employee (see section III.B.4 for exposure information for a declared pregnant employee).

Badge dosimeters, such as a personal chest dosimeter or a fetal waist dosimeter, must be attached to the provided plastic dosimeter holder. To attach the dosimeter badge to its plastic holder, a plastic tab on the top of the dosimeter badge must be removed. If the tab is not removed, the dosimeter manufacturer will count the dosimeter as unused, and the exposure will not be analyzed. Ring dosimeters do not have anything to tear off and will be analyzed as is.

Monthly dosimeters are provided for declared pregnant employees as well as for special situations which may require careful monitoring. The Radiation Safety office may recommend monthly dosimetry upon certain radioisotope/activity use.

Note: When the dosimeter is not in use it should be stored away in an area away from any radiation sources such as in a desk drawer.

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III.J. Bioassay

III.J.1. Thyroid Scans

Radioactive iodine in the form of NaI can be volatile and become airborne and it is important to monitor researchers for potential internal contamination when they are working with the material. When radioactive iodine is inhaled or absorbed through the skin it collects in the thyroid. Since I-125 and I-131 are gamma emitters they can be readily detected with a NaI detector placed adjacent to the thyroid. If a researcher anticipates working with radioactive iodine in amounts greater than 1 mCi, they should contact the RSO to schedule a thyroid scan. A baseline scan is conducted prior to the experimental procedure. Six to twenty-four hours after the procedure the researcher should return to the Safety Office to receive a post experiment scan to determine if they have received an uptake to the thyroid.

III.J.2. Urinalysis

On rare occasions a urinalysis may be required for individuals working with large quantities of radioactive material. This is of particular importance when working with tritiated water in millicurie quantities. If a researcher is working with radioactive material in excess of the quantities specified in Table 1, the RSO will require that a bioassay be performed.

Containment Device: If a researcher is using a containment device, such as a glove box or fume hood, the RSO will take this into consideration when setting requirements for bioassays.

Table 1: Action Levels for Performing Bioassays

Hazard Group	Radioisotopes	Activity handled at One time (mCi)
1	Am-241, Ra-226, I-125	1
2	Ca-45, Cl-36, Na-22,	10
3	C-14, Cr-51, P-32, S-35	100
4	H-3, Rb-87, U-238	1000

III.J.3. Summation of Dose

Any exposure resulting from an uptake of radioactive material as determined by the bioassay will be added to the external exposure to give the total effective dose equivalent for that individual.

III.K. Posting and Labeling for Radioactive Material

Laboratories in which radioactive materials are used must be posted with certain signs and labels. “Caution Radioactive Materials” warning labels must be posted on the entrance to the lab. The following locations and equipment should also be posted or labeled:

- laboratory benches on which radioactive material is used
- plexiglass shields or containers
- refrigerators/freezers used to store material
- potentially contaminated equipment (glassware, pipettes, centrifuges, etc.)

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- waste storage cabinets and containers
- material storage containers
- fume hoods in which radioactive material is used or stored
- sinks used for radioactive material disposal

Anywhere radioactive material is used, or any equipment radioactive material is used with shall be labelled accordingly. If radioactive material is no longer stored in a refrigerator/freezer or area, that location or equipment should be wipe tested to confirm no contamination and the radiation label shall then be removed.

The laboratory should also be posted with emergency procedures that describe how to respond to spills, injuries, fires, and unauthorized removal of radioactive material (see appendix D).

In addition, the City of New York's "Notice to Employees" which describes standards for protection against radiation must be posted in each licensed laboratory (see Appendix C).

III.L. Obtaining Radioactive Material

To order radioactive material you must be a licensed PI or work for a licensed PI. The PI must be authorized to receive the particular radioisotope and amount to be ordered. The ordered material will be reviewed by the Radiation Safety Officer.

III.L.1. Purchasing Material

When purchasing radioactive material, the researcher must use Procurement's ePro service and include the PI's name, vendor providing the material, the catalog number, radioactive isotope, and the amount of material being ordered. The delivery address for all radioactive material packages must be to the "Radiation Safety Officer" at "The Department of Environmental Health and Safety, Forchheimer Room 800." When ordering material, be sure to include commodity code "12004" and to check off the radiation hazard box.

The order must be approved by the RSO prior to being placed by the Purchasing Department. The RSO is only responsible for approving the order, not for calling-in the order to the vendor or tracking the order if not received.

III.L.2. Other Institutions

Anyone wishing to receive radioactive material from another institution must notify the RSO. The institution will require a copy of Einstein's Radioactive Materials License and may request additional information. As with routine shipments of radioactive material, orders from other institutions must be addressed to the RSO at the EH&S Office and cleared by the Radiation Safety Staff before being delivered to the laboratory.

Anyone wishing to ship radioactive material must contact the RSO with the name of the individual receiving the material, the name of the institution, and the telephone number of the individual receiving the package. A copy of the radioactive materials license for the institution will be required and the package will be surveyed by the RSO before the package can be shipped. Proof of radioactive material shipping training is required for any laboratory who wishes to ship radioactive material to another institution.

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III.L.3. Delivery

All radioactive material packages must be delivered to the EH&S Office at Forchheimer 800 and be processed by the Radiation Safety Staff. Once processed, EH&S will notify the laboratory that the package has arrived. The laboratory is responsible for picking up the package in a timely manner. Dosimeter badges and lab coats should be worn when picking up the radioactive package. EH&S is not responsible for damage to items that are not picked up by the end of the business day on which they arrived. Under special circumstances, some laboratories or users may get approval for direct delivery.

III.L.4. Disposing of Packing Material

After the package is brought to the laboratory, the packing material must be surveyed to determine that it is free of contamination. This should be done using the wipe test method. The activity on the package should not exceed 220 dpm/100 cm2. All radioactive material labels must be defaced or removed. If the packing material is free of contamination, it may be disposed as non-radioactive waste. However, if contamination is found on the packing material greater than the limit above, The RSO should immediately be contacted at x2243. Always wear gloves when handling radioactive material containers.

III.M. Inventorying Radioactive Material

III.M.1. Incoming Material

All radioactive material must be tracked from the moment it is purchased until its final disposal. All incoming material must be inventoried by the laboratory to ensure that the PI does not exceed their quantity limits. A running total should be kept of each radioisotope that the PI has on hand. The inventory must include all radioactive material in stock solution, samples, radioactive waste, and material disposed of through the sewer (See "Record of Radioactive Materials" form in Appendix A). On an annual basis, licensed laboratories are required to complete an Inventory Form for the materials that they have on hand at that time.

When incoming packages of material are received, the total quantity of material received should be documented on the Record of Radioactive Material Form with the date received. The Record of Radioactive Material Form must be placed in the laboratory's yellow radiation safety binder.

III.M.2. Radioactive Waste

Radioactive waste including dry/solid waste material, animal carcasses/bedding, and liquid waste must be included on the Record of Radioactive Material Form. This may be accomplished through estimating the amount of material for a particular radioisotope in the waste stream. You may assume that a certain percentage goes into liquid waste, the scintillation vials, and dry solid waste. Please refer to section III.S for more information on radioactive waste disposal.

III.N. Radiation and Contamination Monitoring

The PI has two standard techniques available to monitor for the presence of contamination: the portable survey instrument or the wipe test method. The portable survey instrument may use a Geiger Mueller (GM) detector or a sodium iodide (NaI) detector. Survey meters are used to detect gross contamination on a

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surface or an object. However, it is not as sensitive when attempting to detect small amounts of contamination or low energy beta radiation as the wipe test method.

Therefore, the wipe test method is the method of choice for conducting a thorough survey of laboratories or determining if an object is contaminated. Low energy beta emitters such as tritium (H-3) will not be picked up by standard Geiger Mueller detectors, thus wipe testing is the only method at Einstein to monitor for tritium contamination.

III.N.1. Survey and Wipe Test Frequency

Monthly wipe tests are required to be performed in all laboratories that are using or possessing radioactive material. In addition, a survey of the designated work areas should be performed after each use of radioactive material. Monitoring should be done with a survey meter equipped with a Geiger Mueller (GM) or Sodium Iodide (NaI) detector, or wipe tested if tritium is involved. All wipe test results must be recorded in dpm/100 cm^2 and the results shall be placed within the laboratories yellow radiation safety binder. Table 2 in section III.N.3. provides guidance regarding the frequency for conducting wipe tests for large quantities of common radioisotopes.

III.N.2. Radiation Survey Meters

There are many different types of radiation detection meters out there. The type of meter and detector needed will depend upon the type of radiation, the energy, and the type of measurement needed. The three most common types of instruments used in biomedical research facilities are Gieger Mueller detectors, scintillation detectors, and ionization chambers. Certain types of probes/detectors will be more efficient at detecting specific radioisotopes than others, so it is important to be using the correct meter/detector. Radiation survey meters must be calibrated annually, contact EH&S regarding meter calibration.

Geiger Mueller (GM) detectors: These are simple to use gas filled detectors which work for alpha, beta, and gamma emitters. These detectors are most efficient when working with beta emitters, however low energy beta emitters such as tritium are not detectable due to its low energy not being able to penetrate the detectors window. Some alphas and Gammas will be detected by a GM probe, but the counting efficiency will be low and inaccurate (~1-3%). This meter will detect radiation and should be used for contamination surveys but does not measure radiation dose. The meter scale may show counts per minute (cpm) as well as milliroentgens per hour (mR/hr), however the mR/hr scale should be used with caution as GM probes cannot truly measure exposure rates, except for the radioisotope it is calibrated against or if an energy-compensated GM tube is used. Ionization chambers should be used for exposure.

It is recommended to use a Ludlum model 44-9 probe when working with ^{32}P as the efficiency is ~ 35%.

Scintillation detectors (Sodium Iodide probes): These detectors come in multiple forms. At Einstein, sodium iodide (NaI) crystal probes are typically used which can detect gamma and x-ray emitters. If working with a low energy gamma emitter such as I-125 or x-rays under 40 keV, a Ludlum model 44-3 probe should be used. If working with higher energy gammas above 40 keV such as Cr-51, I-131, or Co-57, a Ludlum model 44-2 probe should be used.

If working with alpha emitters, a zinc sulfide (ZnS) scintillation detector should be used. A Ludlum model 43-2 probe is recommended for detecting alpha radiation.

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Ionization Chambers: These meters are similar to GM counters however with a lower voltage. This allows for proportional counting of the energy received from radiation rather than simply counting the number of pulses. This allows the meter to accurately measure exposure and exposure rate in milliroentgens (mR) or mR/hr. It measures the ionization of air and should be used to measure exposure rates, not to detect contamination. This type of meter should only be used for gamma and x-ray emitters unless the meter includes a beta shield. For gamma and x-ray emitters, exposure rate and dose equivalent are approximately equal, so this measurement can be converted directly to mrem/hour.

Note: The meter scales (cps, cpm, mR/hr, R/hr) may be different depending upon the type of meter used.

III.N.3. Meter Surveys

The GM detector is the most commonly used instrument for conducting surveys. However, a better instrument to use if working with Gamma and X-ray emitters is a Sodium Iodide (NaI) detector. Laboratories may purchase their own survey meter or rent a meter from EH&S for a monthly fee.

Table 2: Frequency of Wipe Test Survey According to Hazard Group and Activity (mCi)

Hazard Group	Radioisotopes	Monthly	Bi-Weekly	Weekly
1	Am-241, Ra-226	<0.1	>0.1 and <1.0	>1.0
2	Ca-45, Cl-36, Na-22, I-125	<1.0	>1.0 and <10.0	>10.0
3	C-14, Cr-51, P-32, S-35	<10.0	>10.0 and <100.0	>100.0
4	H-3, Rb-87, U-238	<100.0	>100.0 and <1000.0	>1000.0

When beta (except H-3) and gamma emitters are used in the laboratory the PI must conduct a survey using a portable, handheld meter. The survey should be conducted in the following manner:

1. Ensure that the instrument has been calibrated within the last 12 months,
2. Ensure that the batteries have an adequate charge (many meters have a battery check function),
3. Check the survey instrument with a known source of material to ensure that it is responding to radiation,
4. Monitor the area very slowly at about one centimeter above the surface being monitored.
5. Document the results of the survey, include the instrument make, model number, serial number, calibration date, and readings on the survey report.

III.N.4. Wipe Tests

Wipe tests are performed by wiping the areas of interest with a piece of absorbent material (i.e., filter paper or Q-tip) and then determining the removable activity in a liquid scintillation or gamma counter set to detect the suspected radionuclides. The wipe test method is more sensitive than instrument surveys and should especially be used when instrument surveys indicate possible contamination. This is the only practical method of monitoring for low energy beta emitters, such as H-3, C-14 and S-35. Wipe tests should be used

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for all surveys conducted for identifying and/or documenting removable contamination levels. Wipe testing must be completed on a monthly basis no matter what radioisotopes are being used in the laboratory. The wipe test results must be in dpm/100 cm^2. If the results print out in counts per minute (cpm), the results must be converted to disintegrations per minute (dpm) according to the regulations.

III.N.5. Converting Wipe Tests from CPM to DPM

Wipe test results must be in disintegrations per minute (dpm) according to the NYC Dept. of Health regulations. If the laboratories wipe test results print out in counts per minute (cpm), the results must be converted to dpm. Many newer liquid scintillation counters will do this conversion for the user, however older models will require conversion by hand.

In order to convert from cpm to dpm, the researcher must know the efficiency of the testing equipment for the radioisotope that is used within their laboratory. The efficiency for H-3 and C-14 is typically posted on the exterior of liquid scintillation counters on campus. If the laboratory is using other radioisotopes other than H-3 or C-14, the efficiency can be figured out by following the instructions on the Wipe Test Calibration Worksheet found in Appendix A. The formula to convert from cpm to dpm is below.

Formula: $$\text{dpm} = \frac{\text{net count (cpm)} - \text{background count (cpm)}}{\text{Efficiency of device}}$$

III.N.6. Radiation Limits

External radiation levels should be kept to less than 0.1 mRem/hr at 12 inches from a source's surface and to levels as low as reasonably achievable. For most energetic beta and gamma emitters roentgens, rads, and rems may be said to be equivalent. For practical purposes, 1 R (exposure) = 1 rad (absorbed dose) = 1 rem or 1000 mrem (dose equivalent).

III.N.7. Contamination Limits

The Radiation Safety Office records removable contamination levels in terms of disintegrations per minute (dpm) per 100 square centimeters. The limits required for decontaminating a surface are listed in Table 3: Contamination Limits.

Table 3: Contamination Limits

Contamination Levels	Location
<20 dpm/100 cm^2 alpha <200 dpm/100 cm^2 beta/gamma	Unrestricted areas: (hallways, offices, and labs not licensed for radioactive material)
<100 dpm/100 cm^2 alpha <1000 dpm/100 cm^2 beta/gamma	Laboratories: Cleanup recommended to as low as practicable levels.
>100 dpm/100 cm^2 alpha >1000 dpm/100 cm^2 beta/gamma	Cleanup to less than 1000 dpm/100cm^2 beta/gamma or 100 dpm/100 cm^2 alpha and as far below as practicable is required

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All post-cleanup contamination surveys must be documented to demonstrate that the area was decontaminated. All cleanup debris must be placed inside of a radioactive waste container, not normal trash or in a bio-waste bin.

III.O. External Exposure Control

External exposures can be reduced to as low a level as possible by following the principles of time, distance, and shielding. Note that gamma and x-rays have the greatest potential for external exposure due to their penetrability. Beta particles present a lesser degree of potential external exposure (depending on the energy of the radioisotope), and alpha particles present a very small potential for external exposure due to their very short range and ability to penetrate.

III.O.1. Time, Distance, and Shielding

There are three mechanisms for reducing an individual's exposure to radiation: time, distance and shielding. One can minimize their exposure to radiation by limiting the amount of time in proximity to a radiation source. Therefore, it is a good idea to have a thorough knowledge of the experimental technique to be used when handling radioactive material. Performing "dry runs" of procedures with non-radioactive material prior to working with active material will allow a researcher to gain experience with the methods involved. As a result, the individual may complete the task in a timely manner when working with the radioactive material and help to minimize their exposure. Increasing the distance from a source can significantly reduce exposure to radiation. The exposure levels fall off at the inverse square of the distance from the source. Therefore, if one is standing one meter from a source that has a dose rate of 40 mRem/hour at one meter and moves back two meters from the source, the dose rate will reduce to 10 mRem/hour. Doubling your distance from a radiation source will quarter the dose received.

$$\text{Dose at 2 m} = 40\ \text{mrem/hr} * \left(\frac{1\ \text{m}}{2\ \text{m}}\right)^2 = 40\ \text{mrem/hr} * \left(\frac{1}{4}\right) = 40\ \text{mrem/hr} * 0.25 = 10\ \text{mrem/hr}$$

Shielding can effectively reduce exposure to radiation depending on the type, quantity, and energy of the radiation. The most common types of radiation found in a medical research laboratory are beta, gamma, and x-ray radiation. The energies for these types of radiation vary from a few KeV to several MeV. Lead is the typical shielding used for x-rays and gamma radiation. Thin sheets of lead or lead bricks are used for the radioactive materials used in the laboratory such as I-125 or Cr-51. Acrylic shielding such as Plexiglass/Lucite is used for shielding common beta-emitting radioisotopes such as P-32. Alpha radiation typically does not require shielding due to its inability to travel far and penetrate matter. Both acrylic and lead shielding come in many different shapes and sizes depending on one's needs. The thickness of shielding needed will depend on the activity and energy of the radioisotope being utilized. Shielding should be used when working with materials as well as when storing materials to reduce exposure. Contact Radiation Safety for shielding suggestions and placement.

III.O.2. Bremsstrahlung Radiation

X-rays occur when high energy beta radiation strikes dense material such as lead. When a negatively charged high speed electron interacts with the positive electric field surrounding a nucleus, it quickly

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accelerates toward it. The rapid acceleration and sudden change of direction results in the release of an x-ray. These x-rays are given the name Bremsstrahlung (braking) radiation because the kinetic energy of the electron is transferred to the creation of the x-ray which results in it slowing down. Bremsstrahlung radiation may be a source of exposure for individuals working with P-32. Use acrylic shielding when working with high energy beta emitters so that Bremsstrahlung radiation is not created. See section III.O.1, Time, Distance, and Shielding, for information on shielding.

III.O.3. Storage of Material and Waste

Radioactive material should be stored in areas of the laboratory located away from staff. Material stored in refrigerators/freezers may need to be stored in shielded containers. The best locations for waste are in the back corner of the laboratory or in cabinets under unoccupied lab benches. P-32 waste should be stored in plexiglass waste containers, while I-125 and Cr-51 may need to be stored in lead containers. The containers used should be lined with a durable clear plastic bag so that the containers themselves do not get contaminated.

Radioactive waste storage involves strict storage and record keeping procedures. Only short-lived radioisotopes such as P-32 can be reasonably kept in laboratories for decay. All other waste isotopes should be collected in the appropriate container and turned over to Radiation Safety for disposal and/or decay.

III.P. Contamination Control

III.P.1. Containment

Radioactive material use should be restricted to designated areas of the laboratory to minimize the potential spread of contamination. The designated area should be marked with radiation tape and signage so that the hazards are obvious to all personnel who enter the area. The material should be used at a workstation equipped with a tray and absorbent pad. This will help reduce the spread of contamination if there is an accidental spill. A survey meter should be used to monitor for contamination before and after conducting research. The area should also be wipe-tested on a monthly basis at a minimum to test for small quantities of contamination. If working with radioactive dust, mists, fumes, gases, or organic vapors, be mindful of any fans or air-circulating devices in the area that may help the spread of contamination. Volatile radioactive material should be used in a fume hood to minimize the spread of airborne contamination. Contact Radiation Safety if working with volatile forms of radioiodine.

III.P.2. Fume Hoods

When using a fume hood, it is important to confirm that it is operational. Verify that the flow rate has been checked within the last year and is at least 100 cfm while the sash is at a height of 12 inches. If it has been verified, a sticker should be affixed to the hood providing the flow rate and the date that it was checked. Confirm that air is flowing into the fume hood by holding tissue paper up to the edge of the sash and note if it is being drawn in. Any fume hood used with radioactive materials should be labeled accordingly.

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III.Q. Internal Contamination Control

III.Q.1. Contamination Routes

Internal contamination can result from material entering the body through four different routes: it can be inhaled, ingested, absorbed through the skin, or from an injection or puncture. For it to be inhaled the material must become airborne. This can happen if the radioactive material is volatile, an aerosol or a dry dust. Material can be ingested by the transfer of material to food or to the hand, and then transferred to the mouth. Certain materials, such as I-125 in the form of NaI or tritium in the form of tritiated water, can be absorbed through the skin. Radioactive material can also be absorbed through wounds, cuts or through the mucous membranes in the eyes.

III.Q.2. Airborne Contamination

When working with volatile radioactive material, it is necessary to use a fume hood. This will prevent the potential inhalation of airborne material by the researcher. It is also important to avoid the splattering of radioactive materials that have the potential to generate aerosol. Note that certain radionuclides may require special filtration such as charcoal. Only ducted fume hoods may be used at Einstein.

III.Q.3. No Eating, Drinking, or Smoking

It is important to enforce the requirement of no eating, drinking, smoking or application of make-up in a laboratory. This minimizes the potential risk of ingesting radioactive material or any other hazardous material in the laboratory. This is a strict rule. Food and beverages shall not be brought into the laboratory or stored in refrigerators/freezers in which radioactive material or other chemicals are stored. In addition, mouth pipetting is not allowed.

III.Q.4. Absorption Through Skin

Always wear a lab coat, gloves, and safety glasses when working with radioactive material. You should not work with radioactive material with an open wound or sore. If you are working with tritiated water or radioactive iodine in the form of NaI, wear double gloves to provide additional protection to your hands. Gloves should be replaced frequently as they have permeation rates and/or may develop holes/tears. See section III.T.3. for information on personal contamination.

III.R. Working with Common Radioisotopes

III.R.1. General Requirements

Follow general precautions for working with radioactive material.

Preparation:

- Designate and label areas where radioactive materials are used.
- Label all containers with radiation caution tape and specify the radioisotope.
- No eating, drinking, applying cosmetics or smoking in the laboratory.
- No mouth pipetting of radioactive material. Mechanical pipettes only.

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Conducting the Research:

- Use spill trays and absorbent material.
- Use a fume hood or glove box when handling potentially volatile material.
- Wear lab coat, disposable gloves, close toed shoes, and safety glasses.
- Wear gloves that are appropriate for the chemicals being handled.

Post Research:

- Monitor and decontaminate surfaces.
- Dispose of radioactive waste in waste containers.
- Store radioactive material in refrigerator/freezer.

III.R.2. Low-Energy Beta Emitters (H-3, C-14, S-35)

- Follow General Precautions for working with radioactive material.
- Dosimetry is generally not required when handling H-3, C-14, or S-35.
- Most research involving low energy beta emitters may be performed on a laboratory bench, however volatile forms should be used within a fume hood.
- Shielding is generally not required.
- Use the wipe test method to monitor for contamination.
- Urinalysis is required within 24 hours after working with large quantities of material (100 mCi).
- Dispose of radioactive waste in accordance with requirements in section III.S, Radioactive Waste.

III.R.3. High-Energy Beta Emitters (P-32, Sr-90/Y-90)

- Follow general precautions for working with radioactive material.
- Whole body and ring dosimetry is required when using mCi quantities of material.
- Use acrylic (plexiglass/Lucite) shielding to keep exposures to less than 0.1 mRem/Hr.
- For larger quantities of material lead may be added to the outside surface of the acrylic shield.
- Avoid looking into or working over an un-shielded container of P-32.
- Conduct dry-run experiments to ensure dexterity and speed of handling high energy beta emitters.
- Routinely monitor gloves for contamination and replace if contaminated.
- Urinalysis is required within 24 hours after working with 100 mCi or greater of P-32.
- Isolate waste in a labeled, shielded container.
- Dispose of radioactive waste in accordance with requirements in section III.S, Radioactive Waste.

III.R.4. X-ray and Gamma Emitters (I-125, Cr-51)

- Follow general precautions for working with radioactive material.
- Store in lead shielded containers.
- Whole body and ring dosimetry is required for work with large quantities (mCi).
- Minimize exposure with lead shielding. Leaded needle holders may be needed to protect hands.
- Use a NaI detector or liquid scintillation counter/gamma counter to detect gamma and x-ray emitters.
- Urinalysis is required within 24 hours after working with 10 mCi or greater.
- Thyroid scans are required if working with radioiodine in amounts greater than 1 mCi.
- Dispose of radioactive waste in accordance with requirements in section III.S, Radioactive Waste.

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III.S. Radioactive Waste Disposal

To submit a radioactive waste pick-up request, log into iLab and go to the Environmental Health and Safety page. Under the "Request Services" tab you may initiate a radioactive waste disposal request. When completing the form be sure to select the specific type of waste that you want to dispose of (i.e., dry waste, liquid scintillation vials, decayed waste, etc.) and include the radioisotope and the activity of the waste. One form should be submitted for each container or type of waste that needs to be disposed of. Once submitted, attach a printout copy of the request to the waste container that needs to be disposed of. Keep in mind that radioactive waste disposal can be expensive and often times cost more than the material itself. Only certain types of waste disposal are free of charge, contact the Radiation Safety Officer with any questions.

III.S.1. Dry Solid Waste

Dry solid waste consists of potentially contaminated items such as paper, plastic, and glass. It may include gloves, absorbent pads, pipette tips and empty containers. The waste container should be labelled with the "caution: radioactive materials label, the radioisotope, the date, and the total estimated activity. Each time waste is added to the container, the activity should be noted so that the total can be estimated once ready for disposal.

This waste type can be broken down into two categories: long-lived and short-lived material. The long-lived material includes all radioisotopes with half-lives greater than 90 days, such as H-3 and C-14. This waste type must be disposed of as radioactive waste through an approved radioactive waste vendor. It must be segregated from short-lived radioactive waste in a separate waste container and be scheduled for removal by Radiation Safety Staff. Only H-3 and C-14 waste may be mixed together. All other radioisotope waste must be segregated from one another and separated into their own waste containers. Short-lived radioactive waste with half-lives less than 90 days can be held for decay and disposed of as non-radioactive waste after 10 half-lives. For example, P-32 waste may be held in storage for 6 months and then be disposed of as decayed waste. It is strongly recommended that the PI only store P-32 waste in the laboratory for decay or schedule EH&S to pick up the waste and hold it for decay (for a fee). All other waste containing decayable radioisotopes should be scheduled for removal and decay through Radiation Safety.

Segregation of waste by radioisotope is still required even if waste is being decayed in the lab. Otherwise, the volume of the waste could overwhelm the storage capacity. If P-32 were mixed with S-35, all the waste in the container would have to be decayed for the half-life of S-35 (3 years). If the P-32 waste was separate from the S-35 it could be disposed of in 6 months while the S-35 would be disposed of in 3 years. Mixing different radioisotope waste together may also present issues in emergency situations. You must request a radioactive waste pick-up in iLab for disposal through EH&S once the container is full.

If a PI holds the waste for decay, it is important that they provide the proper shielding for the waste containers and ensure that staff are not needlessly exposed to radiation. Once fully decayed, a decayed waste pickup request shall be submitted in iLab so that EH&S can survey the waste prior to disposal. See section III.S.7. for more information on decayable waste.

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III.S.2. Liquid Scintillation Vials

Liquid scintillation vial waste is generated due to monthly wipe test requirements. This waste must be collected separately from dry solid waste. All vials are required to be collected in a designated liquid scintillation vial waste drum. Be sure that the caps to the vials are secured tightly so that the liquid does not leak into the waste drum. Once the drum is full the laboratory should submit a request in iLab for EH&S to remove it. Reasonable amounts of biodegradable scintillation counting fluid may be disposed down the sink as long as the sink disposal limits for radioactive material are observed. EH&S recommends using biodegradable scintillation fluid; however, fluid can be flammable or corrosive. If flammable or corrosive scintillation fluid is used, this must be noted on the pickup request form in iLab.

III.S.3. Liquid Waste

Liquid waste consists of aqueous, non-hazardous radioactive liquids. Liquid waste should be collected in durable plastic containers with a screw top lid. The waste container should be labelled with the "caution: radioactive materials label, the radioisotope, the date, and the total estimated activity This waste may contain any radioisotope typically used in research and may be disposed down the drain in accordance with the limits specified in Table 4. If you do not wish to use the sink disposal method or if you have liquid waste with activities that exceed sink disposal limits, the liquid waste can be either held for decay in the lab or a pickup request can be submitted for its removal. High activity liquid waste that poses a dose risk may also be collected and handed over to Radiation Safety Staff. Liquid waste with other hazardous properties such as flammable, corrosive, toxic, or reactive must be collected as "mixed waste" and may not be disposed of through sink disposal.

Table 4: Limits for Sink Disposal

Isotope	Limit/month/lab	Average/day/lab
	uCi	uCi
P-32	360	12
S-35	300	10
I-125	360	12
Cr-51	1500	50
H-3	360	12
C-14	900	30

III.S.4. Biological Waste

Biological waste may consist of animal carcasses, tissues, or blood that was used with radioactive material.

III.S.4(a) Animal Carcasses

Animal carcasses and tissue samples containing short-lived radioisotopes (half-life ≤ 90 days) must be held in a freezer for decay for 10 half-lives. If the animal carcasses/samples contain H-3 or C-14 in quantities less than 0.05 uCi/gram of animal tissue, they may be treated as non-radioactive and turned over to the Institute for Animal Studies for pathological waste disposal. If the concentration of H-3 or C-14 is greater than 0.05 uCi/gram, the carcass/samples must be placed in a freezer, labeled with the radioisotope, the activity, the date, the P.I. name and be disposed of as biological radioactive waste (you must request a

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radioactive waste pick-up in iLab). All other long-lived radioisotopes (half-life ≥ 90 days) in animal carcasses and tissue samples must be labelled accordingly and be stored in a freezer until ready for pick-up by EH&S. Discuss plans to use long-lived radioisotopes with the Radiation Safety Officer.

III.S.4(b) Animal Bedding and Cages

Animal cages and bedding contaminated with long-lived radioactive material such as H-3 or C-14 must be disposed of as radioactive pathological waste. The cage/bedding must be labeled with the "caution: radioactive materials" label, the radioisotope, the activity, the date, the PI name, and be stored in a closed durable plastic bag until collected by Radiation Safety Staff by request through iLab. The cages may be decontaminated with a radioactive decontaminate cleaner such as NoCount Solution, and then wipe tested thoroughly to confirm no contamination. If there is no contamination, the cages can be returned to the Animal Institute after being surveyed by Radiation Safety. Disposable animal cages may be purchased as well for use with long-lived radioisotopes. Contact the Radiation Safety Officer and the Animal Institute for more information on disposable cages.

As with animal carcasses and tissues, bedding/cages containing short-lived radioisotopes may be held for decay for 10 half-lives. Decayed animal bedding may be disposed of as nonradioactive pathological waste. Decayed cages shall be returned to the Animal Institute.

III.S.5. Radioactive Sharps

Radioactive sharps consist of syringes, needles, razor blades, etc. that have been used with radioactive material. These items must be placed into a sharps container that is labelled with a "caution: radioactive material" label, the radioisotope, the date, and the total estimated activity. Just as all other waste streams, radioactive sharps containers must be segregated by radioisotope. Only H-3 and C-14 may be added to the same container. If the sharps container contains a long-lived radioisotope, once full the container will be treated as dry waste. If the sharps container contains a short-lived radioisotope (half-life ≤ 90 days), once full it can be held for decay for 10 half-lives. Decayed sharps waste will be handled the same as other decayed waste, see section III.S.7. for more information.

III.S.6. Mixed Waste

Mixed waste is hazardous waste that contains radioactive material. It may contain organic, corrosive, toxic, or other hazardous compounds. This waste must be collected by Radiation Safety Staff for disposal. Short-lived mixed waste must be stored separately from long-lived waste so that it can be decayed and disposed of as non-radioactive hazardous waste. Due to regulatory restrictions and the very high cost of disposal, all attempts must be made to minimize the generation of mixed waste. Please consult with the Radiation Safety Officer before creating mixed waste.

III.S.7. Decayed Waste

Waste that contains short-lived radioisotopes and has been held in storage for 10 half-lives is considered fully decayed radioactive waste. Only radioisotopes with a half-life ≤ 90 days may be held for decay. All radioisotopes with a half-life > 90 days must be disposed of through a radioactive waste vendor. There are regulatory requirements associated with the proper disposal of decayed waste. The lab must complete a

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"Survey Record of Disposed Radioactive Waste from Decay-In-Storage Form" after the waste has decayed for 10 half-lives (see Appendix A). After the waste has been surveyed and the results have been recorded, a decayed waste pickup request shall be submitted in iLab.

These records will be reviewed quarterly by Radiation Safety Staff and will be required to be maintained as a condition of the PI's radioactive materials license. Survey records shall be kept inside the laboratory's yellow radiation safety binder. Ten half-lives for the commonly used radioisotopes are listed below.

Table 5: Ten Half Lives for Common Radioisotopes

Isotope	Half-Life	Minimum Storage Time
P-32	14.3 days	143 Days/6 months
Cr-51	27.7 days	277 days/1 year
I-125	59.6 days	596 days/2 years
S-35	87.4 days	874 days/2.5 years
H-3	12.4 years	N/A*
C-14	5,730 years	N/A*

* These radioisotopes may not be decayed.

Radiation Safety strongly recommends that only short-lived radioisotopes such as P-32 be kept in the laboratory for decay-in-storage. All other radioisotopes should be turned over to the Radiation Safety Officer for decay.

III.T. Emergency Procedures

Emergency procedures must be posted in each laboratory in which radioactive material is used (see Appendix D). What follows provides additional information for responding to an emergency.

III.T.1. Minor Spills

For spills that involve no radiation hazard to personnel with survey meter readings of less than or equal to 2.5 mR/hr, or for a spill of up to 100 uCi:

1. Immediately notify all persons in the lab.
2. Permit access to only the minimum number of persons necessary to deal with the spill.
3. Confine the spill by placing paper towels or absorbing pads around the perimeter of the spill.
4. If the spill is a dry powder, cover with dampened absorbent material to minimize airborne radioactivity
5. Wear gloves, lab coat, and safety glasses when cleaning up the spill.
6. Using a soapy solution or professional decontamination spray, clean the spill from the outside edge inward with paper towels.
7. Avoid spreading the contamination beyond its original area.
8. Dispose of all contaminated paper towels in a labeled radioactive waste container.
9. Check the area for contamination using the wipe test method.
10. Repeat decontamination efforts and wipe test process until contamination levels are below acceptable limits. *
11. Dispose of paper towels, gloves, and other potentially contaminated items as radioactive waste.

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* If contamination remains after four or five attempts contact the Radiation Safety Officer.

III.T.2. Major Spills

For spills that present a potential radiation hazard to personnel:

1. Notify all persons not involved in the spill cleanup to vacate the room at once.
2. If the spill is liquid, and the hands are protected, upright the container.
3. If the spill is a dry powder, cover with dampened absorbent material to minimize airborne radioactivity
4. If the spill is on the skin, flush thoroughly. (More information below in section III.T.3.)
5. For a spill on clothing, discard outer or protective layer of clothing, and keep contamination confined to the room in which the spill occurred.
6. Switch off all fans.
7. Vacate the room and close all entrances to the space.
8. Notify the Radiation Safety Officer immediately.

III.T.3. Personal Contamination

For personal contamination:

1. Contact Radiation Safety
2. Record initial survey results taken with a GM detector if the contaminant is a high-energy beta or gamma emitter.
3. Wash the affected area with lukewarm water and mild soap for 15 minutes in a sink.
4. Do not use an abrasive soap or brush as it could abrade the skin and create a pathway for the contamination to enter the body. If the contamination is in the eyes, use an eye wash station to flush the eyes (keep mouth closed when using an eye wash station to limit any intake).
5. Take additional measurements of the affected area with a survey meter.
6. If no contamination is found, discontinue the decontamination process.
7. Otherwise repeat the decontamination process up to two more times. If unsuccessful after 3 attempts, stop decontamination efforts.
8. Bioassay monitoring may be required afterwards.

III.T.4. Accidents Involving Radioactive Dusts, Mists, Fumes, Organic Vapors and Gases

For accidents involving radioactive dusts, mists, fumes, organic vapors, and gases:

1. Notify all other personnel to vacate the room immediately.
2. Hold breath and switch off all air circulating devices if time permits.
3. Close any windows, vacate the room, lock the door and post a notice on the door’s exterior.
4. Notify the Radiation Safety Officer immediately.
5. Any personnel who were inside the area must stay onsite to be checked for skin/clothing contamination.
   - bioassay may be required for any personnel who inhaled or ingested radioactive material

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III.T.5. Injuries to Personnel involving Radioactive Materials

For injuries to personnel involving radioactive materials:

1. For serious injuries call 911 for EMTs and an ambulance.
2. Administer first aid to the individual
3. Notify the EMTs that the individual is potentially contaminated with radioactive material.
4. Wash minor wounds immediately under running lukewarm water while spreading the edges of the wound.
5. Report all radiation accidents to the Radiation Safety Officer as soon as possible (wounds, overexposure, ingestion, and inhalation).

III.T.6. Unauthorized Removal, Theft, or Loss of Radiation Source

For unauthorized removal, theft, or loss of radioactive material, notify the Radiation Safety Officer, who shall in turn notify the Department of Health, Office of Radiation Control.

III.U. Emergency Contact Information

Radiation Safety Officer:	Office: (718) 430-2243 Cell Phone: (646) 385-1304 (for emergencies only)
Einstein's 24-hour Emergency Hotline:	ext. 4111 From cell phone: (718) 430-4111

*Be prepared to state the problems and identify the location.

IV. Definitions

None.

V. Effective Date

Effective as of: 27 April 2018

VI. Procedure Management and Responsibilities

Einstein's Department of Environmental Health and Safety is the Responsible Office under this Manual. Einstein's Associate Dean for Administration and Finance is the Responsible Executive. Einstein's Associate Vice President of Environmental Health and Safety is the Responsible Officer for the management of this Manual.

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Appendix A: Radiation Safety Forms

Select radiation safety forms can be found within Einstein's Document Library or below in this manual. Contact the Radiation Safety Office for any questions related to the forms.

- Record of Radioactive Material Form
  Link to Document Library:

- Survey Record of Disposed Radioactive Waste from Decay-in-Storage Form
  Link to Document Library:

- Dosimeter badge Request/Deletion Form
  Link to Document Library:

- Sink Disposal Log
  Link to Document Library:

- Exposure Information Request Form
  Link to Document Library:

- Wipe Test Calibration Worksheet
  Link to Document Library:

- Amendment to PI's Radioactive Materials License Form
  Link to Document Library:

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Record of Radioactive Material

Investigator:_____ **Department:**_____ **Building:**_____ **Room:** _____

Radioisotope:_____ **Chemical Form:**_____ **Date Received:**_____ _____

Amount Received (mCi)	Date of Use	Amount Used	Date of Waste Disposal	Manner of Disposal (list amount under appropriate category)					Balance Remaining
XXXXXXX XXXXXXX	XXXXXXX XXXXXXX	XXXXXXX XXXXXXX	XXXXXXX XXXXXXX	Dry Solid Waste	Sink Disposal	Collected Liquid Waste	Scintillation Vials	Animal Carcasses	XXXXXXXXXX XXXXXXXXXX

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SURVEY RECORD OF DISPOSED RADIOACTIVE WASTE FROM DECAY-IN-STORAGE

DATE	ISOTOPE	DECAY START DATE	WASTE VOLUME (Gallons)	SURVEY INSTRUMENT USED				INSTRUMENT READINGS (mR/hr)		NAME OF SURVEYOR
				MAKE / MODEL	DETECTOR	SERIAL NUMBER	CALIBRATION DATE	BACKGROUND	SURFACE OF CONTAINER	

The information recorded on this form is required by Title 24 section 175.13 (e)(11)(ii) of the Rules of the City of New York.

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EINSTEIN
Albert Einstein College of Medicine

JACK AND PEARL RESNICK CAMPUS | 1300 MORRIS PARK AVENUE | BRONX, NY 10461

ENVIRONMENTAL HEALTH AND SAFETY DEPARTMENT

PHONE: (718) 430-2243 **Email:** james.harold@einsteinmed.edu **FAX:** (718) 430-8740

Dosimeter Badge Request or Deletion Form

Date: _____

Check one: **Please Issue:**_____ **Please Delete:**_____ **Lost Dosimeter:** _____

Investigators Name: _____

Department:_____

Building:_____ Room:_____ Extension:_____

Employee or Student Name: _____

Individuals Date of Birth: _____ Male: _____ Female:_____

Series Code (for deletion or lost dosimeters only):_____ Dosimeter No.:_____

1. Did individual have a previous dosimeter at Einstein? Yes:_____ No:_____
2. Has individual taken Radiation Safety Training through Einstein's EH&S Department?

   Yes: _____ No: _____ **If "yes", please provide date of training:** _____
3. Is individual a new employee at Einstein? Yes: _____ No: _____
4. Did individual wear a dosimeter at their previous place of employment? Yes:____ No: ____

   If "Yes", complete the EH&S *Exposure Information Request Form* which can be found in Einstein's Document Library and send it to the previous employer & Einstein's Radiation Safety Officer.

   Signature: _____

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Sink Disposal Log

Investigator's Name: _____ **Building:** _____ **Room #:** _____

Date	Isotope	Amount (uCi)	Name

Laboratory Sink Disposal Limits			
Isotope	Monthly Limit (uCi)	Daily Average (uCi)	* For sink disposal of any other nuclide contact the RSO at x2243
P-32	360	12	
S-35	300	10	
I-125	360	12	* The daily average can occasionally be exceeded provided the monthly limit is met
Cr-51	1500	50	
C-14	900	30	
H-3	360	12	* All sink disposals must be documented

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Exposure Information Request Form

Date: _____

To Previous Institution: _____

_____

_____

Dear Radiation Safety Officer:

_____, DOB: _____, who is presently associated with Albert
Print Full Name Print Full Date of Birth

Einstein College of Medicine has advised us that _____was associated with your institution
Print Full Name

from _____ to _____ and while there, worked with radioactive materials and/or radiation producing
(Start Date) (End Date)

Machines. I would appreciate it if you would forward all pertinent previous radiation exposure data for this person to the below address.

Albert Einstein College of Medicine
Attention: James Harold, Radiation Safety Officer
1300 Morris Park Ave
Forchheimer, Room 800
Bronx, NY 10461

This information is requested under the provision of Article 175, New York City Radiological Health code, and Title 10 CFR Part 20, Regulations.

Please see authorization below from _____ to release this information.
(Print Full Name)

Thank you for your cooperation.

Respectfully,
James Harold, Radiation Safety Officer
E-MAIL: james.harold@einsteinmed.edu
PHONE: (718) 430-2243

AUTHORIZATION TO OBTAIN RADIATION EXPOSURE RECORDS

I hereby authorize and request that my radiation exposure records be released to the Albert Einstein College of Medicine's Radiation Safety Office.

_____ _____
(Signature) (Print Full Name)

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Wipe Test Calibration Worksheet

1. Standard Source for Calibration

Radioisotope: _____

Amount (microcuries): _____ (Note: Use less than 0.1 microcuries as standard)

2. Convert to DPM by multiplying Amount in microcuries by 2.22×10^6 dpm/uCi:

_____ X 2.22×10^6 dpm/uCi = _____ dpm
amount uCi amount dpm

Place standard solution in a scintillation vial with the liquid scintillation fluid used for your wipe tests and cap the vial. Run the standard with your wipe test vials and a background vial. Obtain results for the standard vial and background vial in counts per minute (cpm).

3. Calculate the net count rate by subtracting the background results from the standard or gross results:

Net Count Rate (cpm) = Gross Count Rate (cpm) – background (cpm)

Net Count Rate (cpm) = _____ - _____ = _____ cpm
gross cpm background cpm net cpm

4. Calculate the efficiency by dividing the net count rate (cpm) by the activity of the standard in dpm:

Efficiency = Net count rate (cpm) / Activity (dpm)

_____ / _____ = _____ cpm/dpm
net cpm activity efficiency

5. To calculate the activity for wipe tests in dpm, subtract the background results from the wipe test results and divide that by the efficiency in cpm/dpm:

$$\text{Wipe Test Activity (dpm)} = \frac{\text{Wipe Test Results (cpm)} - \text{background result (cpm)}}{\text{Efficiency}}$$

_____ - _____ / _____ = _____ dpm
wipe test cpm background cpm efficiency activity

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The *“Radioactive Materials License Amendment Form”* will be added to this spot once in PDF

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Appendix B: Radioactive Hazard Group

Laboratory Classification Table: Radionuclides classified according to relative radiotoxicity per unit activity

Group 1: Very High Radiotoxicity

^{210}Pb	^{210}Po	^{223}Ra	^{226}Ra
^{228}Ra	^{227}Ac	^{227}Th	^{228}Th
^{230}Th	^{213}Pa	^{230}U	^{232}U
^{233}U	^{234}U	^{237}Np	^{238}Pu
^{239}Pu	^{240}Pu	^{241}Pu	^{242}Pu
^{241}Am	^{243}Am	^{242}Cm	^{243}Cm
^{244C}m	^{245C}m	^{246}Cm	^{249}Cf
^{250}Cf	^{252}Cf		

Group 2: High Radiotoxicity

^{22}Na	^{36}Cl	^{45}Ca	^{46}Sc	^{54}Mn	^{56}Co
^{60}Co	^{89}Sr	^{90}Sr	^{91}Y	^{95}Zr	^{106}Ru
$^{110}Ag_m$	$^{115}Cd_m$	$^{114}In_m$	^{124}Sb	^{125}Sb	$^{127}Te_m$
$^{129}Te_m$	^{124}I	^{126}I	^{131}I	^{133}I	^{134}Cs
^{137}Cs	^{140}Ba	^{144}Ce	^{152}Eu	^{154}Eu	^{160}Tb
^{170}Tm	^{181}Hf	^{182}Ta	^{192}Ir	^{204}Ti	^{207}Bi
^{210}Bi	^{211}At	^{212}Pb	^{224}Ra	^{228}Ac	^{230}Pa
^{234}Th	^{236}U	^{249}Bk			

Group 3: Moderate Radiotoxicity

^{7}Be	^{14}C	^{18}F	^{24}Na	^{38}Cl	^{31}Si	^{32}P	^{35}S	^{41}A	^{42}K	^{43}K
^{47}Ca	^{47}Sc	^{48}Sc	^{48}V	^{51}Cr	^{52}Mn	^{56}Mn	^{52}Fe	^{55}Fe	^{59}Fe	^{57}Co
^{58}Co	^{63}Ni	^{65}Ni	^{64}Cu	^{65}Zn	$^{69}Zn_m$	^{72}Ga	^{73}As	^{74}As	^{76}As	^{77}As
^{75}Se	^{82}Br	$^{85}Kr_m$	^{87}Kr	^{86}Rb	^{85}Sr	^{91}Sr	^{90}Y	^{92}Y	^{93}Y	^{97}Zr
$^{93}Nb_m$	^{95}Nb	^{99}Mo	^{96}Tc	$^{97}Tc_m$	^{97}Tc	^{99}Tc	^{97}Ru	^{103}Ru	^{105}Ru	^{106}Rh
^{103}Pd	^{109}Pd	^{105}Ag	^{111}Ag	^{109}Cd	^{115}Cd	$^{115}In_m$	^{113}Sn	^{125}Sn	^{122}Sb	^{125}Te
^{127}Te	^{129}Te	$^{131}Te_m$	^{132}Te	^{130}I	^{132}I	^{134}I	^{135}I	^{135}Xe	^{131}Cs	^{136}Cs
^{131}Ba	^{140}La	^{141}Ce	^{143}Ce	^{142}Pr	^{143}Pr	^{147}Nd	^{149}Nd	^{147}Pm	^{149}Pm	^{151}Sm
^{153}Sm	^{152}Eu	^{155}Eu	^{153}Gd	^{159}Gd	^{165}Dy	^{166}Dy	^{166}Ho	^{169}Er	^{171}Er	^{171}Tm
^{175}Yb	^{177}Lu	^{181}W	^{185}W	^{187}W	^{183}Re	^{186}Re	^{188}Re	^{185}Os	^{191}Os	^{193}Os
^{190}Ir	^{194}Ir	^{191}Pt	^{193}Pt	^{197}Pt	^{196}Au	^{198}Au	^{199}Au	^{197}Hg	$^{197}Hg_m$	^{203}Hg
^{200}Ti	^{201}Ti	^{202}Ti	^{203}Pb	^{206}Bi	^{212}Bi	^{220}Rn	^{222}Rn	^{231}Th	^{233}Pa	^{239}Np

Group 4: Low Radiotoxicity

^{3}H	^{15}O	^{37}A	$^{58}Co_m$	^{59}Ni	^{69}Zn	^{71}Ge	^{85}Kr	$^{85}Sr_m$	^{87}Rb	$^{91}Y_m$
^{93}Zr	^{97}Nb	$^{96}Tc_m$	$^{99}Tc_m$	$^{103}Rh_m$	$^{113}In_m$	^{125}I	^{129}I	$^{131}Xe_m$	^{135}Xe	$^{134}Cs_m$
^{135}Cs	$^{147}S_m$	^{187}Re	$^{191}Os_m$	$^{193}Pt_m$	$^{197}Pt_m$	^{232}Th	^{Nat}Th	^{235}U	^{238}U	^{Nat}U

* From *Safe Handling of Radionuclides*, IAEA Safety Standards

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TABLE II. LIMITATION ON ACTIVITIES IN VARIOUS TYPES OF WORKING PLACE OR LABORATORY

Radiotoxicity of Radionuclides	Minimum Significant Quantity (uCi)	Types of working place or laboratory required		
		Type C	**Type B**	**Type A**
1. Very high	0.1	10 μCi or less	10 μCi - 10 mCi	10 mCi or more
2. High	1.0	100 μCi or less	100 µCi - 100 mCi	100 mCi or more
3. Moderate	10	1 mCi or less	1 mCi - 1 Ci	1 Ci or more
4. Low	100	10 mCi or less	10 mCi - 10 Ci	10 Ci or more

Type C, Type B and Type A have the meanings normally used in the classification of laboratories for handling radioactive materials.

Type C is a good quality chemical laboratory.

Type B is a specially designed radioisotope laboratory.

Type A is a specially designed laboratory for handling large activities of highly radioactive materials.

In the case of a conventional modern chemical laboratory with adequate ventilation and fume hoods, as well as polished, easily cleaned, non-absorbing surfaces, etc., it would be possible to increase the upper limits of activity for Type-C laboratories towards the limits for Type-B laboratories for toxicity groups 3 and 4.

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Appendix C: Notice to Employees

NOTICE TO EMPLOYEES
STANDARDS FOR PROTECTION AGAINST RADIATION

YOUR EMPLOYERS RESPONSIBILITY

The transfer, receipt, possession or use of all sources of ionizing radiation in the City of New York is controlled by the applicable rules, regulations and orders of either the New York State Departments of Labor or the New York City Department of Health. These agencies require either the registration or licensing of all significant radiation sources and they require your employer to post or otherwise make available to you a copy of the applicable regulations, license and registration and the operating procedures applying to the work in which you are engaged and to explain relevant provisions to you. These documents are made available in the office of the Radiation Safety Officer or from the licensee

R.S.O. James Harold

Licensee: Albert Einstein College of Medicine

The applicable regulation in this installation is 24 RC NY Article 175.

YOUR RESPONSIBILITY AS A WORKER

You should familiarize yourself with the provisions of the New York City Health Code and your radioactive materials license and the operating procedures which apply to the work in which you are engaged. You should observe these provisions for your own protection and the protection of your co-workers.

WHAT IS COVERED BY THESE REGULATIONS

1. Limits on exposure to radiation and radioactive material In controlled areas;
2. Measures to be taken after accidental exposure;
3. Personnel monitoring, surveys and equipment;
4. Caution signs, labels, and safety interlock equipment
5. Exposure records and reports; and
6. Related matters.

REPORTS ON YOUR EXPOSURE TO RADIATION

If you work where personnel monitoring equipment is required the New York City Department of Health requires your employer to provide you, upon request, a written report of your exposure to radiation both annually and at the time that you terminate employment.

INSPECTIONS

All activities licensed or registered with the New York City Department of Health are subject to inspection. Any notice of violation involving radiological working conditions, any proposed imposition of civil penalty or order issued pursuant to the provisions of the New York City Health Code and any response from the licensee shall be posted within two (2) days after the receipt of the documents from the Department.

The licensee's response if any, shall be posted within two (2) working days after dispatch from the licensee. Such documents shall remain posted for a minimum of five (5) working days or until the action correcting the violation has been completed, whichever is later.

INQUIRIES

Inquiries dealing with matters outlined above can be directed to the:

New York City Department of Health and Mental Hygiene
Office of Radiological Health
42-09 28th Street
14th Floor CN-60
Long Island City, New York 11101

POSTING REQUIREMENT

Copies of this notice must be posted where employees working in or frequently any portion of controlled areas can observe a copy on the way to or from their place of employment

RC39(11/91)

Misc/forms/noticetoemployee

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Appendix D: Emergency Procedures for Radioisotope Users

EMERGENCY PROCEDURES FOR RADIOISOTOPE USERS

I. **Minor Spills** Involving no Radiation Hazard to Personnel: Survey Meter readings up to 2.5 mr/hr or for weak beta emitters such as H-3 or C-14 up to 100 uCi.
   1. **Notify all persons in the room at once.**
   2. Permit only the minimum number of persons necessary to deal with the spill into the areas.
   3. Confine the spill into the area using paper towels or absorbent pads.
   4. **Liquid Spills:** Don protective gloves; drop absorbent paper onto the spill.
   5. **Dry Spills:** Don protective gloves; dampen area of spill thoroughly making sure contamination is not spread.
   6. Using a soapy solution or professional decontamination spray and paper towels, clean the spill from the outside perimeter of the spill inward.
   7. Avoid spreading the contamination beyond its original area.
   8. Check the area for contamination using a wipe test.
   9. Clean area until contamination levels are below acceptable limits.
   10. Dispose of contaminated items as radioactive waste.

II. **Major Spills** Involving Radiation Hazards to Personnel.
   1. **Notify all persons not involved in spill to vacate the room at once.**
   2. If the spill is liquid, and the hands are protected, right the container.
   3. If the spill is on the skin, wash the affected area for at least 15 minutes.
   4. For a spill on clothing, remove outer garments and place in disposal bag, and keep contamination confined to the room in which the spill occurred.
   5. Switch off fans.
   6. Vacate the room.
   7. Notify the Radiation Safety Office at x2243 as soon as possible.

III. **Personal Contamination**
   1. Wash the affected area with lukewarm water and a mild soap for at least 15 minutes.
   2. Do not use an abrasive cleaner or brush.
   3. Survey the affected area with a GM detector if the contamination is a high-energy beta, gamma, or x-ray emitter. Otherwise, repeat the process three times to thoroughly clean the area.
   4. Report the contamination to the Radiation Safety Officer.

Accidents Involving Radioactive Dusts, Mists, Fumes, Organic Vapors and Gases
   1. Notify all other persons to vacate the room immediately.
   2. Hold breath and switch off all air circulating devices, if time permits.
   3. Vacate the room, close windows, lock door, and post notice at entrance.
   4. Notify the Radiation Safety Officer at x2243 at once.

Injuries to Personnel Involving Radioactive Materials
   1. For serious injuries, call 4111 to obtain EMTs and an ambulance.
   2. Wash minor wounds immediately under running water for at least 15 minutes to remove contamination.
   3. Make the victim comfortable and administer basic first aid, if qualified.
   4. Inform the EMTs that the individual is potentially contaminated with radioactive material.
   5. Report all radiation accidents to the Radiation Safety Officer as soon as possible (wounds, overexposure, ingestion, and inhalation.

Persons to be Notified in the Event of an Emergency

Radiation Safety Office	(718) 430-2243
Radiation Safety Officer	James Harold
Cell Phone	(646) 385-1304 – for emergencies only

24-Hour Emergency Number Dial x4111 and state the problem and your location. A Safety Officer will be notified.

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Appendix E: Instruction Concerning Prenatal Radiation Exposure

RECORD OF ATTENDANCE – PREGNANCY CONSULTATION

_____has completed a session with the Radiation Safety Officer in which the risks of working with radiation were reviewed, the NRC Guide 8.13 entitled "Instructions concerning prenatal exposure" was reviewed, and an opportunity to ask questions was given. A copy of their previous radiation exposure history to date was handed to her/them at this time.

Receipt of dosimetry records is dependent on the prompt receipt of the dosimeters by the Radiation Safety Officer for processing; therefore, it is important that all dosimeters be returned immediately upon receipt of the new monthly badges. This was stressed during the lecture.

Questions regarding the dosimeters are to be directed to the Radiation Safety Office:

Date of notification of pregnancy:_____

Date of Interview:_____

I hereby certify that I have attended the above referenced lecture and was informed according to the above statements.

I understand it is my responsibility to notify the Radiation Safety office in writing of any change in my status so that my personal dosimetry records may be properly monitored or discontinued.

Pregnant Worker: _____ _____
(Print Name) (Signature)

Radiation Safety Officer: _____ _____
(Print Name) (Signature)

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U.S. NUCLEAR REGULATORY COMMISSION

Revision 3
June 1999

REGULATORY GUIDE

OFFICE OF NUCLEAR REGULATORY RESEARCH

REGULATORY GUIDE 8.13

(Draft was issued as DG-8014)

INSTRUCTION CONCERNING PRENATAL RADIATION EXPOSURE

A. INTRODUCTION

The Code of Federal Regulations in 10 CFR Part 19, "Notices, Instructions and Reports to Workers: Inspection and Investigations," in Section 19.12, "Instructions to Workers," requires instruction in "the health protection problems associated with exposure to radiation and/or radioactive material, in precautions or procedures to minimize exposure, and in the purposes and functions of protective devices employed." The instructions must be "commensurate with potential radiological health protection problems present in the work place."

The Nuclear Regulatory Commission's (NRC's) regulations on radiation protection are specified in 10 CFR Part 20, "Standards for Protection Against Radiation"; and 10 CFR 20.1208, "Dose to an Embryo/Fetus," requires licensees to "ensure that the dose to an embryo/fetus during the entire pregnancy, due to occupational exposure of a declared pregnant woman, does not exceed 0.5 rem (5 mSv)." Section 20.1208 also requires licensees to "make efforts to avoid substantial variation above a uniform monthly exposure rate to a declared pregnant woman." A declared pregnant woman is defined in 10 CFR 20.1003 as a woman who has voluntarily informed her employer, in writing, of her pregnancy and the estimated date of conception.

This regulatory guide is intended to provide information to pregnant women, and other personnel, to help them make decisions regarding radiation exposure during pregnancy. This Regulatory Guide 8.13 supplements Regulatory Guide 8.29, "Instruction Concerning Risks from Occupational Radiation Exposure" (Ref. 1), which contains a broad discussion of the risks from exposure to ionizing radiation.

Other sections of the NRC's regulations also specify requirements for monitoring external and internal occupational dose to a declared pregnant woman. In 10 CFR 20.1502, "Conditions Requiring Individual Monitoring of External and Internal Occupational Dose," licensees are required to monitor the occupational dose to a declared pregnant woman, using an individual monitoring device, if it is likely that the declared pregnant woman will receive, from external sources, a deep dose equivalent in excess of 0.1 rem (1 mSv). According to Paragraph (e) of 10 CFR 20.2106, "Records of Individual Monitoring Results," the licensee must maintain records of dose to an embryo/fetus if monitoring was required, and the records of dose to the embryo/fetus must be kept with the records of dose to the declared pregnant woman. The declaration of pregnancy must be kept on file, but may be maintained separately from the dose records. The licensee must retain the re-

USNRC REGULATORY GUIDES

Regulatory Guides are issued to describe and make available to the public such information as methods acceptable to the NRC staff for implementing specific parts of the Commission's regulations, techniques used by the staff in evaluating specific problems or postulated accidents, and data needed by the NRC staff in its review of applications for permits and licenses. Regulatory guides are not substitutes for regulations, and compliance with them is not required. Methods and solutions different from those set out in the guides will be acceptable if they provide a basis for the findings requisite to the issuance or continuance of a permit or license by the Commission.

This guide was issued after consideration of comments received from the public. Comments and suggestions for improvements in these guides are encouraged at all times, and guides will be revised, as appropriate, to accommodate comments and to reflect new information or experience.

Written comments may be submitted to the Rules and Directives Branch, ADM, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001.

The guides are issued in the following ten broad divisions:

1. Power Reactors
2. Research and Test Reactors
3. Fuels and Materials Facilities
4. Environmental and Siting
5. Materials and Plant Protection
6. Products
7. Transportation
8. Occupational Health
9. Antitrust and Financial Review
10. General

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Issued guides may also be purchased from the National Technical Information Service on a standing order basis. Details on this service may be obtained by writing NTIS, 5285 Port Royal Road, Springfield, VA 22161.

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quired form or record until the Commission terminates each pertinent license requiring the record.

The information collections in this regulatory guide are covered by the requirements of 10 CFR Parts 19 or 20, which were approved by the Office of Management and Budget, approval numbers 3150-0044 and 3150-0014, respectively. The NRC may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number.

B. DISCUSSION

As discussed in Regulatory Guide 8.29 (Ref. 1), exposure to any level of radiation is assumed to carry with it a certain amount of risk. In the absence of scientific certainty regarding the relationship between low dose exposure and health effects, and as a conservative assumption for radiation protection purposes, the scientific community generally assumes that any exposure to ionizing radiation may cause undesirable biological effects and that the likelihood of these effects increases as the dose increases. At the occupational dose limit for the whole body of 5 rem (50 mSv) per year, the risk is believed to be very low.

The magnitude of risk of childhood cancer following in utero exposure is uncertain in that both negative and positive studies have been reported. The data from these studies "are consistent with a lifetime cancer risk resulting from exposure during gestation which is two to three times that for the adult" (NCRP Report No. 116, Ref. 2). The NRC has reviewed the available scientific literature and has concluded that the 0.5 rem (5 mSv) limit specified in 10 CFR 20.1208 provides an adequate margin of protection for the embryo/fetus. This dose limit reflects the desire to limit the total lifetime risk of leukemia and other cancers associated with

not withdrawn, the written declaration may be considered expired one year after submission.

5. Substantial Variations Above a Uniform Monthly Dose Rate

According to 10 CFR 20.1208(b), "The licensee shall make efforts to avoid substantial variation above a uniform monthly exposure rate to a declared pregnant woman so as to satisfy the limit in paragraph (a) of this section," that is, 0.5 rem (5 mSv) to the embryo/fetus. The National Council on Radiation Protection and Measurements (NCRP) recommends a monthly equivalent dose limit of 0.05 rem (0.5 mSv) to the embryo/fetus once the pregnancy is known (Ref. 2). In view of the NCRP recommendation, any monthly dose of less than 0.1 rem (1 mSv) may be considered as not a substantial variation above a uniform monthly dose rate and as such will not require licensee justification. However, a monthly dose greater than 0.1 rem (1 mSv) should be justified by the licensee.

contained in Regulatory Guide 8.29 (Ref. 1), this information may be included as part of the training required under 10 CFR 19.12.

2. Providing Instruction

The occupational worker may be given a copy of this guide with its Appendix, an explanation of the contents of the guide, and an opportunity to ask questions and request additional information. The information in this guide and Appendix should also be provided to any worker or supervisor who may be affected by a declaration of pregnancy or who may have to take some action in response to such a declaration.

Classroom instruction may supplement the written information. If the licensee provides classroom instruction, the instructor should have some knowledge of the biological effects of radiation to be able to answer questions that may go beyond the information provided in this guide. Videotaped presentations may be used for classroom instruction. Regardless of whether the licensee provides classroom training, the licensee should give workers the opportunity to ask questions about information contained in this Regulatory Guide 8.13. The licensee may take credit for instruction that the worker has received within the past year at other licensed facilities or in other courses or training.

3. Licensee's Policy on Declared Pregnant Women

The instruction provided should describe the licensee's specific policy on declared pregnant women, including how those policies may affect a woman's work situation. In particular, the instruction should include a description of the licensee's policies, if any, that may affect the declared pregnant woman's work situation after she has filed a written declaration of pregnancy consistent with 10 CFR 20.1208.

The instruction should also identify who to contact

D. IMPLEMENTATION

The purpose of this section is to provide information to licensees and applicants regarding the NRC staff's plans for using this regulatory guide.

Unless a licensee or an applicant proposes an acceptable alternative method for complying with the specified portions of the NRC's regulations, the methods described in this guide will be used by the NRC staff in the evaluation of instructions to workers on the radiation exposure of pregnant women.

REFERENCES

1. USNRC, "Instruction Concerning Risks from Occupational Radiation Exposure," Regulatory Guide 8.29, Revision 1, February 1996.

2. National Council on Radiation Protection and Measurements, *Limitation of Exposure to Ionizing Radiation*, NCRP Report No. 116, Bethesda, MD, 1993.

APPENDIX

QUESTIONS AND ANSWERS CONCERNING PRENATAL RADIATION EXPOSURE

1. Why am I receiving this information?

The NRC's regulations (in 10 CFR 19.12, "Instructions to Workers") require that licensees instruct individuals working with licensed radioactive materials in radiation protection as appropriate for the situation. The instruction below describes information that occupational workers and their supervisors should know about the radiation exposure of the embryo/fetus of pregnant women.

The regulations allow a pregnant woman to decide whether she wants to formally declare her pregnancy to take advantage of lower dose limits for the embryo/fetus. This instruction provides information to help women make an informed decision whether to declare a pregnancy.

2. If I become pregnant, am I required to declare my pregnancy?

No. The choice whether to declare your pregnancy is completely voluntary. If you choose to declare your pregnancy, you must do so in writing and a lower radiation dose limit will apply to your embryo/fetus. If you choose not to declare your pregnancy, you and your embryo/fetus will continue to be subject to the same radiation dose limits that apply to other occupational workers.

3. If I declare my pregnancy in writing, what happens?

If you choose to declare your pregnancy in writing, the licensee must take measures to limit the dose to your embryo/fetus to 0.5 rem (5 millisievert) during the entire pregnancy. This is one-tenth of the dose that an occupational worker may receive in a year. If you have already received a dose exceeding 0.5 rem (5 mSv) in the period between conception and the declaration of your pregnancy, an additional dose of 0.05 rem (0.5 mSv) is allowed during the remainder of the pregnancy. In addition, 10 CFR 20.1208, "Dose to an Embryo/Fetus," requires licensees to make efforts to avoid substantial variation above a uniform monthly dose rate so that all the 0.5 rem (5 mSv) allowed dose does not occur in a short period during the pregnancy.

This may mean that, if you declare your pregnancy, the licensee may not permit you to do some of your normal job functions if those functions would have allowed you to receive more than 0.5 rem, and you may not be able to have some emergency response responsibilities.

4. Why do the regulations have a lower dose limit for the embryo/fetus of a declared pregnant woman than for a pregnant worker who has not declared?

A lower dose limit for the embryo/fetus of a declared pregnant woman is based on a consideration of greater sensitivity to radiation of the embryo/fetus and the involuntary nature of the exposure. Several scientific advisory groups have recommended (References 1 and 2) that the dose to the embryo/fetus be limited to a fraction of the occupational dose limit.

5. What are the potentially harmful effects of radiation exposure to my embryo/fetus?

The occurrence and severity of health effects caused by ionizing radiation are dependent upon the type and total dose of radiation received, as well as the time period over which the exposure was received. See Regulatory Guide 8.29, "Instruction Concerning Risks from Occupational Exposure" (Ref. 3), for more information. The main concern is embryo/fetal susceptibility to the harmful effects of radiation such as cancer.

6. Are there any risks of genetic defects?

Although radiation injury has been induced experimentally in rodents and insects, and in the experiments was transmitted and became manifest as hereditary disorders in their offspring, radiation has not been identified as a cause of such effect in humans. Therefore, the risk of genetic effects attributable to radiation exposure is speculative. For example, no genetic effects have been documented in any of the Japanese atomic bomb survivors, their children, or their grandchildren.

7. What if I decide that I do not want any radiation exposure at all during my pregnancy?

You may ask your employer for a job that does not involve any exposure at all to occupational radiation dose, but your employer is not obligated to provide you with a job involving no radiation exposure. Even if you receive no occupational exposure at all, your embryo/fetus will receive some radiation dose (on average 75 mrem (0.75 mSv)) during your pregnancy from natural background radiation.

The NRC has reviewed the available scientific literature and concluded that the 0.5 rem (5 mSv) limit

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provides an adequate margin of protection for the embryo/fetus. This dose limit reflects the desire to limit the total lifetime risk of leukemia and other cancers. If this dose limit is exceeded, the total lifetime risk of cancer to the embryo/fetus may increase incrementally. However, the decision on what level of risk to accept is yours. More detailed information on potential risk to the embryo/fetus from radiation exposure can be found in References 2-10.

8. What effect will formally declaring my pregnancy have on my job status?

Only the licensee can tell you what effect a written declaration of pregnancy will have on your job status. As part of your radiation safety training, the licensee should tell you the company's policies with respect to the job status of declared pregnant women. In addition, before you declare your pregnancy, you may want to talk to your supervisor or your radiation safety officer and ask what a declaration of pregnancy would mean specifically for you and your job status.

In many cases you can continue in your present job with no change and still meet the dose limit for the embryo/fetus. For example, most commercial power reactor workers (approximately 93%) receive, in 12 months, occupational radiation doses that are less than 0.5 rem (5 mSv) (Ref. 11). The licensee may also consider the likelihood of increased radiation exposures from accidents and abnormal events before making a decision to allow you to continue in your present job.

If your current work might cause the dose to your embryo/fetus to exceed 0.5 rem (5 mSv), the licensee has various options. It is possible that the licensee can and will make a reasonable accommodation that will allow you to continue performing your current job, for example, by having another qualified employee do a small part of the job that accounts for some of your radiation exposure.

9. What information must I provide in my written declaration of pregnancy?

You should provide, in writing, your name, a declaration that you are pregnant, the estimated date of conception (only the month and year need be given), and the date that you give the letter to the licensee. A form letter that you can use is included at the end of these questions and answers. You may use that letter, use a form letter the licensee has provided to you, or write your own letter.

10. To declare my pregnancy, do I have to have documented medical proof that I am pregnant?

NRC regulations do not require that you provide medical proof of your pregnancy. However, NRC regulations do not preclude the licensee from requesting medical documentation of your pregnancy, especially if a change in your duties is necessary in order to comply with the 0.5 rem (5 mSv) dose limit.

11. Can I tell the licensee orally rather than in writing that I am pregnant?

No. The regulations require that the declaration must be in writing.

12. If I have not declared my pregnancy in writing, but the licensee suspects that I am pregnant, do the lower dose limits apply?

No. The lower dose limits for pregnant women apply only if you have declared your pregnancy in writing. The United States Supreme Court has ruled (in *United Automobile Workers International Union v. Johnson Controls, Inc.*, 1991) that "Decisions about the welfare of future children must be left to the parents who conceive, bear, support, and raise them rather than to the employers who hire those parents" (Reference 7). The Supreme Court also ruled that your employer may not restrict you from a specific job "because of concerns about the next generation." Thus, the lower limits apply only if you choose to declare your pregnancy in writing.

13. If I am planning to become pregnant but am not yet pregnant and I inform the licensee of that in writing, do the lower dose limits apply?

No. The requirement for lower limits applies only if you declare in writing that you are already pregnant.

14. What if I have a miscarriage or find out that I am not pregnant?

If you have declared your pregnancy in writing, you should promptly inform the licensee in writing that you are no longer pregnant. However, if you have not formally declared your pregnancy in writing, you need not inform the licensee of your nonpregnant status.

15. How long is the lower dose limit in effect?

The dose to the embryo/fetus must be limited until you withdraw your declaration in writing or you inform the licensee in writing that you are no longer pregnant. If the declaration is not withdrawn, the written declaration may be considered expired one year after submission.

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16. If I have declared my pregnancy in writing, can I revoke my declaration of pregnancy even if I am still pregnant?

Yes, you may. The choice is entirely yours. If you revoke your declaration of pregnancy, the lower dose limit for the embryo/fetus no longer applies.

17. What if I work under contract at a licensed facility?

The regulations state that you should formally declare your pregnancy to the licensee in writing. The licensee has the responsibility to limit the dose to the embryo/fetus.

18. Where can I get additional information?

The references to this Appendix contain helpful information, especially Reference 3, NRC's Regulatory Guide 8.29, "Instruction Concerning Risks from Occupational Radiation Exposure," for general information on radiation risks. The licensee should be able to give this document to you.

For information on legal aspects, see Reference 7, "The Rock and the Hard Place: Employer Liability to Fertile or Pregnant Employees and Their Unborn Children—What Can the Employer Do?" which is an article in the journal *Radiation Protection Management*.

You may telephone the NRC Headquarters at (301) 415-7000. Legal questions should be directed to the Office of the General Counsel, and technical questions should be directed to the Division of Industrial and Medical Nuclear Safety.

You may also telephone the NRC Regional Offices at the following numbers: Region I, (610) 337-5000; Region II, (404) 562-4400; Region III, (630) 829-9500; and Region IV, (817) 860-8100. Legal questions should be directed to the Regional Counsel, and technical questions should be directed to the Division of Nuclear Materials Safety.

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REFERENCES FOR APPENDIX

1. National Council on Radiation Protection and Measurements, *Limitation of Exposure to Ionizing Radiation*, NCRP Report No. 116, Bethesda, MD, 1993.

2. International Commission on Radiological Protection, *1990 Recommendations of the International Commission on Radiological Protection*, ICRP Publication 60, Ann. ICRP 21: No. 1-3, Pergamon Press, Oxford, UK, 1991.

3. USNRC, "Instruction Concerning Risks from Occupational Radiation Exposure," Regulatory Guide 8.29, Revision 1, February 1996.[1] (Electronically available at www.nrc.gov/NRC/RG/index.html)

4. Committee on the Biological Effects of Ionizing Radiations, National Research Council, *Health Effects of Exposure to Low Levels of Ionizing Radiation* (BEIR V), National Academy Press, Washington, DC, 1990.

5. United Nations Scientific Committee on the Effects of Atomic Radiation, *Sources and Effects of Ionizing Radiation*, United Nations, New York, 1993.

6. R. Doll and R. Wakeford, "Risk of Childhood Cancer from Fetal Irradiation," *The British Journal of Radiology*, 70, 130-139, 1997.

7. David Wiedis, Donald E. Jose, and Timm O. Phoebe, "The Rock and the Hard Place: Employer Liability to Fertile or Pregnant Employees and Their Unborn Children—What Can the Employer Do?" *Radiation Protection Management, 11,* 41-49, January/February 1994.

8. National Council on Radiation Protection and Measurements, *Considerations Regarding the Unintended Radiation Exposure of the Embryo, Fetus, or Nursing Child*, NCRP Commentary No. 9, Bethesda, MD, 1994.

9. National Council on Radiation Protection and Measurements, *Risk Estimates for Radiation Protection*, NCRP Report No. 115, Bethesda, MD, 1993.

10. National Radiological Protection Board, *Advice on Exposure to Ionising Radiation During Pregnancy*, National Radiological Protection Board, Chilton, Didcot, UK, 1998.

11. M.L. Thomas and D. Hagemeyer, "Occupational Radiation Exposure at Commercial Nuclear Power Reactors and Other Facilities, 1996," Twenty-Ninth Annual Report, NUREG-0713, Vol. 18, USNRC, 1998.[2]

[1]Single copies of regulatory guides, both active and draft, and draft NUREG documents may be obtained free of charge by writing the Reproduction and Distribution Services Section, OCIO, USNRC, Washington, DC 20555–0001, or by fax to (301)415–2289, or by email to <DISTRIBUTION@NRC.GOV>. Active guides may also be purchased from the National Technical Information Service on a standing order basis. Details on this service may be obtained by writing NTIS, 5285 Port Royal Road, Springfield, VA 22161. Copies of active and draft guides are available for inspection or copying for a fee from the NRC Public Document Room at 2120 L Street NW., Washington, DC; the PDR's mailing address is Mail Stop LL-6, Washington, DC 20555; telephone (202)634–3273; fax (202)634–3343.

[2]Copies are available at current rates from the U.S. Government Printing Office, P.O. Box 37082, Washington, DC 20402–9328 (telephone (202)512–1800); or from the National Technical Information Service by writing NTIS at 5285 Port Royal Road, Springfield, VA 22161. Copies are available for inspection or copying for a fee from the NRC Public Document Room at 2120 L Street NW., Washington, DC; the PDR's mailing address is Mail Stop LL-6, Washington, DC 20555; telephone (202)634–3273; fax (202)634–3343.

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FORM LETTER FOR DECLARING PREGNANCY

This form letter is provided for your convenience. To make your written declaration of pregnancy, you may fill in the blanks in this form letter, you may use a form letter the licensee has provided to you, or you may write your own letter.

DECLARATION OF PREGNANCY

To:_____

In accordance with the NRC's regulations at 10 CFR 20.1208, "Dose to an Embryo/Fetus," I am declaring that I am pregnant. I believe I became pregnant in_____ (only the month and year need be provided).

I understand the radiation dose to my embryo/fetus during my entire pregnancy will not be allowed to exceed 0.5 rem (5 millisievert) (unless that dose has already been exceeded between the time of conception and submitting this letter). I also understand that meeting the lower dose limit may require a change in job or job responsibilities during my pregnancy.

_____
(Your signature)

_____
(Your name printed)

_____
(Date)

8.13–8

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