

The University of Texas at El Paso Radiation Safety Manual



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Radiation Safety Manual Notice

The purpose of this manual is to supplement federal, state, and local regulations for the control of radiation and in no case is it intended to replace these regulations.

In the event that existing or future federal, state, or local regulations are found to differ from the requirements contained in this manual, those legally accepted regulations shall be followed.

This Radiation Safety Manual has been approved by the Texas Department of State Health Services, Radiation Safety Licensing Branch and replaces all regulations and procedures for the use of radioisotopes and ionizing radiation previously issued by the University.

Copies of the Texas Administrative Code regulations for Control of Radiation, the University radioactive material license, conditions or documents incorporated into the license, and amendments thereto are available for inspection in the Environmental Health and Safety department at the El Paso Natural Gas Conference Center, Room 010, 2051 Wiggins Rd, El Paso, TX 79968.

Also available are copies of the University Certificate of Registration for X-ray Producing Devices including supporting documents and correspondence and any notice of violation involving radiological working conditions.

Radiation Safety Manual Directory

Environmental Health and Safety department, El Paso Natural Gas Conference Center (EPNGCC), Room 010, 2051 Wiggins Rd., El Paso, TX 79968

Gustavo Rojo, Radiation Safety Officer
Phone: (915) 747-7160

Emilio Rodriguez, Assistant Vice President for EH&S
Phone: (915) 747-7179

The University of Texas at El Paso Police
Phone: (915) 747-5611

Texas Department of State Health Services, Radiation Licensing Branch
Phone: (512) 834-6688

In case of incidents involving unusual radiation exposure, all personnel and students are to contact one of the above immediately.

Radiation Safety Manual

Forward

General Remarks

The University has been granted an Academic Radioactive Material License by the Texas Department of State Health Services, Radiation Licensing Branch for research, development, and instruction.

A Certificate of Registration for use of x-ray producing equipment has also been granted by the Texas Department of State Health Services.

The use of radiation in a university where a large number of people may be unaware of their exposure to radiation hazards makes strict adherence to procedures established by federal and state authorities of paramount importance for the protection of the University and the safety of faculty, staff, and students. The purpose of this manual is to present the guidelines necessary for a successful Radiation Safety Program. Further information can be found in Title 25 Texas Administrative Code (TAC) §289.203, §289.251, §289.251, §289.252, and §289.259.

Environmental Health and Safety Department

The Environmental Health and Safety department has the responsibility for maintaining an effective radiation control program for the University. In addition to seeing that the University is in compliance with the requirements of the Texas Department of State Health Services radiation control regulations, the Environmental Health and Safety department will make every reasonable effort to maintain radiation exposures and releases of radioactive materials in effluents to unrestricted areas, as low as reasonably achievable.

It is the responsibility of all faculty, staff and students involved in radiation work to familiarize themselves thoroughly with the University's radiation control processes outlined in this manual, and to comply with its requirements and all applicable federal and state regulations.

Radiation Safety Officer Responsibilities

The Radiation Safety Officer acts as the delegated authority of the Texas Department of State Health Services in the day-to-day implementation of policies and practices regarding the safe use of radioisotopes and sources of radiation, including non-ionizing radiation.

The Radiation Safety Officer is ultimately responsible for the following:

- Terminate any operations which are deemed radiation hazards.
- Perform periodic inspections of areas where sources of radiation are stored and used.
- See that records of radiation surveys and inventories of radioisotopes are maintained for each faculty member who is authorized to use radioactive material and sources of radiation.
- Develop the rules and procedures needed to control the procurement and use of radioisotopes and sources of radiation at the University.

- Prepare such instructions as are necessary to provide adequate protection of University personnel in compliance with state and federal regulations.
- Provide a service for periodic calibration of survey instruments or have the instruments calibrated by an outside entity licensed by the Texas Department of State Health Services to provide such calibration services.
- Maintain a comprehensive file on personnel radiation dose records; receipt, use, storage, and disposal of radioisotopes; and all other matters pertinent to the Program involving radiation control.
- Periodically evaluate the results of leak tests on sealed sources and recommend action to comply with State and Federal regulations.
- Review and evaluate safety precautions and procedures for each prospective user of radioactive materials and radiation producing equipment prior to purchasing radioisotopes or operating a source of ionizing radiation. Safety precautions and procedures must be approved by the Texas Department of State Health Services before an authorization to use radioisotopes or radiation-producing equipment can be issued.
- Act as the principal liaison between the University and state and/or federal authorities in matters of radiation safety and license requirements.
- Arrange for the disposal of radioactive waste.
- Advise and assist University personnel in matters of radiation safety (radiation monitoring, area posting and record keeping) and in procuring, using, storing, and disposing of radiation sources.
- Providing overall administrative direction of the University Radiation Safety Program.

Radiation Safety Manager and Health Physics Consultants

The Radiation Safety Officer designates qualified personnel to carry out the Radiation Safety Program duties.

Authority of the Radiation Safety Officer

The Radiation Safety Officer has the authority to suspend the use of radioactive materials at any time it is deemed to be necessary. Repeated violations of University policy and radiation safety are reasons for such actions. Suspended privileges can only be regained after the Radiation Safety Officer has given approval.

Radiation Safety Manual

General Information

Authorization for Procurement of Radioactive Material

The University of Texas at El Paso has been issued an academic radioactive materials license by the Texas Department of State Health Services to possess and use radioactive materials.

Each applicant for authorized use must have sufficient training and experience in the use of radioactive materials so that the proposed work is conducted in a safe manner. This information and other facts necessary for the Texas Department of State Health Services' evaluation of the applicant's abilities are obtained by the submission of a Radioactive Material License Application form by the applicant to the Environmental Health and Safety department ([Appendix B](#)). The Radiation Safety Officer will perform a preliminary evaluation of the applicant and an inspection of the proposed use area.

Authorized faculty members, otherwise referred to as authorized users, are responsible for the safe use of radioactive materials and radiation producing equipment. The Environmental Health and Safety department must carry out the required administrative and safety procedures, approve laboratory practices which are applicable to the work to be conducted, supervise the people who work with radioactive materials, acquaint them with proper radiation safety practices, and see that these practices are observed. The Environmental Health and Safety department must maintain the proper records on the receipt, use, transfer, storage, and disposal of radioisotopes, and on the radiation surveys and wipes conducted in the immediate area of use. Any persons working with radioactive materials must immediately notify the Environmental Health and Safety department if, during an experiment, any unexpected difficulties arise which might affect the safety of personnel, students, or the public.

Requirements for the Purchase of Radioactive Material or Sources

Authorized users may purchase radioactive materials by the steps indicated below. Failure to do so will result in a delay in receiving the material.

- Any purchase requisition for radioactive material must be accompanied by a completed copy of the "Request to Order Radioactive Material" form (see [Appendix C](#)). This form must be signed by both the authorized user and the Radiation Safety Officer, or the RSO designee, the Radiation Safety Manager. Before signing the form authorizing procurement of isotopes, the Environmental Health and Safety department will examine inventory records to determine if its approval of the purchase would result in the license limits being exceeded. All shipment of radioactive materials must be delivered to Environmental Health and Safety. Central Receiving has been instructed not to accept any radioactive material shipments. For this reason, if a licensed user obtains a purchase order for radioactive material to be delivered on an as needed basis, it will be necessary to have a request form signed by the Radiation Safety Officer before each shipment.

- ***Radioactive materials or sources may not be directly received by a faculty member.*** The shipping address must be the following:

Ship To:

Environmental Health and Safety
The University of Texas at El Paso
El Paso Natural Gas Conference Center, Room 010
2051 Wiggins Rd
El Paso, Texas 79968-0648

The Purchasing Department will not process any purchase order for radioactive materials or sources that have not received prior approval by the Environmental Health and Safety department.

Note: It is suggested that purchase requests for perishable or short-lived radioactive materials include shipping instructions that require the vendor to ship the material early in the week to avoid weekend delivery when the University is closed.

Proper Package Handling of Radioactive Materials or Sources upon receipt by the Environmental Health and Safety department

- Upon receipt of radioactive material or sources by the University, the Environmental Health and Safety department will monitor/survey the package and its contents to evaluate container integrity. On weekends, it will be taken to the appropriate location by University police, where it will be secured until processed.
- The package containing the radioactive material will be monitored for external contamination caused by leakage of the radioactive contents unless the contents are exempted by the Texas Regulations for Control of Radiation. For packages requiring monitoring, the monitoring shall be performed as soon as practical after receipt, but no later than three hours after the package is received at UTEP if received during normal working hours, or no later than three hours from the beginning of business the next working day if received after normal working hours. (Appendix B describes correct procedures for examining incoming packages for leakage, contamination or damage, and for safely opening packages).
- After the required monitoring is completed, the shipment will be assigned a Radioactive Material (RAM) inventory number. This number will be placed on the primary container and on the inventory forms.
- A Radioactive Material Data Form (see [Appendix C](#)) will be prepared and issued to the licensee for each inventory number assigned. This form will provide basic information on the shipment as well as the date of receipt, person performing survey, and what survey instrument(s) was used, if applicable.
- Radiation Safety Personnel will promptly notify the appropriate person when a shipment of radioactive material arrives. It will be the individual's responsibility to make arrangements to have the radioactive material picked up or have it delivered.

Responsibilities of the Licensee and Authorized Users

- Upon receiving the radioactive material and forms, the user will verify the shipment of the requested radioactive material and the receipt of the proper forms. The individual receiving the material must sign the Radioactive Material Data Form. That individual is then given the original form and one copy. The Environmental Health and Safety department will retain one copy and will place that copy in the licensee's file under "Current Inventory".
- The Radioactive Material Data Form is used to indicate the licensee's use and disposal of material. At a time when the material is no longer useful, the total amount disposed in the sewage system or placed in the disposal barrels must be indicated on the Radioactive Material Data Form (See section entitled "[Radioactive Material Disposal Practices](#)"). Disposal information should be as accurate as possible because these data provide the basis for university radioactive material disposal reports as required by the Texas Regulations for Control of Radiation.
- Upon completion of the Radioactive Material Data Form indicating the above information, the original copy must be returned to the Environmental Health and Safety department as soon as possible. The duplicate is retained by the licensee for personal files so that disposition of the material is known. The licensee should be aware that until the original is returned to the Environmental Health and Safety department, the material will remain in the user's inventory. This may interfere with future shipments being approved because the inventory indicates that the licensee has the maximum permissible quantity of radioactive material in his possession.
- As per 25 TAC §289.252(x)(11); Authorized users shall not hold radioactive waste, sources, or devices not authorized for disposal by decay in storage, and that are not in use for longer than 24 months following the last principal activity use. The authorized user must complete the usage log section in the Radioactive Material Data Form within the 24 month period to document the date of last usage. Radioactive materials that exceed a 24 month non-usage period will be picked up for disposal by EH&S unless an alternative disposal plan is approved by TDSHS within the 24 month period. An authorized user may submit a plan for an alternative disposal timeframe to the RSO no later than 60 days prior to the end of the 24 months of nonuse. The alternative disposal plan shall be reviewed by the RSO and submitted to TDSHS for approval. If TDSHS denies an alternative disposal plan, the radioactive materials shall be picked up for disposal.
- Each Authorized User shall immediately report to the RSO at the EH&S office any lost, missing, or suspected stolen radioisotopes. The RSO will report all such validated claims of lost, missing or stolen materials to the Texas Department of State Health Services.
- Only EH&S personnel trained and current via timely 3-year DOT refreshers shall prepare Radiation Packages for Transport in accordance with 49 CFR Part 172, Subpart H shall prepare packaging and shipping manifests. All such training shall be completed prior to placing materials into transport with an approved and bonded carrier. The same packaging requirements shall be followed for materials transported using University owned and operated vehicles between the University campus and University owned sites remote from the main campus. All material packages shall be monitored/surveyed and documentation retained to assure that containers are sufficiently sealed against contamination leakage and packaging does not exceed limits in 25 TAC§289.257(e) and DOT regulations in Title 49 CFR Part 107, Parts 171 – 180 and 390 – 397.

Radioactive Material Disposal Practices

Radioactive material may be released to the environment only under strictly controlled conditions approved by the Radiation Safety Officer. Detailed records must be kept as to the method of disposal as well as the activity of the material disposed of. Copies of these disposal records must be sent to the Environmental Health and Safety department as wastes are disposed. It is the shared responsibility of the authorized user and the Radiation Safety Officer to see that the applicable regulations for radioactive waste disposal are met. Authorized users shall not dispose of radioactive material except in the following manners, if specifically approved by the Radiation Safety Officer:

- Release into sanitary sewage system. Liquid radioactive waste may be placed in the sewage system provided the material is soluble or dispersible in water and the amount disposed does not result in concentrations that exceed those permitted by the Texas Regulations for Radiation Control. Check with the Radiation Safety Officer for the amount of activity of each nuclide that can be disposed of in this manner from your lab space. Following sink disposal, the water should be left running for several minutes.
- Placing of waste in drums provided by licensed Disposal Company. Solid wastes may be placed in fifty-five gallon steel drums provided by a licensed waste disposal company. Such waste includes contaminated gloves, "diapers," small volumes of liquid in sealed containers (i.e., scintillation vials), etc. The Radiation Safety personnel from the EH&S department will pick up this type of waste from your laboratory and place it into the disposal drums upon receipt of a waste disposal request form. The waste must be in closed bags or containers and must be identified with a radioactive waste tag indicating the radionuclide, the approximate activity of the waste when placed into the container (in microcuries or millicuries), and the date.
- Transfer of radioactive material from one licensee to another. Radioactive material may be transferred from one licensee to another as a means of removing material from a Radiation license inventory. However, the transaction can only take place with prior approval by all of the Radiation Safety Officer, the receiving licensee's Radiation Safety Officer, and the receiving licensee must be licensed to possess the material up to the activity being transferred. Procedurally speaking, such a transfer must be initiated by the transferring license holder's RSO and must follow all conditions for transfer, verification procedures, and record retention for transfers as outlined in accordance with 25 TAC §289.252(cc) of the Texas Regulations for Radiation Control.
- Storage of radioactive material for radioactive decay. For radionuclides with short half-life less than or equal to 120 days, it may be practical to store the waste until it has undergone sufficient radioactive decay (10 or more half-lives of decay). The waste container can then be monitored at the surface prior to disposal to ensure radioactivity is indistinguishable from background with an appropriate survey meter set on its most sensitive scale and with no interposed shielding. All radiation labels will be obliterated or removed prior to disposal. Records of surveys will be retained to include the date, a unique identification of the meter used, the background radiation level, the radiation level at the surface of each container and the name of the individual who performed the survey. The waste materials can then be treated as non-radioactive or disposed of by one of the above methods. Whenever practicable, this method should be used. The procedure for having the Environmental Health and Safety department pick up material for storage and

decay is the same as that described above for waste to be placed in disposal drums. For more information, contact the Radiation Safety Officer.

- Incineration of biological materials containing ^3H or ^{14}C . UTEP's radioactive material license from the Texas Department of State Health Services permits the incineration of a limited quantity of ^3H or ^{14}C in animal carcasses or other biological research materials, provided the activity concentration of ^3H or ^{14}C is less than or equal to $0.05 \mu\text{Ci/gram}$. Given material activity concentration that can be disposed of in this manner is so limited, only faculty members specifically authorized to do so may incinerate if expressly authorized to do so by the Radiation Safety Officer each time disposal by incineration is to be performed. In the event of disposal by incineration, activity may not be greater than $0.05 \mu\text{Ci/gram}$ of material, and the subsequently produced ash must be sampled by the RSO to assure proper disposal of the resulting ash is documented properly.

Use of Radioactive Material in Humans

Human use is not allowed under the radioactive materials license.

Use of Radioactive Material in Animals

- Radioactive materials are not to be administered to research animals unless the user has received prior approval of the specific research protocol by the Radiation Safety Officer. The specifics of the planned work must include provisions limiting the isotopes and the concentrations to be used in the animals.
- Animals which have been administered radioactive material are not to be housed in the general animal care facilities. Alternative housing and appropriate warning signage must be approved by the Radiation Safety Officer and the director of the animal care facility. Users desiring to house such animals in the animal care facility but separate from other animals must submit information to the Radiation Safety Officer, which will ensure a safe environment for all personnel and non-radioactive animals. The information must include a copy of instructions provided to animal caretakers for the handling of animals, animal waste and carcasses, and for cleaning and decontamination of animal cages, and procedures for guaranteeing the security of the area.

Location of Use of Radioactive Materials

- Radioactive materials are to be used only in those facilities, which have been approved by the Radiation Safety Officer.
- When vacating an area where radioactive materials have been used, radiation surveys and/or wipe tests must be performed and the results sent to the Environmental Health and Safety department so that the licensee is released from further responsibility for radiation safety in that area.

Absence of Licensee

- If any user wishes to be absent from the campus for an interval of time greater than three weeks, the following must be performed:

- I. Suspend the use of radionuclides currently possessed, or
 - II. Notify the Radiation Safety Officer as to the responsible user who will take over the supervision of the use of the radionuclides. This user must be competent in the use of radionuclides.
- If a user is leaving the campus for a visiting professorship or sabbatical at another institution, radioactive material may be transferred there pending notification of approval by the Radiation Control programs of both institutions. If radioactive material is not to be transferred, it may be transferred to another licensee with the approval of the Radiation Safety Officer, or the material may be disposed of as per approval of the Radiation Safety Officer.

Radiation Safety Manual Radiation Safety Operational Procedures

Posting of Restricted Areas

Areas in which access is controlled by the authorized user for purposes of protection of individuals from exposure to radiation and radioactive material will be designated as "**Restricted Areas**". These areas or rooms must be posted with appropriate radiation caution signs or labels bearing the three-bladed design in magenta on a yellow background unless exempted by 25 TAC§289.202 (dd).

The presence of radioactive material will be noted by a "**Caution - Radioactive Material**" sign or label. If conditions in a room or area are such that an individual could receive in any one hour more than 5 millirems, a sign showing the radiation symbol and the words "**Caution - Radiation Area**" must be displayed. If an individual could receive more than 100 millirems in any one hour, a sign showing the radiation symbol and the words, "**Caution - High Radiation Area**" must be displayed. Storage areas must be labeled if the dose rates exceed 0.5 mR/hr. There are also specific requirements for the labeling of radiation-producing devices. Labels shall be visibly affixed on the face of the control unit, which warns individuals that radiation is produced when the machine or device is in operation.

Unless the above conditions exist, the described signs and labels must not be displayed. Shipping or storage containers no longer holding radioactive materials must have the caution signs removed or defaced. Additional posting information may be found in the 25 TAC §289.202 (z)-(ee).

Personnel and Student Radiation Monitoring

Since radiation cannot be seen and affects none of the senses, it is necessary to use special means of recording exposures to individuals. This is accomplished in compliance with 25 TAC §289.202(q) by using film badges, electronic "Instadose" badges, pocket ionization chambers, or thermo-luminescent dosimeters (TLDs).

Film or Instadose badges are used when monitoring individuals over extended periods of time; usually a month or longer. Pocket ionization chambers are used when it is necessary to monitor an individual for a short time and/or obtain an immediate reading. TLDs are usually used for monitoring the extremities, such as hands or fingers and film badges for monitoring the whole body. Personnel Monitor Request Forms may be obtained from the Environmental Health and

Safety department. Personnel dosimetry records are maintained by the Radiation Safety Officer and are kept in the Environmental Health and Safety department. An individual desiring the review personal records may do so by contacting the Environmental Health and Safety department. A sample form is included in [Appendix A](#).

The University will monitor occupational exposure to radiation and supply and require the use of individual monitoring devices by: (A) adults likely to receive, in one year from sources external to the body, a dose in excess of 10% of the Radiation Maximum Permissible Dose (MPD); (B) minors likely to receive, in one year from sources of radiation external to the body, a deep dose equivalent in excess of 0.1 rem (1 mSv), a lens dose equivalent in excess of 0.15 rem (1.5 mSv), or a shallow dose equivalent to the skin or to the extremities in excess of 0.5 rem (5 mSv); (C) declared pregnant women likely to receive during the entire pregnancy, from sources of radiation external to the body, a deep dose equivalent in excess of 0.1 rem (1 mSv); and (D) individuals entering a high or very high radiation area.

The University will monitor, to determine occupational intake of radioactive material by and assess the committed effective dose equivalent to: (A) adults likely to receive, in one year, an intake in excess of 10% of the applicable ALI in Columns 1 and 2 of Table I of in 25 TAC §289.202 (ggg)(2).

Radiation Dose Limits

The federal and state governments have set limits as to the maximum amount of radiation that an individual may receive. These limits, called Maximum Permissible Doses (MPDs), are set well below levels at which adverse effects are likely to occur.

MPDs are set very low in an effort to minimize the incidence of genetic effects for the population as a whole. It should be noted that these dose limits do not include any dose received by an individual as a patient or the dose from natural background radiation.

It is emphasized that the risk to individuals exposed to an MPD or the dose limits for the population is considered to be very small; however, risk increases with increasing dose. For this reason, it is desirable to keep radiation exposures to a minimal dose.

MPDs for Radiation Workers and Non-Worker Public	Hourly Dose Limit	Annual Dose Limit
Total effective body dose		5 rem
Sum of deep dose equivalent to any individual organ or tissue other than the lens of the eye		50 rem
Lens of the eye		15 rem
Shallow dose equivalent to the skin or any extremity		50 rem
Non-worker public dose limit	2 mrem	100 mrem

A "Radiation Worker" is an individual who, in the course of employment, is exposed to radiation. Individuals under the age of 18 years cannot be classified as radiation workers. Their exposure is limited to 10% of the limits specified above.

The licensee or individual in charge of X-ray producing devices is responsible for ensuring that the applicable MPDs are not exceeded.

Bioassay for internal exposure monitoring

Where activity levels warrant, bioassays are performed on persons who use unsealed quantities of radioactive materials to determine whether any activity has entered the body. The results are used to:

1. Estimate internal organ doses.
2. Determine the presence of airborne radioactive materials.
3. Evaluate work habits, experimental and facility design. Bioassays are performed either by:
 - a. Analyzing samples of blood, urine, or tissue. OR
 - b. Monitoring the organ of interest to determine the presence and quantity of radioisotopes. The method chosen depends upon the type of radioisotope involved (e.g. urine analysis for ^3H or thyroid scanning for ^{125}I).

Bioassay for ^3H , ^{14}C , ^{32}P , ^{35}S and other non-radioiodine materials

When there is an airborne activity risk that would lend itself to personnel exposures through internal contamination, UTEP requires that individuals handling greater than 100 mCi of potentially volatile ^3H , or greater than 50 mCi of potentially volatile ^{14}C , ^{32}P and ^{35}S shall perform a bioassay after such uses and document the results in a logbook. However, no individuals of the UTEP campus are authorized up to these limits. Still, it is recommended that individuals who in a single experiment use millicurie (mCi) quantities of any volatile radioisotope without the benefit of a fume hood should perform a urine assay after such uses.

Bioassay Procedure

Urine is analyzed to estimate any uptake of radioactive materials other than radioiodine.

1. Place 1cc of urine in a scintillation counting vial.
2. Add 9cc of liquid scintillation cocktail.
3. Set the counter for the appropriate radioisotope.
4. Count the sample for 1 minute.
5. Count a 10cc LS cocktail for 1 minute as a background count (C_b).
6. Obtain net count (C_n). $C_n = C_s - C_b$
7. Divide the net count by counter efficiency to obtain dpm. ($\text{dpm} = C_n / \text{efficiency}$)
8. Convert dpm to activity (μCi).

Log the results in the appropriate radioisotope bioassay record sheet. The results of the calculations on the record sheet should be compared with Annual Limit of Intake (ALI). If the calculated body burdens exceed 10% of ALI values, inform the Radiation Safety Officer (RSO) so that an investigation can be conducted to determine the causes of the uptake and recommendations for remedial can action be made.

Maximum Values

Reference Annual Limit of Intake (ALI). The activity should not exceed the following values:

Isotope	ALI (μCi)
H-3	8×10^4
C-14	2×10^3
P-32	6×10^2

Bioassay for ¹²⁵I and ¹³¹I

The bioassay program is developed for persons working with radioiodine to aid in determining the extent, if any, of an individual's exposure to concentrations of airborne radioiodine.

Bioassays are performed by measuring the emissions from radioiodine within the thyroid.

Bioassays are performed for those quantities listed below, by appointment with the Radiation Safety Officer:

For ¹²⁵I, Occupational ALI (40 μCi):

(A=) Single Purchase (mCi)	Frequency
1.0 < A < 15.0, Volatile	Quarterly
15.0 < A < 20.0, Volatile	Monthly
20.0 < A , Volatile	Within 14 Days
5.0 < A , Non-Volatile	Quarterly

For ¹³¹I, Occupational ALI (30 μCi):

¹³¹I users must obtain a bioassay within 2 weeks of any iodination utilizing more than 1.0 mCi.

Radioiodine Action Level

The action levels set are 10% of the ALIs. When action levels are exceeded the following steps should be taken:

1. An investigation of the operation involved, including air sampling, will be carried out to determine the causes of exposure and to evaluate the potential for further exposures.
2. If the investigation indicates that further work in the area might result in exposure of a worker to concentrations exceeding the Derived Air Concentrations (DAC) the worker will be restricted from further exposure until the cause of exposure is discovered and corrected.
3. Corrective actions that will eliminate or lower the potential for further exposures will be implemented.
4. A repeat bioassay will be taken within 2 weeks of the previous measurement and should be evaluated within 24 hours after measurement in order to confirm the presence of internal radioiodine, and to obtain an estimate of its effective half-life for use in estimating dose commitment.
5. If the thyroid burden exceeds 50% of ALI, refer the case to appropriate medical consultation as soon as possible for recommendations regarding therapeutic procedures that may be carried out to accelerate removal of radioactive iodine from the body. This should be done within 2-3 hours after exposure when the time of exposure is known so that any prescribed thyroid blocking agent would be effective.

All exposures exceeding the ALI will be reported to the Dept of State Health Services immediately by telephone and followed by additional reports and actions prescribed.

Use of Radioactive Materials or Radiation Sources in Laboratories

Personnel or students who use radioactive materials or sources in laboratories must adhere to the following:

- Personnel monitoring devices, if issued, must be worn. The section entitled "Personnel and Student Radiation Monitoring" specifies who must wear such devices. All personnel monitoring equipment is obtained from the Environmental Health and Safety department located at EP Natural Gas Conference Center, Lower level room 010.
- All laboratory personnel and students working in laboratories with radioactive materials must wear some type of outer garment to prevent contamination of personal clothing.
- Eating, drinking, smoking, and the use of cosmetics in the immediate area where radioactive material is being used is strictly forbidden.
- Absorbent padding must be made available on which to carry out the transfer and manipulation of radioactive material.
- All radioactive waste and contaminated materials must be placed in the receptacles especially designed for radioactive material storage. Such a receptacle must have a lid and be kept in a secure location. The material must be transferred to the licensed waste drum for permanent disposal.
- When storing radioactive material, it must always be covered or stoppered and properly labeled with the following information:
 - I. Radionuclide
 - II. Chemical form
 - III. Amount of radioactivity and assay date, if applicable.
 - IV. Inventory code number.

This material must be properly shielded. If the material is stored in a refrigerator or freezer, nothing intended for consumption by or administered to humans can be placed in that storage area. Also, stored radioactive materials must be kept secure from unauthorized removal. This can be achieved by locking the storage areas or by having an authorized person in attendance when the area is not locked. Storage areas must be properly labeled with radiation caution signs.

- When handling radioactive materials which are not sealed sources, personnel and students must wear nonporous disposal gloves and goggles. All isotopes will be prepared for use in a fume hood. Isotopes will remain in the fume hood until no longer needed and are either placed back in storage or disposed of by an approved method. Primary containers of high beta isotopes should remain in the container or in a shielded area while being prepared for use.
- Contact of potentially contaminated articles by the mouth must be avoided. For this reason, remote pipetting devices must be used when transferring radioactive material. Pipetting radioactive materials by mouth is strictly forbidden.
- Remote handling devices such as tongs must be used when handling millicurie sealed gamma sources or high energy beta sources.

- Radioactive liquid waste must be poured into specific sinks which are clearly labeled to indicate the possible presence of radioactive material (See the section entitled "Radioactive Material Disposal Practices"). Only those designated sinks should be used for washing contaminated glassware. Contaminated glassware should be soaked in a decontamination agent prior to washing with a regular detergent.
- If in the course of work, personnel or student contamination is suspected, a survey with suitable survey instrument should be made immediately, and if necessary, the appropriate decontamination procedure must be initiated (see Section 7 entitled "[Emergency Procedures](#)").
- Each authorized user shall immediately notify the Radiation Safety Officer by telephone of any accidents involving any source of radiation possessed by the licensee. This includes personnel contamination, laboratory contamination, or excessive radiation exposure (See "[Emergency Procedures](#)" in Section 7).
- The proper radiation caution signs must be posted in the appropriate areas containing radioactive materials and radiation areas (Radiation caution signs must be posted in radiation areas and areas containing radioactive materials in accordance with Section 5 entitled "[Posting of Restricted Areas](#)").
- A "Notice to Employees" sign must be posted in a sufficient number of places throughout the laboratory so that the employees may observe a copy on their way to and from their place of employment. Additionally, a notice must be posted indicating where individuals may view copies of the following: Texas Regulations for Control of Radiation, the University radioactive material license, conditions or documents incorporated into the license, and amendments thereto; the University Certificate of Registration for X-ray Producing Devices including supporting documents of correspondence; and any notice of violation of working conditions.
- Radiation surveys to determine the levels of radiation and/or contamination must be performed on at least a monthly basis. The actual type of and frequency of the survey will depend on the type and quantity of radioactive material or sealed source in use (See [Appendix D](#)). **Note:** If radioactive material in a non-contained form has been used by students as a part of a classroom experiment, contamination checks must be performed at the completion of the experiment. Records of all surveys must be kept for inspection.
- Authorized users of X-ray producing devices shall afford to Radiation Safety personnel opportunity to inspect materials, machines, activities, facilities, premises, and records pursuant to these regulations.
- Disposal of radioactive material will be carried out according to the current disposal regulations established by the Texas Radiation Control Division.
- Sealed sources will not be opened.
- Individuals involved in operations which utilize, at any one time, more than 25 millicuries of hydrogen-3 (tritium) in a non-contained form, other than metallic foil, shall have bioassays performed within one week following a single operation and at weekly intervals for continuing operations.
- Leak tests must be recorded for each sealed source at intervals not to exceed 6 months. A sealed source is a radioactive source permanently fixed or bonded in a capsule or matrix. These tests will be performed by Radiation Safety personnel and analyzed by a company licensed by the State of Texas to perform such analyses.

- Experimental animals or their products shall not be used for human consumption after having been administered radioactive material.
- Authorized users must periodically inspect their radiation detection equipment to make sure that it is operating properly. Safety personnel will provide assistance.
- Calibration of dose rate instruments will be provided by a licensed facility at annual intervals.
- Control of access into restricted areas is the responsibility of the authorized user.

Training

Texas Regulations for Control of Radiation requires that all individuals working in or frequently within any area where sources of radiation are used or stored must be instructed in the following:

- Where the above are being stored, used, or transferred.
- Health protection problems associated with the exposure to such radiation or radioactive materials.
- Precautions or procedures to minimize exposure.
- Purposes and functions of protective devices.
- All applicable regulations concerning the use of radiation or radioactive sources.
- To report promptly any conditions which may lead to or cause a violation of the above regulations or result in any unnecessary exposure to radiation or radioactive material.
- Response to emergency situations involving radiation or radioactive materials.
- Availability of radiation exposure reports.

The authorized user is responsible for seeing that all personnel working under his supervision receive this training.

The extent of these instructions shall be commensurate with potential radiological health protection problems associated with the source(s) of radiation. However, undergraduate students must not be permitted to use, transfer, or store radioactive materials or operate radiation-producing equipment without the immediate supervision of the authorized user.

The only exception will be individuals such as teaching assistants or undergraduate research students to whom the authorized user has given detailed formal instruction.

The Environmental Health and Safety department schedules monthly Radiation Safety training sessions covering radiation safety in laboratories, emergency procedures, and basic radiation protection and physics. This training is required for all authorized users, laboratory technicians and students who will be assigned to work with ionizing radiation sources and instruments.

Procedure for Remote/Temporary Site Use of Radioactive Materials

Purpose

The purpose of this procedure is to provide control for the use of radioactive materials by The University of Texas at El Paso at sites within the State of Texas other than the specific locations listed on State of Texas Department of State Health Services, License L00159.

License References

The University of Texas at El Paso is licensed to use radioactive materials at temporary remote field research sites throughout the State of Texas. Such activities shall be limited to open form amounts of radioactive materials, specifically Carbon-14 (C-14), Tritium (H-3) and Phosphorus-33 (P-33) labeled reagents, with no single purchase to exceed 2.0 millicuries or 6.0 millicuries cumulative at any one time in inventory. Each protocol proposal shall be independently approved by TDSHS under the specific license and shall explicitly address expected dose to the public.

Discussion

- **Research with Open Form Materials** - Field research is performed by The University of Texas at El Paso, from both aquatic and terrestrial locations. During the research protocols, microscopic aquatic life and/or water samples are taken, tagged with radioactive materials, processed in experimental conditions, and then stored for proper disposal. This research may be performed in international waters or in non-agreement states, in which case a Form NRC-241 will be submitted to the United States Nuclear Regulatory Commission arranging for reciprocity.
- **Procedures for Control** - The procedures detailed here are designed to assist the researcher in achieving proper safety and in complying with relevant regulations. No procedures can fully replace cognizance and awareness of safety, therefore the procedures are designed to reinforce training and heighten attention to the requirements of using radioactive materials.
- **Procedure – Open Form Radioactive Materials**
 1. Confirm the presence of the following items on the transport vehicle or remote lab site:
 - A. Copy of The University of Texas at El Paso Radioactive Materials License, including the License Commitments.
 - B. Storage containers for radioactive materials and waste.
 - C. Labels, placards and signs to denote containers, storage and laboratory spaces which have radioactive materials, and postings required by the 25 TAC §289, specifically including the *Notice to Employees and Students*.
 - D. Protective wear, including gloves, coats, glasses, and any other garments or wear to prevent contamination of an individual using radioactive materials.
 - E. Tools used to properly handle radioactive materials during the experimental protocol.
 - F. Adequate space dedicated to radioactive materials use, storage, and handling.
 - G. Detection equipment suitable for detecting the radioactive materials used in the experiment.
 - H. Containment materials and cleanup equipment to avoid spills.

2. Confirm all protocols and procedures are approved by the Authorized User.
3. Confirm all individuals who will be performing the protocol have proper training in the use of radioactive materials.
4. Move the radioactive materials to the transport vehicle, post the storage cabin in which the materials are located, and ensure proper marking of equipment to be used during the protocol.
5. Perform the experiment per requirements of the protocol. During the experiment, ensure containment of all radioactive materials.
6. After completion of the experiment or of the day's work, perform surveys of work areas and equipment to determine levels of contamination, if any.
7. During decontamination, clean all equipment, and place all cleaning solutions, materials, and equipment which are contaminated into marked containers for disposal/cleanup.
8. Check all personnel involved in the experiment for contamination on hands, feet, and other areas, and decontaminate if required.
9. At termination of field research trip, perform complete survey of equipment and work areas. If surveys indicate contamination levels of 1000 dpm/100 cm² of surface area, clean the area until the contamination is reduced significantly below this level. NOTE: Copies of all survey data shall be maintained at the Authorized User's primary lab space at the University of Texas at El Paso.
10. Before leaving the remote site, properly placard transportation equipment in accordance with DOT requirements.
11. On return to campus, remove all radioactive materials (including radioactive waste) from the transport vehicle and transfer the materials to appropriate storage locations. Document the radioactive waste for pickup by Radiation Safety. Document the surveys in the radiation log book. Perform final survey of the transport vehicle, and record survey readings. Remove postings and markings from cleaned containers.

Radiation Safety Manual

X-Ray Producing Equipment

General Information

All x-ray producing devices and other radiation producing equipment are required to be registered with the Texas Department of State Health Services. University personnel purchasing radiation producing equipment must contact the Environmental Health and Safety department who will submit registration forms to the Texas Department of State Health Services for registration of the equipment.

Only qualified personnel will be allowed to operate x-ray producing equipment such as x-ray diffraction units or cabinet x-rays and x-ray fluorescence devices. Qualification of an operator must be certified by the person in charge of the instrument.

Control of ON-OFF and interlock keys is the responsibility of the person in charge of the x-ray unit or electron microscope. Records should be kept of each operation of the x-ray machine or electron microscope and should indicate the date of operation, time, and the individual operating the device.

It is also recommended that the experiment be identified. The Environmental Health and Safety department must be notified prior to any modification of the shielding in these devices.

Electron Microscopes

An electron microscope may produce excessive amounts of x-rays if the electron beam is defocused and is hitting the aperture. If this occurs and appropriate adjustments cannot be made by the operator, the microscope should be shut down and an authorized representative of the company that manufactured the device called to make needed repairs.

The company representative should perform a radiation survey at the completion of the repair. A copy of this survey should be retained by the operator of the microscope.

If a survey is not performed, contact the Environmental Health and Safety department. It should be noted that in normal operation, electron microscopes do not constitute a radiation hazard to personnel and registration of electron microscopes is not a requirement under the rules.

Analytical X-ray Equipment

Both 25 TAC §289.228 and 25 TAC§289.231 are quite specific about safety requirements for analytical x-ray equipment. This includes all x-ray equipment used for x-ray diffraction, fluorescence analysis, or spectroscopy. The contents of these regulations are summarized below. Both 25 TAC §289.228 and 25 TAC§289.231 are obtainable from the Environmental Health and Safety department.

The person responsible for the equipment must ensure that all individuals operating the equipment be aware of the content of these regulations.

- Safety devices must be present which prevent the entry of any portion of an individual's body into the primary x-ray beam on all open-beam configurations.
- All open-beam configurations must be provided with a readily discernable indication of x-ray tube status (ON-OFF) and/or shutter status (OPEN-CLOSED).
- Unused ports shall be secured in the closed position in a manner which will prevent casual opening.
- All analytical x-ray equipment shall be labeled with a readily discernable sign or signs bearing the radiation symbol and the words: "**Caution - High Intensity X-Ray Beam**" and "**Caution Radiation - This Equipment Produces Radiation When Energized**" or similar words.
- Warning lights labeled with the words "**X-Ray On**" or similar words must be located near any switch that energizes an X-ray tube and shall be illuminated only when tube is energized.
- Radiation surveys must be performed to ensure that no radiation levels exist in any area surrounding the equipment which could result in a dose to an individual in excess of the dose limits specified by the regulations.
- Each area or room containing analytical x-ray equipment shall be posted with a sign or signs bearing the radiation symbol and the words "**Caution - X-Ray Equipment**".
- Normal operating instructions must be written and available to all analytical x-ray equipment workers.
- The bypassing of a safety device is not permitted unless approved by the Radiation Safety Officer.
- Individuals permitted to operate analytical x-ray equipment must be instructed in and have demonstrated competence as to:
 - I. Identification of radiation hazards associated with the use of the equipment.
 - II. Significance of the various radiation warning and safety devices incorporated into the equipment, or the reasons they have not been installed on certain pieces of equipment and the extra precautions required in such cases.
 - III. Proper operating procedures for the equipment.
 - IV. Symptoms of an acute localized exposure.
 - V. Proper procedures for reporting an actual or suspected exposure.
- Finger dosimetric devices shall be provided to and shall be used by:
 - I. Analytical x-ray equipment workers using systems having an open-beam configuration and not equipped with a safety device; and
 - II. Personnel maintaining analytical x-ray equipment if the maintenance procedures require the presence of a primary x-ray beam when any local component in the analytical x-ray system is disassembled or removed.

Radiation Safety Manual

Appendix A

Instructions for Preparation of BRC Form 202-2

This form or a clear and legible record containing all the information required on this form must be completed by each licensee or registrant who, pursuant to 25 TAC§289.202, proposes to expose an individual to a radiation limits as specified in 25 TAC§289.202(q). The requirements for completion of this form are contained in 25 TAC§289.202. The information contained in this form is used for estimating the accumulated occupational dose of the individual for whom the form is completed. A separate Form 202-2 shall be completed for each individual to be exposed to a radiation dose in excess of the limits specified in 25 TAC§289.202(q). This form requires the signature of the employee concerned. Questions regarding the completion of the form should be directed to the Radiation Safety Officer.

Personnel Monitor Request Form

Texas Department of State Health Services Occupational External Radiation Exposure History				
Identification				
1. Name (print--last, first, and middle)			2. Employee/Student ID No.	
3. Date of Birth (month, day, year)			4. Age in Full Years (N)	
Occupational Exposure--Previous History				
5. Previous Employments Involving Radiation Exposure--List Name and Address of Employer	6. Dates of Employment (From--To)	7. Periods of Exposure	Previous Dose History	
			8. Whole Body (REM)	9. Record of Calculated (Insert One)
		11. Accumulated Occupational Dose--Total		
10. Remarks				
13. Calculations--Permissible Dose Whole Body: A. Permissible Accumulated Dose = $5(N - 18) =$ _____ REM B. Total Exposure to Date (From Item 11) = _____ REM C. Permissible Dose = _____ REM		12. Certification: I certify that the exposure history listed in columns 5, 6 and 7 is correct and complete to the best of my knowledge and belief. Employee Signature: _____ Date: _____ 14. Name of Licensee or Registrant: _____		

Radiation Safety Manual Appendix B

Instructions for Preparation of Radioactive Material License Application

General Information

An applicant for a "Radioactive Material License" issued by the Texas Department of State Health Services must complete the license application form in detail. The applicant should cover the entire radionuclide program with one application. Supplemental sheets may be appended when necessary to provide complete information. Item 15 must be completed on each application. Subsequent applications for renewals, etc., need show only changes and need not have the departmental chairman's signature. One copy of the completed application form should be sent to the Radiation Safety Department and another retained in the applicant's personal file.

Explanation of Application Form

Item No:

1. (a) The "applicant" is the person legally responsible for possession and use of the radioactive materials specified in the application. Licensees will be granted to individual faculty members and not to departments.
(b) Indicate other locations at which radioactive material will be used, if different from that indicated in 1(a). Include phone numbers.
2. Choose the purpose of this application.
3. The Department Chair must sign the application for a license.
4. The "individual user" under the faculty member's license is the person who actually handles the radioactive material. This list must be kept up to date, as users change, and is required for each renewal of the license.
5. If the applicant has ever been issued a radioactive material license by a university, state, or federal agency, the license number should be provided. It is suggested that a copy of that license be appended.
6. (a) List by name each radionuclide desired, such as C-14, Co-60, etc.
(b) and (c) List chemical and/or physical form of each radionuclide and the quantity of each that the applicant desires to possess at any one time. Separate possession limits should be stated for each chemical and/or physical form. At the Texas Department of State Health Services' discretion, a chemical and/or physical form of "any non-volatile chemical form" may be granted to very experienced applicants.
7. State the use of each radioactive material and chemical form specified in Item 6 (a) or (b). Give the usual amount to be handled per experiment or study. If the radionuclide will be administered to animals, it should be stated and the radiation safety problems addressed.
8. These should show the training and experience of the applicant named under Item 1. The University Radiation Safety Department places much emphasis upon the adequate training and experience for the types and quantities of radioactive materials requested. Any documentation available should be appended.

9. (Look at 8)
10. List radiation detection instruments available for use.
11. Pertains to the applicant's requested use of radionuclides.
12. This must be completed if the radioactive material is a sealed source as defined in the Texas Department of State Health Services radiation control regulations.
13. The sketch or drawing of the work area must show the location of the storage area, refrigerators, trash cans, counting systems, sinks for disposal of radioactive materials, and other permanent equipment in the working area. Hoods should be designated including air flow rates if known. The plan should show room numbers and the building of the area sketched.
14. Any individual who might receive more than 40 mrem in any month must wear a radiation monitoring device. Present regulations require bioassays within one week after any handler opens a container of 100 millicuries, or more, of tritium. This level will soon be reduced, and licensees are urged to perform bioassays at 25 millicuries. Applicant must also include method of radioactive waste disposal. On the job training in radiation protection for students and individual users should be described.
15. The applicant must personally sign the certificate.

Licensee Application Form

University of Texas at El Paso
Application for RadioActive Materials License

INSTRUCTIONS: Complete Items 1 through 15 if this is an initial application. If the application is for renewal of a license, complete only Items 1 through 7 and indicate new information or changes in the program as requested in Items 8 through 14. Use supplemental sheets where necessary. Item 15 must be completed on all applications.

1.(a) Name, Office Location, and Phone Number of Applicant.	(b) Location(s) at which radioactive material will be used. Include Phone Number.	
2. <input type="checkbox"/> New License Application <input type="checkbox"/> Amendment to Present License <input type="checkbox"/> Renewal of Present License	3. Approval: Signature of Department Chair	
4. Individual User(s): Name and title of Individual(s) who will handle Radioactive Materials – List Technologists, RA’s, etc.	5. Previous License Number(s): Please give number and issuing agency.	
6. (a) Radioactive Material (element and mass number)	(b) Chemical and/or Physical Form	(c) Maximum number of milliCuries of each form that you wish to possess at one time.
7. Describe purpose for which radioactive material will be used. Attach additional sheets, if necessary.		

Training and Experience of Applicant named in Item 1. (Use supplemental sheet if necessary)					
8. Type of Training	On-the-Job Training		Formal Course		
	Where	Duration	Where	Duration	
(a.) Principles and practices of radiation protection					
(b.) Radioactivity measurement standardization and monitoring techniques and instructions					
(c.) Mathematics and calculations basic to the use and measurement of radioactivity.					
(d.) Biological effects of radiation					
9. Experience with Radiation – actual use of radionuclides or equivalent experience. (Use supplemental sheets if necessary.)					
Radionuclide	Max. Amount	Where exp. was gained	Duration of exp.	Type of use	
10. Radiation Detection Instruments (Use supplemental sheets if necessary.)					
Type of Instruments (Include make and model of each)	Number Available	Radiation Detected	Sensitivity Range (mR/hr for survey monitor)	Window Thickness (mg/cm ² for beta counters)	Use (Monitoring, Surveying, Measuring)
11. Method, frequency, and standards used in calibrating instruments listed above.					
12. Sealed sources: Give radionuclide, make, model number, date of calibration, date of initial leak test, room number and building where stored.					

The following information should be submitted on additional sheets.

13. Facilities and Equipment: Describe laboratory facilities and remote handling equipment, storage containers, shieldings, fume hoods, etc. Changes must be submitted immediately upon completion of modifications. Attach a drawing of the work area showing items detailed in the instructions.

14. Radiation Protection Program: Describe the type and frequency of surveys for contamination. Include proposed use of film badges, survey instruments, wipe tests, and use of urine bioassays for tritium.

CERTIFICATE

15. The applicant certifies that they will comply with the University license requirements and regulations and that all information contained herein, including any supplements attached hereto, is true and correct to the best of their knowledge and belief.

Date

Signature of Applicant named in Item 1

**Radiation Safety Manual
Appendix C**

Information for Ordering and Receiving Radioactive Material

Request to Order Radioactive Material Form

RMC# _____

**REQUEST TO ORDER
RADIOACTIVE MATERIAL**

Licensed User _____

Isotope to be Ordered _____

Activity (mCi) _____

Chemical Form _____

Approximate Date of Delivery _____

Vendor _____

Authorization Signatures:

Note: All shipment of radioactive materials must be delivered to Environmental Health and Safety. Central Receiving has been instructed not to accept any radioactive material shipments.

REQUEST TO ORDER RADIOACTIVE MATERIAL COMPANION FORM – UTEP
LICENSE No. L00159

I am authorized and the licensed user of radioactive material under RMC#_____.

I understand and have read UTEP’s radiation safety manual and am familiar with the rules and regulations pertaining to usage and disposal requirements at UTEP.

I understand that I will need to keep an organized binder accessible to EH&S that show the following information:

1. Radioactive Material Data form showing current usage and disposal log information.
2. Monthly Radioactive survey for the usage month listed in the usage log of the Radioactive Material Data form.
3. Radiation Safety Training certificate for Laboratory workers and licensed users

I understand that failure to comply with record keeping (up to date documents) will delay or suspend future orders of radioactive materials.

I understand that as an authorized and licensed user I will not hold or store radioactive waste, sources, or devices not authorized for disposal by decay in storage, and that are not in use **for longer than 24 months** following the last principal usage.

I understand that radioactive materials that are held or stored for more than 24 months without an alternative disposal plan approved by TDSHS, are subject to collection by EHS for disposal.

Signature:

Licensed User

Printed Name

Date

Procedures for Picking Up, Receiving and Opening Packages

1. All packages of radioactive materials delivered by carriers to campus must be received at the Environmental Health and Safety department, addressed as follows:

Ship To: Attn: Radiation Safety
 c/o Environmental Health and Safety
 The University of Texas at El Paso
 El Paso Natural Gas Conference Center, Room 010
 2051 Wiggins
 El Paso, Texas 79968-0648

2. Once received by the University, the package will be monitored/surveyed prior to delivery to the user's laboratory. This will necessitate completion of the Radioisotope Data Form at both the EH&S offices and within the user's lab area. The opening of the package will be carried out using a good isotope handling technique.
3. The exterior of all packages must be monitored for removable contamination, potentially caused by leakage of the radioactive material contents. Survey/monitoring will be performed as soon as practicable after receipt, but no later than three hours after the package is received at UTEP if received during normal working hours, or within three hours the next business day if received after normal working hours. To detect gamma-emitting contamination, the package and container(s) will be checked with a Ludlum Model 2 GM meter using a thin window probe. If activity above background is detected, a wipe will be counted in a gamma scintillation counting system. To detect low energy beta radiation, a wipe of about 300 cm² of the external surface of the package will be taken with a filter paper or cotton ball. The wipe will be placed in scintillation cocktail and vials and will be counted in a Liquid Scintillation Counter. The LSC will have an appropriate efficiency for the radionuclide being detected.
4. Similarly the inner radioisotope holder shall be tested in the same manner as the exterior packaging was tested and counted.
5. Counts demonstrating removable contamination above 220 dpm/cm² (22 dpm/cm² for alpha emitters) shall be immediately reported to the Texas Department of State Health Services and to the carrier. The results of all monitoring will be recorded and the record maintained in the Environmental Health and Safety department.

Table of Exempt and Type A Quantities

Transport Group	Exempt Quantity Limit (millicuries)	Type A Quantity Limit (curies)
I	0.01	0.001
II	0.1	0.050
III	1	3
IV	1	20
V	1	20
VI	1	1,000
VII	25,000	1,000
SPECIAL FORM	1	20

Radioactive Half-Life Groups

Radionuclide	0 to 1000 days	1000 days to 10 years	over 10 years
Atomic No. 1-81	Group III	Group II	Group I
Atomic No. 82 and over	Group I	Group I	Group III

Radiation Safety Manual

Appendix D

Methods and Frequency for Conducting Radiation Surveys

Introduction

When radioactive material is handled in the form of solutions or sealed sources, radiation surveys and contamination surveys should be performed to prevent unnecessary radiation exposure to personnel and to prevent the spread of contamination throughout the facility. Radiation surveys are performed by taking wipe samples from the surfaces in the laboratory that are likely to become contaminated during isotope use.

Frequency of Surveys

The frequency of surveys depends on the amount and type of radioactive material used. Listed below are examples, which may be useful in determining how often to perform surveys. The greater the work load, the more often the surveys should be performed.

- **Low Level Areas:** Not less than once a month - Areas such as where in vitro tests are performed, samples analyzed, etc. (samples usually less than 100 microcuries each).
- **Medium Levels Areas:** Not less than once a week - Areas where millicurie amounts of material are handled.
- **High Level Areas:** Not less than once a day - Areas used for storage of activity solutions, preparation of materials, fume hoods, etc. (usually curie amounts).

Survey Methods

Suggested methods of performing these two types of surveys are given below. Records of these surveys should be maintained with copies sent to the Environmental Health and Safety department for review and reference to determine whether the radiation levels or the contamination levels remain constant or increase over a period of time.

1. **Radiation Level Surveys** - A survey meter capable of measuring levels as low as 0.1 mR/hr should be used and the results recorded on a standard form showing location, date, person performing survey, instrument used, exposure levels, and corrective action taken, if any. A sketch of the area should be used to make an easily prepared and easily understood survey record when annotated with this information.
2. **Contamination Level Surveys** - A series of wipes using filter papers or swatches of cloth or cotton should be taken from surfaces where contamination could be expected to exist or where radiation levels are fairly high. The wipe may be dipped in a suitable solvent for the material being wiped if the solvent does not interfere with the counting of the wipe (i.e., the induction of chemical luminescence in liquid scintillation cocktail). The wipes should each be rubbed over a surface area of about 100 cm² when taking the wipe to maintain a consistent means of determining the amount of removable contamination. The wipes may be counted for gamma-emitting radionuclide contamination in a gamma-

scintillation well counter or with a thin-window Geiger counter. To detect contamination with beta-emitting isotopes, the wipe can be counted in a liquid scintillation counter. Efficiencies should be known for the counting instruments being used.

Acceptable Limits

The acceptable limits for the surveys are discussed below.

Contamination Limits

If the wipe samples counted indicate more than 1000 dpm, the area should be cleaned until the contamination has been removed. Since it is difficult to determine exactly when a wipe sample has 1000 dpm, it is recommended when such samples show an easily detectable amount of activity above background, the areas from whence they came be cleaned to remove all radioactive contamination.

Radiation Limits

In no area that is unrestricted (uncontrolled) should radiation levels exist, such that a person could receive 2 mR in any one hour, or 100 mR in any one year. If such areas are found action should be taken to eliminate the excessive exposure levels. Additional shielding or relocation of the source may be required. In restricted areas exposure limits do not apply as personnel are monitored to determine their exposures. However, levels should be reduced to minimum where practicable to reduce exposure and no visitor should receive more than 100 mR in one week or 0.5 mR/hr in such areas.

Radiation Surveys (analytical x-rays)

Surveys: Radiation surveys, as required by the 25 TAC§289.231(s), of all analytical x-ray systems sufficient to show compliance with 25 TAC§289.231 (m)-(p), shall be performed:

- a. Upon installation of the equipment;
- b. Following any change in the initial arrangement, number, or type of local components in the system;
- c. Following any maintenance requiring disassembly or removal of a local component in the system;
- d. During the performance of maintenance and alignment procedures require the presence of a primary x-ray beam when a local component in the system is disassembled or removed;
- e. Any time a visual inspection of the local components in the system reveals an abnormal condition; and
- f. Whenever personnel monitoring devices show a significant increase over the previous monitoring period or the readings are approaching the radiation dose limits.

Radiation survey measurements shall not be required if a registrant can demonstrate compliance to the satisfaction of the Texas Department of State Health Services.

Radiation Levels: The local components of an analytical x-ray system shall be located and arranged and shall include sufficient shielding or access control such that no radiation levels exist in any area surrounding the local component group which could result in a dose to an individual present therein in excess of the dose limits given in 25 TAC§289.231. These levels shall be met at any specified tube rating.

Instrument Calibration

All survey instruments will be calibrated annually by a firm licensed by the Texas Department of State Health Services, Radiation Control Division.

Radiation Safety Manual

Appendix-E

Contamination Information

Personnel Decontamination

1. Personnel decontamination holds the top priority. It should be accomplished immediately.
2. The affected area should be washed with soap and water. A soft brush can be used to remove the contamination but care must be taken not to abrade the skin. Commercial decontamination agents for the skin are available from radioactive material vendors.
3. If radioactive material gets into eyes, ears, nose, and/or mouth, the affected area should be rinsed with copious amounts of water. Medical attention should be sought.
4. Wounds should also be rinsed with volumes of water and medical attention sought.
5. If large portions of the body have varying degrees of contamination, the more heavily contaminated areas should be washed separately first to avoid spreading the heavier contamination to the rest of the body. *The Radiation Safety Officer should be notified immediately of any incident resulting in the contamination of personnel or facilities.*

Laboratory Decontamination

1. **Begin the decontamination procedure immediately.** Limit traffic in area to personnel essential to the decontamination process. Call the Environmental Health and Safety department or the Radiation Safety Officer.
2. **Determine the extent of the radiation hazard.** This is influenced by the radionuclide involved, the quantity, the chemical or physical form, and the location of the spill. The radionuclide involved will determine the type of radiation being emitted and the half-life of that radioactive material. This and the quantity of the radioactive material will influence the radiation exposure that may be received by the personnel decontaminating the area. Monitoring with a dose rate meter may be required. Airborne radioactivity should be handled only after ventilation systems such as air conditioners have been turned off. This should be done immediately. If the spill is on the floor, protective shoe covers should be worn to prevent tracking. Personnel must also wear protective clothing such as lab coats and plastic disposal gloves.
3. **Clean up spill.** Radioactive materials in liquid form may be cleaned up in the same manner as any other liquid. The liquid should be drawn off or removed with absorbent paper or manual pipette. Care should be taken to confine the active solution to as small an area as possible. Spreading of the spill by adding large volumes of liquid should be avoided. Agents are available that make removal of the radioactive material from surfaces easier. These agents should be added once the initial spill is removed. A brush can be used to remove stubborn contamination.
4. **Monitor.** Once the initial spill has been removed and the area has been cleaned once with the decontamination agent, the area should be wiped with a cotton ball or filter paper as described in Appendix C and counted to determine the status of the decontamination procedure. If activity is detected on the wipe, the area should again be cleaned with the

decontamination agent. Leaching the contamination area with a suitable "decon" agent three or four times will usually remove 99% of the contamination. Decontamination should continue until the area presents wipes with only background activity or until approved by a representative of radiation safety.

5. **Important Notes.** Throughout the decontamination process, personnel must adequately protect themselves from contamination. Gloves, shoe covers, lab coats, etc., must be worn. All waste generated must be treated as radioactive. Any items used in the process such as brushes must be decontaminated or treated as radioactive waste. The Environmental Health and Safety department can provide these items if they are not available in the licensee's laboratory.

Leak Tests of Sealed Sources

Each licensee using sealed sources of radioactive material, nickel-63 foil sources, or plated alpha sources shall have such sources periodically tested for leakage and/or contamination.

Each sealed source of radioactive material and each nickel-63 foil source shall be tested at intervals not to exceed six months except that each source designed for the purpose of emitting alpha radiation shall be tested at intervals not to exceed three months.

The Radiation Environmental Health and Safety department will provide the leak test kit. The wipe will be taken from the surface of the device in which the source is stored or mounted and on which one might expect contamination to accumulate.

The wipe will then be sealed in the plastic envelope provided and returned to the Environmental Health and Safety department.

The test will be sent to a licensed company for analysis and the results will be maintained for inspection by the Texas Department of State Health Services. Any leakage will be expressed in microcuries.

If the test reveals the presence of 0.005 microcuries or more of leakage, the source will be immediately withdrawn from use.

The Radiation Control Division regulations exempt a number of sources with half-lives 30 days or less, sources in gaseous form, sources of beta and/or gamma emitting radioactive material with an activity of 100 microcuries or less, alpha sources of 10 microcuries or less; and plated alpha sources with an activity of 0.1 microcuries or less.

Radiation Safety Manual

Appendix F

Disposal Information

The Texas Department of State Health Services has adopted the de minimus rules for disposing of radioactive materials. The term "de minimus" comes from the Latin "*de minimus non curat lex*", which roughly translates to "the law does not concern itself with trifles".

This section contains information for disposal of radioactive waste that is below regulatory concern.

General

The following licensed material may be disposed of without regard to its radioactivity:

- 0.05 microcuries or less of hydrogen-3, carbon-14, or iodine-125, per gram of medium, used for liquid scintillation counting or in vitro clinical or in vitro laboratory testing,
- 0.05 microcuries of the isotopes listed above per gram of animal tissue averaged over the weight of the entire animal. See the 25 TAC§289.202 for more detail.

Sanitary Sewerage Disposal

No radioactive material shall be discharged into a sanitary sewerage system unless:

- It is readily soluble or dispersible in water.
- The quantity of any radioactive material released into the system by the licensee in any one day does not exceed levels specified in 25 TAC §289.202 (ff) and (gg). Seek specific guidance from the Radiation Safety Officer.

Incineration

Only quantities listed in the Texas Regulations for Control of Radiation can be incinerated. Seek specific guidance from the Radiation Safety Officer.

Materials that have been decayed to background, for example, I-131 and P-32 can be incinerated. Only the Radiation Safety staff will incinerate radioactive materials. If a licensee needs to incinerate materials, permission must be obtained from the Radiation Safety Officer. This is so regulatory limits will not be exceeded.

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Appendix G
General Isotope Information

Isotope	Radiation Type	Energy (MeV)	Half Life
Hydrogen-3	Beta	0.018	12.3 years
Carbon-14	Beta	0.156	5730 years
Phosphorus-32	Beta	1.71	14.3 days
Sodium-22	Gamma	1.27	2.6 years
	Beta	0.545, 1.82	
Iodine-131	Gamma	0.360	8.0 days
	Beta	0.606	
Iodine-125	Gamma	0.035	59.7 days
Sulfur-35	Beta	0.1674	88 days
Chromium-51	Gamma	0.752	27.8 days

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Appendix H
Radiological Units

Quantity	Name	Definition (SI Units) and Conversion
Activity	Disintegrations per minute (dpm) Disintegrations per second (dps) Becquerel (Bq) Curie (Ci)	1 dps = 1 Bq 1 Ci = 3.7×10^7 Bq
Absorbed dose	Gray (Gy) Rad (rad)	1 Gy = 1 J/kg 1 Rad = 10^{-2} J/kg
Dose equivalent	sievert rem	1 Sv = 1 J/kg 1 rem = 10^{-2} J/kg
Ionization per kilogram (exposure)	Roentgen	1 R = 2.58×10^{-4} Coulomb/kg (1 R \approx 1 rem)

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Appendix I
Summary of Changes

Previous version: February 19, 2019

Changes made as of September 1, 2022:

- On page 2; added Appendix I, Summary of Changes.
- On page 3; updated new physical address to EPNGCC Building.
- On page 4; removed Robert Moss as RSO and added Gustavo Rojo as RSO
- On page 7; under **Requirements for the Purchase of Radioactive Materials or Sources**, added the following: *All shipments of radioactive materials must be delivered to Environmental Health and Safety. Central Receiving has been instructed not to accept any radioactive material shipments.*
- On page 8; the ship to address is new physical address to EPNGCC Building.
- On page 9; under **Responsibilities of the Licensee and Authorized Users**, added the following: *As per 25 TAC §289.252(x)(11); Authorized users shall not hold radioactive waste, sources, or devices not authorized for disposal by decay in storage, and that are not in use for longer than 24 months following the last principal activity use. The authorized user must complete the usage log section in the Radioactive Material Data Form within the 24 month period to document the date of last usage. Radioactive materials that exceed a 24 month non-usage period will be picked up for disposal by EH&S unless an alternative disposal plan is approved by TDSHS within the 24 month period. An authorized user may submit a plan for an alternative disposal timeframe to the RSO no later than 60 days prior to the end of the 24 months of nonuse. The alternative disposal plan shall be reviewed by the RSO and submitted to TDSHS for approval. If TDSHS denies an alternative disposal plan, the radioactive materials shall be picked up for disposal.*
- On page 31; added note: *All shipment of radioactive materials must be delivered to Environmental Health and Safety. Central Receiving has been instructed not to accept any radioactive material shipments.*
- On page 33; added radioactive order companion form: *Form will be signed by PI*

Reviewed on September 1, 2024. No changes made.