

Radiological Safety Program Manual

(Part Two)

Radiation Producing Devices

Radiological Safety
Environmental Health and Safety
Texas A&M University

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Revised May 2024

Part Two
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PART TWO

PROCEDURE MANUAL FOR THE USE OF
RADIATION PRODUCING DEVICES (RPDs)

SECTION 1
PURPOSE AND SCOPE

The purpose of this manual is to establish the requirements for the use of radiation producing devices (RPDs) at Texas A&M. It is intended for persons applying for or holding a permit for radiation producing devices which include:

- Human use medical and dental x-ray machines;
- Veterinary use x-ray machines; and,
- Other devices associated with research and education.

SECTION 2

ORGANIZATION AND RESPONSIBILITIES

A. Radiological Safety Committee (RSC)

The RSC advises the Texas A&M University administration on matters related to radiation safety and recommends policies and procedures it deems appropriate to ensure an adequate radiation safety program. A full description of the makeup and responsibilities of the RSC can be found in Part One, Radiological Program Manual. An electronic copy may be found at: <https://ehs.tamu.edu/programs/radiological-safety.html>

B. Radiological Safety Staff (EHS-RSS)

The EHS-RSS is responsible for the radiation safety aspects of all uses of radiation producing devices authorized under any of the registrations listed in the Section 1, "Purpose and Scope". Specifically, the RSS shall be responsible for:

1. Applying for new or maintaining existing registrations required by the State to support the use of radiation producing devices in teaching or research and development;
2. Reviewing applications for permits to use radiation producing devices;
3. Maintaining a personnel dosimetry program, including evaluating the need for issuance of dosimetry, maintaining a contract for commercial dosimetry services, maintaining dose records, and providing reports to individuals as per regulations;
4. Maintaining permit records including approved applications, amendments, and renewals;
5. Maintaining inventories of radiation producing devices;
6. Performing routine inspections of permitted Users;
7. Providing support in the event of an incident or emergency and reporting to regulatory agencies, as appropriate;
8. Calibrating portable survey instruments;
9. Providing general safety training for university personnel, as applicable;
10. Providing information and consultation on matters related to radiation safety;

11. Notifying the state of transfer or receipt of RPDs by the University; and,
12. Verifying state requirements for disabling (rendering inoperable) devices turned over to TAMU surplus or otherwise released to non-registrants.

C. Radiological Safety Officer (RSO)

The RSO is charged by the University to direct the radiation safety program for Texas A&M University and supported Texas A&M University System agencies. Specifically, the RSO shall:

1. Serve as an ex-officio member of the RSC;
2. Direct the operations of the RSS;
3. Advise University personnel on matters related to radiation safety;
4. Advise University administration on matters related to radiation safety;
5. Impose conditions of work, restrictions on work, and termination of work involving RPDs as necessary to protect University personnel, the public, or the environment or to ensure regulatory compliance;
6. Review the radiation safety program at least annually; and,
7. Serve as the University's point of contact with state and federal regulatory agencies on all matters related to radiation safety.

D. Permit Holder

The permit holder is at all times responsible for radiation producing devices which he or she possesses and for all operations in his or her laboratory which produce radiation. This responsibility extends to the actions of all employees, students and visitors who enter an area where the RPD is located when it is in use.

Specifically, permit holders shall:

1. Ensure that all activities involving RPDs are authorized under the permit, as amended;
2. Ensure that RPDs are secured from unauthorized removal or access;
3. Maintain an accurate list of employees and students authorized to work with RPDs;

4. Develop and maintain written procedures/protocols for the use of RPDs;
5. Ensure that laboratory personnel receive any relevant and all EHS-RSS approved training in radiation safety and emergency response before being authorized to work unsupervised with RPDs;
6. Ensure that personnel complete any required refresher training required by the EHS-RSS;
7. Ensure that exposures to ionizing radiation are maintained As Low As Reasonably Achievable (ALARA);
8. Conduct as necessary and document radiation surveys in accordance with Section 6 of this Part;
9. Inform EHS-RSS, in writing, if extended leave (more than 4 weeks away from the normal work location) is planned;
10. Notify EHS-RSS immediately in cases of:
 - a. Over exposure (known or suspected) to any person;
 - b. Deceptive or false exposure of personnel dosimetry (known or suspected); and,
 - c. Alleged or known violations of the rules prescribed in this document or of the applicable regulations of the State of Texas.
11. Conform to any conditions placed on the permit by the EHS-RSS or RSC; and,
12. Comply with the provisions of this manual.

E. The Individual

Each employee or student of the Texas A&M University System who works with RPDs under a registration referenced in Section 3 of this manual must take responsibility for their own protection and for reporting any condition which, in the individual's opinion, constitutes unsafe or improper working conditions. Each individual is responsible for:

1. Maintaining their own exposures to radiation as ALARA;
2. Following procedures and accepted safe work practices so as not to endanger themselves, the public, or the environment; and,
3. Reporting any unsafe working conditions, violations of the rules prescribed in this document or violations of the applicable regulations of the State of Texas to their supervisor and/or to the TAMU EHS-RSS.

SECTION 3REGISTRATION REQUIREMENTS AND REGULATIONSA. University Registrations

The primary registration, R00304, covers all activities listed in Table 3-1. The registration is typical of large medical and academic institutions, which have many permitted Users and a wide variety of radiation producing devices. This registration is issued by the Texas Department of State Health Services (TDSHS). Nearly all permitted users within the Texas A&M University System (TAMUS) are permitted under registration number R00304. Registration number R14497 is issued for the University operated ship JOIDES Resolution. Current versions of each of these registrations are available through TAMU EHS-RSS.

TABLE 3-1 Registrations Issued to Texas A&M University

Registration Number	Issuing Agency	Locations
R00304	Texas Department of State Health Services, Radiation Control Program	Main campus, RELLIS Campus, TAMU Prairie View, TAES Beeville, TAMU Galveston, TAMU USB, TAMU Animal Science Complex, TAES Stephenville, Huntsville TDCJ Wynne Unit, TAES Kirbyville, TAMU HSC (Bryan), TAMU Kingsville, TAMU NESC, IBT (Houston).
R14497	Texas Department of State Health Services, Radiation Control Program	JOIDES Resolution

B. Authorization to Use a Radiation Producing Device

1. Any faculty or staff member in the Texas A&M University System may apply for a permit to use a radiation producing device. Application forms are available online at <https://ehs.tamu.edu/programs/radiological-safety.html>.
2. A permit is issued to one person, never to a group, department, or facility.
3. Permits for a radiation producing device are not transferable.

4. Only work that is authorized under the applicable permit may be performed. The permit may include restrictions or limits on:
 - a. Location of use and/or storage of the radiation producing device; and,
 - b. Types of experiments authorized.
5. The RSO or the RSC may at any time place additional conditions or restrictions on a permit for reasons of safety and/or compliance.
6. Permits are valid for two years. At least 30 days prior to the end of the two-year period, EHS-RSS shall notify the permit holder, in writing, of the need for renewal.
7. Requests for renewal shall be submitted to EHS-RSS, in writing, signed by the permit holder. Properly signed copies received by email are acceptable.
8. Radiation producing devices shall not be used in or on humans unless specifically authorized.

C. Application for Permit to Use a Radiation Producing Device

1. An applicant shall complete and submit a copy of the application form, "Application to Permit a Radiation Producing Device". EHS-RSS and the RSC shall review the application for the following:
 - a. Name and position of applicant - permitted users must have sufficient authority to control the use of the radiation producing device. That is, a subordinate should not be the permitted user if that person's supervisor is to be designated as a user on the application.
 - b. Department
 - c. Building name and room number - location of the device. Applicant's proposed use/storage location(s) must be authorized under an appropriate University registration
 - d. Mail stop
 - e. Lab and office telephone numbers
 - f. Email address of the permit holder
 - g. Type of device - This conforms to the state required description of RPD (e.g. analytical x-ray, fluorescence device, accelerator). Other specific descriptions are listed in the appendix.

- h. Machine manufacturer - the manufacturer's name as stated on the control panel, even if a different manufacturer makes the machine.
 - i. Machine model number - the manufacturer's model number taken from the control panel.
 - j. Inventory number - taken from the control panel.
 - k. Machine serial number - taken from the control panel.
 - l. Maximum kVp of the device - if applicable.
 - m. Maximum mA of the device - if applicable. If the device is an accelerator list the maximum E and beam current.
 - n. Number of X-ray tubes - zero, one or two, as applicable.
 - o. Indicate what interlocks or safety devices are engineered into the device, how security is maintained and indicate what radiation survey devices are available. Each applicant must possess appropriate survey instrumentation for devices used.
 - p. Describe the intended use of the machine - will the device be used for student training, demonstration, analytical, research, diagnostic purposes, etc.
 - q. Describe the training and experience of the permit holder with regard to the use of this type of RPD. Applicants must demonstrate that they have the experience and training necessary to safely operate the RPD. Applicants wishing to be authorized to use medical x-rays or veterinary x-ray devices shall demonstrate appropriate certification.
 - r. Sketch the room or lab with device placement indicated. Indicate occupational uses of nearby areas and the approximate use frequency of the device. The facilities must be adequate for the device.
 - s. Names of authorized users - maintain a current list for inspections.
2. Reviewed applications, along with EHS-RSS recommendations, shall be forwarded to three RSC members for review and approval. Approval is contingent upon written approval by all three RSC members. Unless directed otherwise by the RSC Chair, the RSO shall select three RSC members to review the application based upon the expertise and availability of the members.

3. If the application is denied, EHS-RSS shall contact the applicant with information regarding the reasons for denial. At the applicant's discretion, he/she may revise the permit application to address the inadequacies or criticisms of the RSC and resubmit the application.

D. Amendments to Permits

1. A request for an amendment to a permit shall be submitted in writing (memo or email) to EHS-RSS.
2. Permit amendments are required for changes in:
 - a. Authorized devices;
 - b. Storage or use location;
 - c. Type of experiment; or,
 - d. Any other condition or restriction placed upon the Permit by the EHS-RSS or the RSC.
3. Amendment requests, which involve significant changes to the permit, shall require written approval of a subcommittee of three RSC members.

E. Termination of Permits

1. Permit holders in College Station, who intend to terminate a permit shall notify the EHS-RSS, in writing, at least ten working days prior to leaving, moving, or relinquishing control of the facility in which the RPD is located. Permit holders at authorized sites outside of College Station shall provide at least 30 calendar days advance notification.
2. Prior to terminating a permit, permit holders shall transfer registered devices in their possession to another Permittee (approved by the EHS-RSS), or to the University surplus for disposal (with prior notification and concurrence of EHS-RSS).

F. Termination of Permits for Cause

1. Any permit holder who willfully and/or negligently violates any applicable University, State, or Federal regulation governing the use of the radiation producing device as determined by the RSO shall have their permit modified, suspended, or revoked. Radiation producing devices may be rendered inoperable.
2. Reinstatement of a permit following suspension or revocation shall require approval by a two-thirds majority of all voting members of the RSC.

G. Sabbaticals and Absences (of 28 days or greater)

Permit holders shall notify the EHS-RSS at least one month prior to the beginning of the sabbatical or extended leave. The permit holder shall:

1. Arrange for another permit holder to oversee ongoing operations and records keeping, and be available to laboratory personnel for routine or emergency assistance (documentation shall be required by the EHS-RSS); or,
2. Transfer all radiation producing devices to another permit holder (documentation shall be required by EHS-RSS); or,
3. The device may be removed from operation or stored for the duration of the permit holder's absence (the RPD can be rendered inoperable or clearly indicate that the device is not to be used during the permit holder's absence unless an alternate permit holder is authorized by EHS-RSS per G.1).

SECTION 4CONTROL AND LIMITATION OF RADIATION EXPOSURESA. Radiation Dose Limits

1. Occupationally Exposed Adults:
 - a. Total Effective Dose Equivalent (TEDE) - 5 rem/y (5,000 mrem/y)
 - b. Total Organ Dose Equivalent (TODE) - 50 rem/y (50,000 mrem/y)
 - c. Shallow Dose Equivalent (SDE) -50 rem/y (50,000 mrem/y)
 - d. Extremity Dose Equivalent -50 rem/y (50,000 mrem/y)
 - e. Lens (of Eye) Dose Equivalent (LDE) - 15 rem/y (15,000 mrem/y)
2. Occupational Dose Limits for Minors (under 18 years of age)
 - a. Ten percent (1/10) of any applicable limit in item 1 above
3. Dose to an Embryo/Fetus of a Declared Pregnant Woman (occupational exposure)
 - a. Total Effective Dose Equivalent (TEDE) - 500 mrem over entire pregnancy
 - b. TEDE should not vary substantially above 50 mrem in any month
4. Individual Members of the Public
 - a. 2 mrem in any one hour
 - b. Total Effective Dose Equivalent (TEDE) - 0.1 rem/y (100 mrem/y)

B. Types of Exposure

The only means of exposure from a radiation producing device is external exposure. A possible exception is if an accelerator uses a radioactive target (radioactive material) or creates activation products (also radioactive material). This presents the possibility of the ingestion, inhalation or injection of radioactive material. If either of these conditions exist (use of a target or activation products) the permit holder will be instructed in the use of radioactive material. Normally devices that use radioactive material as a target are covered in Part 1 of this manual, "Procedure Manual for the Use of Radioactive Materials".

C. Control of External Exposure

Common external exposure controls include the use of time, distance, and shielding to minimize radiation doses. In many X-ray devices the radiation is emitted in a primary beam. Any off-axis position from the beam reduces significantly the exposure possibility

SECTION 5RADIATION DOSIMETRY

The purpose of the radiation dosimetry program is to measure radiation dose equivalent received by occupationally exposed individuals at TAMU. The results serve to verify and document compliance with the applicable dose limits (see section 4) as well as to identify problems and monitor the effectiveness of existing radiation safety controls. Note that most users of RPDs will not be monitored individually for external radiation exposure (will not receive dosimetry "badges") because of the very low radiation exposure associated with most RPDs. In such cases, dosimetry will normally be issued for the area in which the device is located to ensure exposures are minimal as expected.

A. External Radiation Dosimetry

1. Radiation dosimeters appropriate for the radiations to be monitored shall be issued by EHS-RSS to the individual and shall be worn by:
 - a. Adults, minors and declared pregnant women likely to receive, in one year from sources external to the body, a dose in excess of 10% of the applicable dose limits; or,
 - b. Individuals entering a High Radiation Area; or,
 - c. Individuals doing maintenance or alignments with a potential of exposure must wear ring dosimeters.
2. EHS-RSS shall determine the "likely to exceed 10%" status of an individual, the dosimeter type, the wear period, etc.
3. Radiation dosimeters shall not be issued for wear periods greater than three months.
4. Radiation dosimeters shall not be deceptively exposed.
 - a. Dosimeters are issued to only one person. Dosimeters shall not be shared.
 - b. Dosimeters in storage and not being worn shall not be stored near sources of radiation.
 - c. Dosimeters should not be exposed to high heat, chemical or physical insults, or washed in a washing machine.
 - d. No person shall wear dosimeters issued by TAMU EHS-RSS while working for another employer or institution without prior approval of EHS-RSS. Permit holders shall notify EHS-RSS if employees are concurrently working for another (non-TAMUS) employer and working with sources of ionizing radiation.

- e. Dosimeters shall not be worn during medical or dental x-ray examinations.
 - f. Dosimeters shall not be worn after medical administration of radioactive materials (thyroid ablation therapy, cardiac stress tests, diagnostic nuclear medicine tests, etc.) unless approved by TAMU EHS-RSS.
 - g. Permit holders shall notify EHS-RSS immediately upon learning of possible deceptive exposures of dosimeters.
 - h. Intentional deceptive exposures of dosimeters are forbidden and may result in enforcement actions.
5. Lost or damaged dosimeters shall be reported to EHS-RSS as soon as possible.
 6. Persons who have lost or damaged their dosimeters shall be required to provide documentation of work activities and radioactive material uses as necessary for EHS-RSS to assess doses.
 7. Proper wearing of dosimeters:
 - a. Whole body dosimeters shall be worn at the location on the whole body likely to receive the highest dose (refer to definition of “whole body” in glossary).
 - b. Persons who wear a leaded apron should wear whole body dosimeters outside of any leaded apron. Those who perform diagnostic x-ray and/or fluoroscopy procedures should normally wear the dosimeter at the collar.
 - c. Declared pregnant women, who wear dosimeters for fetal monitoring shall wear the dosimeters on the abdomen. If a leaded apron is worn (as in veterinary radiology), the dosimeter should normally be placed on the abdomen, under the apron.
 - d. TAMU normally uses ring dosimeters for extremity monitoring. Ring dosimeters should be worn on the hand, (R)ight or (L)eft, indicated on the dosimeter, with the sensitive portion of the dosimeter turned toward the source of radiation.
 8. Permit holders or their designees shall collect and return used dosimeters to EHS-RSS promptly after receiving replacement dosimeters at the beginning of a new wear period.
 9. Any person who works with any source of radiation at TAMUS (or did so in the past) may request a copy of their dose records at any time. These records are maintained by and are available from EHS-RSS upon written request.

10. All individuals issued personal dosimetry will receive annual reports indicating their exposure.
11. Permit holders shall be responsible for costs of dosimetry services.

SECTION 6

RADIATION SURVEYS, POSTINGS, AND INSTRUMENTATION

Radiation surveys are used to identify and quantify radiological hazards and to document regulatory compliance. EHS-RSS and permit holders must work together to ensure safety in the workplace and to protect both the public and the environment from the harmful effects of radiation. Most surveys will be conducted by EHS-RSS personnel at regular intervals.

A. Radiation Levels

Radiation levels must be determined to prevent exposures from exceeding limits described in Section 4. Normally, radiation surveys are performed to measure exposure or dose rates from sources of radiation. EHS-RSS may, at its discretion, choose to perform calculations to demonstrate compliance.

B. Limits

1. Radiation levels

- a. Less than 2 mrem in any one hour in unrestricted areas - applies to short term (typically less than 24-hour) exposures.
- b. Less than 50 mrem in any one year in unrestricted areas ($< 5.7 \mu\text{rem/hr}$) - applies to long-term (typically greater than 8-hour) exposures. Exceptions may be granted by EHS-RSS. This requirement is based on maintaining exposure to the public at less than 100 mrem per year.
- c. In restricted areas, exposure rates should be kept ALARA (As Low As Reasonably Achievable). Generally, the goal should be to keep radiation levels less than 5 mrem per hour.

C. Postings

The following signs are required:

1. Caution - X-ray equipment - each area or room containing operational X-ray equipment shall be conspicuously posted with a sign or signs bearing a radiation symbol and the words "Caution - X-ray equipment" (or words with similar meaning).
2. Caution (or Danger) Radiation Area - any area, accessible to individuals, in which radiation levels could result in an individual receiving a dose equivalent in excess of 5 mrem in 1 hour at 30 centimeters from the source of radiation or from any surface that the radiation penetrates shall be conspicuously posted with a sign or signs bearing a radiation symbol and the words "Caution - Radiation Area".

3. Caution (or Danger) High Radiation Area - any area, accessible to individuals, in which radiation levels could result in an individual receiving a dose equivalent in excess of 100 mrem in 1 hour at 30 centimeters from the source of radiation or from any surface that the radiation penetrates shall be conspicuously posted with a sign or signs bearing a radiation symbol and the words "Caution (or Danger) High Radiation Area".
4. Signs and postings shall conform to regulatory specifications on wording, symbol, and colors.
5. Signs and postings should be removed when conditions no longer warrant that posting.

D. Labeling

The control panel shall be labeled in a conspicuous manner that cautions individuals that radiation is produced when it is energized

SECTION 7TRAINING

All individuals who work with or (in some cases) near registered sources of radiation are required to complete radiation safety training. The depth of the training must be commensurate with the level of hazard to which the individual is exposed. All training must be documented. No individual shall be allowed to work unsupervised with sources of radiation until that person completes appropriate radiation safety training. Users must be at least 18 years of age, unless written authorization has been obtained from EHS-RSS.

A. Basic Radiation Safety Training

1. All individuals, including principal investigators, who work with or are authorized to possess registered sources of radiation are required to satisfactorily complete appropriate radiation safety training course(s) offered by EHS-RSS and/or demonstrate competence on that subject matter by scoring at least 70% on a test administered by EHS-RSS.
2. Each permit holder is responsible for providing and documenting laboratory-specific training to individuals (including students) who work with registered sources of radiation under the permit holder's control. This training shall address, as applicable:
 - a. Area restrictions - where RPDs are to be used within the lab(s) and restrictions on that use;
 - b. Procedures for security;
 - c. Posting locations for required signs and notices;
 - d. Walk-through review of protocols involving radiation producing devices and;
 - e. Special handling techniques which will minimize exposures when using RPDs.
3. Radiation safety training shall be provided to persons who visit or frequent areas where RPDs are in use. Examples include custodians, clerical personnel, etc. Except for the custodial staff, this training shall be the responsibility of the permit holder. Custodial and maintenance staff shall receive radiation safety training through their administrative department (Physical Plant). Under no circumstances will a visitor be allowed to operate RPDs. Training for individuals, who may be in the vicinity of the RPD during its operation, including visiting and ancillary personnel shall include:
 - a. A brief discussion of hazards of radiation and radioactive materials;
 - b. Recognition of warning signs;
 - c. Areas from which such persons are restricted; and,

- d. Person(s) to contact in the event of incident or emergency.
4. All training shall be documented and maintained on file by the permit holder. Training documentation shall include:
- a. Content of the training (outline, course description, etc.);
 - b. Instructor name and permit holder's name;
 - c. Date and duration of training;
 - d. Printed name of trainee(s);
 - e. Signature or initials of trainee(s).

SECTION 8INSPECTIONS OF PERMIT HOLDER OPERATIONS

Permit holders may be inspected at any time by either the TAMU EHS-RSS or The Texas Department of State Health Services (TDSHS). The following information is intended to make the permit holder aware of the inspection program and to provide general information on what is expected of the permit holder.

- A. Inspections by the Texas Department of State Health Services (TDSHS)
1. Inspections of EHS-RSS by the Department of State Health Services may include spot inspections of individual permit holders. Such inspections are typically unannounced.
 2. Inspections of permit holders not located on the TAMU main campus may be expected at least once every two years. Unannounced inspections may be performed at any time. Permit holders are requested to notify EHS-RSS when an inspection is in progress.
 3. Permit holders not located on the TAMU main campus should expect the inspector to hold an exit interview at which time the inspector should discuss any apparent deficiencies or violations found.
 4. Permit holders should keep in mind that EHS-RSS may have duplicates of any records found to be missing. By calling EHS-RSS- during the inspection and having those duplicates emailed, the permit holder may avoid being cited for violations.
- B. Inspections by Environmental Health and Safety
1. EHS-RSS inspections of permit holder may include:
 - a. Review of training records;
 - b. Review of approved worker list;
 - c. Review of procedures;
 - d. Review of permit authorizations and conditions;
 - e. Performance of radiation area surveys in restricted and unrestricted areas, as appropriate;
 - f. Review of permit holder's inventory;
 - g. Review of security; and,
 - h. Review of permit holder's survey records.

2. EHS-RSS reserves the right to inspect any permit holder with no advance notice. However, routine inspections are normally scheduled at a time that is mutually acceptable with the permit holder.
3. Inspection reports shall be generated by EHS-RSS and a copy sent to the permit holder.
4. Permit holder's responses, if any, shall be filed with EHS-RSS inspection report maintained on-file at EHS-RSS and remote site as appropriate.

SECTION 9INCIDENTS AND EMERGENCIES

In the event of a radiation incident or emergency, TAMU EHS-RSS must be notified immediately. In instances where there is doubt about whether such notification is necessary, contact should be made to allow EHS-RSS staff member on duty to assess the situation.

The staff of EHS-RSS is “on-call” for emergency response 24-hours per day, seven days per week. Any individual may contact EHS-RSS to obtain assistance. Emergency telephone numbers shall be posted in every laboratory in which an RPD is located.

During normal business hours:

Ask for Radiological Safety at (979) 845-2132

After normal business hours, weekends and holidays:

(979) 862-1111 (EHS-RSS Emergency Assistance)

- A. What Constitutes an Incident or Emergency
1. Loss or theft of any radiation producing device.
 2. High or potentially high radiation exposure to an individual or to a member of the public.
For example:
 - a. Greater than 500 mrem in a short period of time to any occupationally exposed individual;
 - b. Greater than 5000 mrem in a short period of time to the extremity of any occupationally exposed individual; or,
 - c. Greater than 10 mrem to any member of the public.
 3. Deceptive or potentially deceptive exposure of a dosimeter.
 4. Any personnel injuries which may involve radiation exposure.
- B. Personnel Injury Involving Actual or Suspected Exposure to Radiation
1. Provide first aid immediately for serious injuries.
 2. Call 911 for emergency medical or police services.
 3. Notify EHS-RSS

SECTION 10PERMIT HOLDER RECORDS

Record keeping requirements vary depending on the type of activities conducted under a permit.

A. General Record-Keeping Requirements

1. All permit holders on the TAMU campus in College Station shall maintain the following records in a clear, concise and orderly format. Retention periods are included in parentheses.
 - a. Current approved permit records (life of permit).
 - b. Current radiation survey (life of permit).
 - c. Survey instrument calibrations performed by anyone other than EHS-RSS (3 years).
 - d. Personnel records (current):
 - i. Worker/user lists; and,
 - ii. Training records.
 - e. Operating and emergency procedures (current).
 - f. Procedure manuals from EHS-RSS (current).
 - g. Records of radiation safety training performed by the permit holder (3 years).
2. In addition to maintaining duplicates of certain records, EHS-RSS shall maintain the following records, which are available for review during normal office hours.
 - a. Original copy of all registrations issued to TAMU; and,
 - b. Copies of current regulations relating to RPDs.
 - c. Inspection reports and copies of all “Notices of Violation” issued by state or federal regulatory agencies and the TAMU responses to those Notices.
 - d. Current version of all policy manuals and procedure manuals
 - e. Dosimetry records
 - f. Survey instrument calibrations

B. Additional Record-Keeping Requirements for Permit Holders Not on the TAMU Campus

1. All permit holders not located on the TAMU campus in College Station shall maintain the documentation identified in A.1 and shall also maintain the following records.

Retention periods are included in parentheses.

- a. Current copy of Texas Regulations (life of permit, <https://www.dshs.texas.gov/texas-radiation-control/laws-rules-radiation-control-program>)
- b. Current copy of the applicable TAMU Registration (life of permit, <https://ehs.tamu.edu>)
- c. records of most recent inspection performed by the Texas Department of State Health Services (TDSHS) (3 years) including:
 - i. Any “Notice of Violations” issued (at least 3 years);
 - ii. TAMU response to those violations (at least 3 years);
 - iii. Survey Instrument Calibrations (3 years); and,
 - iv. Radiation Protection Plan reviews (current).

C. Information Required on Specific Records

1. Radiation surveys
 - a. Records shall be in units of mR/h, mrem/h, etc., as appropriate.
 - b. Records shall uniquely identify the source of the radiation.
 - c. Records shall clearly indicate the areas surveyed (use of a map is acceptable and recommended).
 - d. Records shall indicate the person performing the survey and date of survey.
 - e. Records shall uniquely identify the survey instrument used, i.e., serial number, or other unique description.
2. Training records are specified in Section 7

SECTION 11GLOSSARY OF TERMS

“Absorbed dose” means the energy imparted by ionizing radiation per unit mass of irradiated material. The units of absorbed dose are the rad and the gray (Gy). 1 Gy = 100 rad.

“Adult” means an individual 18 or more years of age.

“As low as is reasonably achievable (ALARA)” means making every reasonable effort to maintain exposures to radiation as far below regulatory dose limits as is practical, consistent with the purpose for which the licensed or registered activity is undertaken, taking into account the state of technology, the economics of improvements in relation to benefits to public health and safety, and other societal and socioeconomic considerations, and in relation to utilization of ionizing radiation and licensed sources of radiation in the public interest.

“Background radiation” means radiation from cosmic sources; non-technologically enhanced naturally occurring radioactive material, including radon, except as a decay product of source or special nuclear material, and including global fallout as it exists in the environment from the testing of nuclear explosive devices. “Background radiation” does not include sources of radiation from radioactive materials regulated by the Texas Bureau of Radiation Control (BRC).

“Declared Pregnant Woman” means a woman who voluntarily informed her employer, in writing, of her pregnancy and the estimated date of conception. At Texas A&M this will be in the form of a completed form available at EHS-RSS

“Deep dose equivalent (H_d or DDE),” which applies to external whole body exposure, means the dose equivalent at a tissue depth of 1 centimeter (1000 mg/cm^2).

“Dose” is a generic term that means absorbed dose, dose equivalent, effective dose equivalent, committed dose equivalent, committed effective dose equivalent, total organ dose equivalent, or total effective dose equivalent.

“Dose equivalent (H_T)” means the product of the absorbed dose in tissue, quality factor, and all other necessary modifying factors at the location of interest. The units of dose equivalent are the sievert (Sv) and rem. 1 Sv = 100 rem.

“Dose limits” means the permissible upper bounds of radiation doses established in accordance with these rules. For purposes of the rules, “limits” is an equivalent term.

“Dosimeter” means devices designed to be worn by a single individual for the assessment of dose equivalent. Examples of individual monitoring devices are film badges, thermoluminescent dosimeters (TLDs), and pocket ionization chambers.

“Effective dose equivalent (H_E)” means the sum of the products of the dose equivalent to each organ or tissue (H_T) and the weighting factor (w_T) applicable to each of the body organs or tissues that are irradiated ($H_E = w_T H_T$).

“Embryo/fetus” means the developing human organism from conception until the time of birth.

“Entrance or access point” means any opening through which an individual or extremity of an individual could gain access to radiation areas or to source of radiation. This includes portals of sufficient size to permit human access, irrespective of their intended use. “Exposure rate” means the exposure per unit of time, typically milliroentgen per hour (mR/h).

“External dose” means that portion of the dose equivalent received from any source of radiation outside the body.

“Extremity” means hand, elbow, and arm below the elbow, foot, knee, and leg below the knee. The arm above the elbow and the leg above the knee are considered part of the whole body.

“Eye dose equivalent (LDE)” means the external dose equivalent to the lens of the eye at a tissue depth of 0.3 centimeter (300 mg/cm^2).

“Gray (Gy)” means the System International (SI) unit of absorbed dose. One gray is equal to an absorbed dose of 1 joule per kilogram (100 rad).

“High radiation area” means an area, accessible to individuals, in which radiation levels could result in an individual receiving a dose equivalent in excess of 0.1 rem (1 millisievert) in 1 hour at 30 centimeters from any source of radiation or from any surface that the radiation penetrates.

“Human use” means the internal or external administration of radiation or radioactive material to human beings for healing arts purposes or research and/or development.

“Ionizing radiation” means any electromagnetic or particulate radiation capable of producing ions, directly or indirectly, in its passage through matter. Ionizing radiation includes gamma rays and x-rays, alpha and beta particles, high-speed electrons, neutrons, and other nuclear particles.

“Member of the public” means any individual, except an individual who is performing assigned duties for a licensee or registrant involving exposure to sources of radiation.

“Minor” means an individual less than 18 years of age.

“Occupational dose” means the dose received by an individual in the course of employment in which the individual’s assigned duties involve exposure to sources of radiation.

Occupational dose does not include dose received from background radiation, as a patient from medical practices, from voluntary participation in medical research programs, or as a member of the public.

“Permit” means a form of permission given by the TAMU Radiation Safety Committee to an applicant (faculty or staff of Texas A&M University) to possess, store, and/or use radiation producing devices under the authority granted to Texas A&M University in the applicable Registration. A Permit is issued to one individual; never to a department, office or group of individuals.

“Permit Holder” means the successful applicant, the individual issued the RPD Permit.

“Rad” means the special unit of absorbed dose. One rad is equal to an absorbed dose of 100 erg per gram or 0.01 joule per kilogram (0.01 gray).

“Radiation area” means any area, accessible to individuals, in which radiation levels could result in an individual receiving a dose equivalent in excess of 0.005 rem (0.05 millisievert) in 1 hour at 30 centimeters from the source of radiation or from any surface that the radiation penetrates.

“Radiation machine” means any device (RPD) capable of producing ionizing radiation except those devices with radioactive material as the only source of radiation.

“Radiation safety officer” means an individual who has knowledge of, and the authority and responsibility to apply appropriate radiation protection rules standards, and practices and who must be specifically authorized on a certificate of registration or radioactive material license.

“Rem” means the special unit of any the quantities expressed as dose equivalent. The dose equivalent in rem is equal to the absorbed dose in rad multiplied by the quality factor (1 rem = 0.01 sievert).

“Restricted area” means an area, access to which is limited a permit for the purpose of protecting individuals against undue risks from exposure to sources of radiation. Restricted area does not include areas used as residential quarters, but separate rooms in a residential building may be set apart as a restricted area.

“Roentgen (R)” means the special unit of exposure. One roentgen (R) equals 2.58×10^{-4} coulombs/kilogram of air. (See “Exposure”).

“Shallow dose equivalent (H_s or SDE),” which applies to the external exposure of the skin or an extremity, means the dose equivalent at a tissue depth of 0.007 centimeter (7 mg/cm^2) averaged over an area of 1 square centimeter.

“Sievert” means the System International (SI) unit of any of the quantities expressed as dose equivalent. The dose equivalent in sievert is equal to the absorbed dose in gray multiplied by the quality factor (1 Sv = 100 rem).

“Survey” means an evaluation of the radiological conditions and potential hazards incident to the production, use, transfer, release, disposal, and/or presence of sources of radiation. When appropriate, such evaluation includes, but is not limited to, tests, physical examination of location of materials and equipment, and measurements of levels of radiation or concentration of radioactive material present.

“Total effective dose equivalent (TEDE)” means the sum of the deep dose equivalent for external exposures and the committed effective dose equivalent for internal exposures.

$$\text{TEDE} = \text{DDE} + \text{CEDE}$$

“Total organ dose equivalent (TODE)” means the sum of the deep dose equivalent and the committed dose equivalent to the organ receiving the highest dose. $\text{TODE} = \text{DDE} + \text{CDE}$

“Unrestricted area” means an area, access to which is neither limited nor controlled by the licensee (or permit holder).

“Whole body” means for purposes of external exposure, head, trunk (including male gonads), arms above the elbow, or legs above the knees.

“Worker” means an individual engaged in work under a license or a permit.

AppendixRPD Category Descriptions

RPDs are assigned a three-character code which is descriptive of their intended use and potential risks. Use codes listed in the Texas A&M University X-Ray Registration include:

Use Code	Description
571	Veterinary – including diagnostic and therapy machines used under the supervision of a licensed veterinarian. This category is inclusive of general x-ray, dental, CT, and fluoroscopy units.
572	Minimal Threat
573	Other Industrial – including accelerators and portable (or hand-held), open beam fluorescence devices
576	Radiographic Machines – intended for human use only under the supervision of a licensed practitioner of the healing arts
J01	Fluoroscopy - – intended for human use only under the supervision of a licensed practitioner of the healing arts