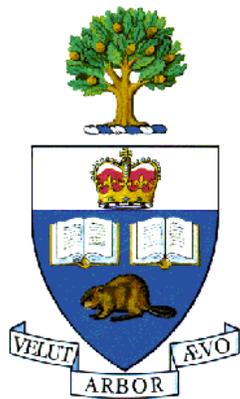


University of Toronto



X-RAY SAFETY PROGRAM

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University of Toronto X-RAY SAFETY POLICY

Preamble

In accordance with its Health and Safety Policy and the general provisions of the Occupational Health and Safety Act of Ontario, the University of Toronto is committed to promoting the health, safety and well being of its employees, students, visitors and contractors.

X-ray sources are part of day-by-day university activity. They are present in our research and teaching laboratories, student projects and other activities that incorporate X-ray sources in the educational and research processes. Radiation generated by X-ray sources can cause a wide range of negative health effects when not used in accordance with rules and regulations.

The **ALARA (As Low As Reasonably Achievable)** concept has been adopted by the UTRPA as the philosophy governing the use of all ionizing radiations. The ALARA principle seeks to keep all doses of ionizing radiation as low as reasonably achievable, social and economic factors being taken into consideration. No practice involving the exposure of patients or X-ray workers to ionizing radiation may take place if there is no benefit to them as a result of carrying out the practice. Radiation exposures must be kept below the statutory limit regardless of the practice. Persons using X-ray equipment should endeavour to keep all radiation exposures as low as possible.

Mandate and Application

The University has the responsibility to ensure that reasonable and adequate controls exist for the safe use of X-ray sources in all U of T controlled areas. Hazard evaluations should be performed, and appropriate engineering and administrative controls should be put in place, before using any X-ray sources.

This Policy applies to areas controlled by the University of Toronto: buildings, structures or open areas, to all employees and students of the University, to occupants of University buildings, and to external organizations that may use or be affected by X-ray sources hazards in such areas.

University of Toronto Radiation Protection Authority (UTRPA)

The UTRPA is responsible for the safe use of all sources of ionizing and non-ionizing radiation (both materials and machines), on all areas under U of T control. The use of X-ray sources and X-ray machines is under the jurisdiction of the UTRPA.

The UTRPA approves the University X-ray sources Safety Program and ensures that all components of the program are adequately implemented. The essential elements of the program are:

- The registration of all X-ray sources used in University controlled areas
- Hazard evaluation of the X-ray sources
- Training of all X-ray sources users

The implementation of these parts of the program relies on University faculty members (Principal Investigators/Supervisors) responsible for the use of X-ray sources. The Principal Investigator is fully responsible for the safe use of X-ray sources under their jurisdiction. He/she must ensure that X-ray sources users are competent to use X-ray sources in a safe manner, that an X-ray sources hazard evaluation is performed and that adequate controls are in place, before using X-ray sources.

Implementation of the X-ray Safety Program

The Radiation Protection Service of the Office of Environmental Health and Safety has the responsibility of implementing, updating, and auditing the X-ray Safety Program. The Radiation Protection Service will nominate one Radiation Safety Officer as the University X-ray Safety Officer.

The University X-ray Safety Officer has the authority to stop the use of any X-ray sources in the University controlled areas, if the health and safety of persons (faculty, staff, students, visitors) or the environment are at risk. The use of those X-ray sources can be resumed only after all control measures are implemented according to the University X-ray Safety Program and upon written approval of the UTRPA.

1 INTRODUCTION AND SCOPE

Under its Health and Safety Policy and the general provisions of the Occupational Health and Safety Act of Ontario, the University of Toronto is committed to taking every reasonable precaution for the health and safety of its employees and students.

The X-ray Safety Program is intended to assist the University community in the effective control of X-ray hazards.

The basic elements of the control program are:

- X-ray permit system;
- registration of all X-ray machine and X-ray sources;
- requirements for the inspections of X-ray machines and X-ray sources;
- requirements for training and education of X-ray workers;
- requirements for reporting accidents/incidents involving X-ray machines and X-ray workers
- requirements for personal dosimetry;
- requirements for engineering controls;
- requirements for administrative and procedural controls;
- requirements for auditing the implementation and effectiveness of the program.

Objective of the X-ray Safety Program

It is the objective of this X-ray safety program to effectively control X-ray sources hazards in accordance with the University Health and Safety Policy and the general provisions of the Occupational Health and Safety Act of Ontario.

Scope

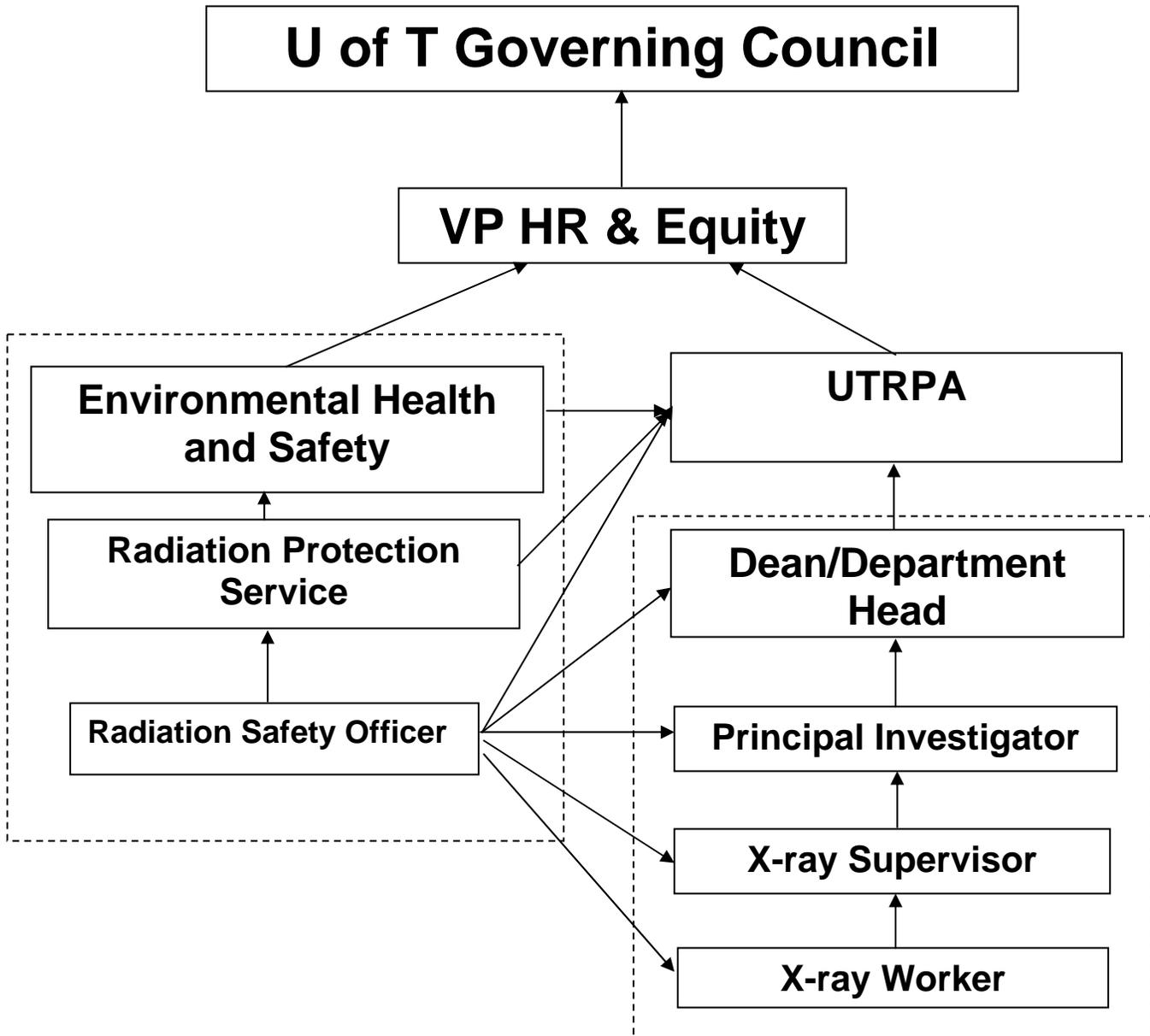
This program applies to all X-ray machines and X-ray sources in controlled areas (indoors) under the jurisdiction of the University of Toronto, and to all those identified as Principal Investigators, X-ray sources supervisors and X-ray sources workers (see definitions in the U of T X-ray Safety Manual).

2 RESPONSIBILITIES

This section outlines the responsibilities for the implementation of the X-ray safety program within the University.

The responsibility chart for X-ray safety on U of T controlled areas is presented below.

Figure 1 - Responsibility for X-ray safety in U of T



University of Toronto Radiation Protection Authority (UTRPA)

The terms of reference of the UTRPA are outlined in the U of T Ionizing Radiation Policies and Procedures Manual.

The UTRPA's responsibilities regarding the X-ray sources are:

- a. To approve the U of T X-ray safety program; periodically assess the effectiveness of the program and recommend changes;
- b. To establish and maintain standards and guidelines for the safe use of X-ray sources within the University; the recommendations of the UTRPA will be evaluated for implementation by the RPS;
- c. To provide expert advice on X-ray safety hazards;
- d. To approve the content of the X-ray safety training program materials;
- e. To review and act on the recommendation of the Senior Radiation Safety Officer (SRSO) to suspend, restrict or terminate the operation of an X-ray sources;
- f. To report annually to the Vice-President, Administration and Human Resources, on the operation of the X-ray safety program.

2.2 Radiation Protection Service

The Radiation Protection Service of the Office of Environmental Health & Safety has the following responsibilities within the X-ray safety program:

- a. To update and present the U of T X-ray safety program for approval of the UTRPA;
- b. To provide a Radiation Safety Officer to fulfil the requirements of the X-ray safety program;
- c. To notify principal investigators of the X-ray safety program training of all X-ray supervisors/workers under their authority;
- d. To provide administrative support to the UTRPA in regard with the X-ray sources;
- e. To audit the implementation and effectiveness of this program on an on-going basis.

2.3 Radiation Safety Officer

The Radiation Safety Officer (RSO) is one who is directed by the SRSO of the Office of Environmental Health and UTRPA and is knowledgeable in the evaluation and control of X-ray sources hazards.

The RSO has the following responsibilities regarding X-ray sources in his/her jurisdiction:

- a. Hazard evaluation of X-ray sources work area;
- b. Approval, or recommending for approval, the beginning of work for new facilities involving the usage of X-ray sources, commissioning and decommissioning the X-ray sources;
- c. Developing and maintaining policies and procedures for engineering and administrative control of X-ray sources hazards. The RSO is also responsible for ensuring that the prescribed controls are in effect;
- d. Approval of procedures connected with X-ray sources operation that may be subject to administrative and procedural control;
- e. Inspection of X-ray sources according to the X-ray safety program;
- f. Recommendation and approval of protective equipment, X-ray sources working area signs and equipment labels;
- g. Ensuring safe operation through the authority to suspend, restrict or terminate operations; stopping individual/laboratory work when the safety of workers, the public or the environment is at risk; documenting the technical reasons for the above decision, and reporting to the Manager RPS;
- h. Investigation of the X-ray sources related incidents and accidents, analysis of the causes, ensuring corrective actions are taken as required;
- i. Maintenance and up-dating X-ray Safety Data Base:
 - X-ray sources registrations
 - Inspection reports
 - Training records
- j. Provides the appropriate X-ray safety training to all categories of personnel according to the X-ray safety program;
- k. Verifies the quarterly personal dosimeter reports and investigates all the exposure reports that do not appear to be reasonable and appropriate. The result of the investigation will be communicated to the Ontario Ministry of Labour. If a record indicates a value above 0.4 mSv in one quarter and the investigation yields a real result, the RSO will recommend measures to reduce any further exposure;
- l. Reports on all aspects of the X-ray safety program to the Manager RPS on a regular basis.

2.4 Dental Radiation Protection Officer

For the dental X-ray facility (Faculty of Dentistry), a Radiation Protection Officer who is a member of the Royal College of Dental Surgeons of Ontario shall be appointed as required by the HARP Act. A dental radiation protection officer for a facility has the same responsibilities as a RSO and he/she is also responsible for:

- ensuring that every X-ray machine operated in the facility is maintained in safe operating condition; and

- such other matters related to the safe operation of each X-ray machine in the facility are as prescribed by the regulations (Ontario Regulation 663/00 - X-ray Safety Code)

2.5 Department Head

The Department Head has the following responsibilities within this program:

- a. To identify all principal investigators under his/her authority and ensure that they clearly understand their duties and responsibilities as individuals with principal authority for X-ray sources;
- b. To ensure that all components of the U of T X-ray Safety Program are implemented in the department.

2.6 Principal Investigator

The PI is one who is in charge of an X-ray source laboratory and/or principal authority for X-ray sources; usually an appointed U of T professor.

The principal investigator may **delegate** some or all of his/her responsibilities to an X-ray sources supervisor. However, the principal investigator cannot **discharge** these responsibilities to the X-ray sources supervisor.

The principal investigator has the following responsibilities:

- a. To register all X-ray sources before use, and to deregister the decommissioned ones with the Radiation Protection Service of the Office of Environmental Health and Safety;
- b. To identify all X-ray sources, supervisors and workers under his/her authority to the RPS;
- c. To ensure that X-ray sources supervisors and workers participate in the University's X-ray safety program training prior to operating or working in proximity to any X-ray sources;
- d. To provide and enforce the use of appropriate personal protective equipment when required;
- e. To provide and enforce the wearing of a personal dosimeter by all X-ray workers when necessary;
- f. To provide written standard operating procedures (SOPs) for X-ray sources and to ensure that each X-ray source is used **only** under conditions and in locations which meet the requirements of the SOP(s);
- g. To ensure that each X-ray sources supervisor/worker is trained in the safe operation of the specific X-ray sources that he/she will operate;
- h. To ensure that all X-ray machines and X-ray sources are stored securely and safely when not in use so that they are not usable by unauthorized personnel or under unauthorized conditions;

- i. To permit only trained X-ray sources supervisors/workers to operate or work in proximity of an X-ray source;
- j. To ensure that all administrative and engineering controls are implemented and followed;
- k. To correct unsafe conditions in a timely manner;
- l. To ensure that all spectators are properly informed of and protected from potential X-ray sources hazards;
- m. To cancel X-ray sources supervisor/worker privileges until satisfied that he/she fully meets the requirements of this control program;
- n. To report known or suspected accidents to the Radiation Protection Service of the Office of Environmental Health & Safety within 24 hrs of the accident;

2.7 X-ray Supervisor

An individual who has been delegated supervisory responsibilities for X-ray sources and X-ray workers by the principal investigator. He/she has the following responsibilities:

- a. To participate in the University's X-ray safety program training prior to operating or working in proximity to X-ray sources;
- b. To be familiar with all operational procedures and specific safety hazards of the X-ray sources that he/she will operate/oversee;
- c. To operate X-ray sources safely and in a manner consistent with safe X-ray sources practices, requirements and written SOPs;
- d. To operate X-ray sources only under the conditions authorized by the principal investigator;
- e. To report all unsafe conditions to the principal investigator;
- f. As directed by the principal investigator, to provide instruction and supervision to X-ray workers;
- g. As directed by the principal investigator, to conduct other activities associated with the University's X-ray safety program;
- h. To promptly report known or suspected accidents and unsafe conditions to the principal investigator.

2.8 X-ray Worker

The X-ray worker is one who operates or works in proximity to an X-ray source. He/she has the following responsibilities:

- a. To participate in the University's X-ray safety program training prior to operating or working in proximity to an X-ray source;
- b. To be familiar with all operational procedures and specific safety hazards of the X-ray sources that he/she will operate;
- c. To operate X-ray sources safely and in a manner consistent with safe X-ray sources practices, requirements and written SOPs;
- d. To operate X-ray sources only under the conditions authorized by the X-ray sources supervisor/principal investigator;
- e. To report all unsafe conditions to the X-ray sources supervisor/principal investigator;
- f. To promptly report known or suspected accidents and unsafe conditions to the X-ray sources supervisor/principal investigator.

3 REGISTRATION OF X-RAY SOURCES

There are two primary reasons for preparing and maintaining a record of all X-ray sources. These are:

- a to identify areas where X-ray sources are present so that appropriate administrative and engineering controls may be put in place;
- b to enable the X-ray sources to be inspected on a regular basis for compliance with the University's X-ray safety program.

The principal investigator is responsible for the registration of all X-ray sources and deregistration of decommissioned ones (see registration form in Appendix 1).

If an X-ray source will be used in permanent location the PI responsible for the X-ray source will send to the RPS, an application for review (see Form 2 of the Appendix 2) together with the plan drawings (for guidance see Appendix 2). The RPS will verify the application and the drawings, will inspect the location and will forward the application and two copies of the drawings to the Ontario Ministry of Labour for approval. After receiving approval from the Ministry the RPS will inform the PI and a copy of the approval will be sent to the PI.

When after the installation of an X-ray in a permanent location there is a change in:

- a the installation or use of the X-ray source;
- b the use of the rooms or areas adjacent, horizontally or vertically, to the X-ray source, or
- c any shielding of the X-ray source

that may result in an increase in the exposure of a worker, student or visitors, the PI shall request a review of the approval.

When the X-ray source is portable or mobile and is used in that way the information contained in the registration form (Appendix 1) will be sent by the RPS to the Ontario Ministry of Labour.

The Dental Radiation Protection Officer will register all Medical X-ray machines with the Ontario Ministry of Health.

The RSO is responsible for the preparation and maintenance of the X-ray sources registry.

4 **X-RAY SAFETY INSPECTIONS**

Periodic inspections of X-ray sources are an integral part of the X-ray safety program; inspections provide some indication as to whether or not these X-ray sources are being operated in a safe manner. The X-ray safety inspection check sheet is presented in Appendix 4. The PI will be informed about the results of the inspection (a copy of the check sheet will be sent to the PI) and of the necessary measures to improve the safe use of the X-ray source.

The RSO is responsible for inspecting all new X-ray sources and also (at least annually) all X-ray machines for compliance with the University's X-ray safety program and to report to the Radiation Protection Service of the Office of Environmental Health and Safety and the UTRPA.

5 TRAINING AND EDUCATION

All X-ray sources supervisors/workers must participate in the University's X-ray safety program training prior to operating or working in proximity to X-ray machines. The register for the RPS X-ray training is done online at the following address:

<http://www.ehs.utoronto.ca/services/radiation/register.htm>

The form for the TLD badge applications is presented in Appendix 3 of the program or in:

http://www.ehs.utoronto.ca/services/radiation/X-ray_safety.htm

This training will include the following:

- a. X-ray basics
- b. X-ray hazards, bio-effects
- c. Engineering and administrative control measures
- d. X-ray safety regulations and U of T X-ray safety program
- e. Responsibilities
- f. Causes of accidents
- g. X-ray accident reports
- h. Quiz

All X-ray supervisors must also be familiar with all standard operating procedures and specific safety hazards of the X-ray machines that he/she will operate/oversee.

All X-ray workers must also be familiar with all standard operating procedures and specific safety hazards of the X-ray machines that he/she will operate.

The RSO is responsible for maintaining records of all X-ray supervisors and X-ray workers who have participated in the X-ray safety program training and for notifying principal investigators of this participation.

All persons using X-ray machine shall participate every 3 years at the refresher training sessions organized by the RPS. The refresher training will include:

- a. X-ray safety news
- b. Changes in X-ray safety legislation
- c. Changes in U of T X-ray safety program and manual
- d. Responsibilities
- e. Results of X-ray safety inspections
- f. Quiz

6 ACCIDENT/INCIDENT REPORTING AND EMERGENCY RESPONSE

University policy requires the reporting of all accidents/incidents, which result in or have the potential to result in personal injury.

Reporting of accidents involving death, critical injury, lost time or health care is required for employees under the Occupational Health and Safety Act and the Workplace Safety and Insurance Act, while University policy requires the reporting of accidents/incidents involving students and visitors and other persons on university premises.

Therefore, reportable accidents/incidents are those which:

- a. result in personal injury (including those requiring first aid) or property damage; **or**
- b. have the potential to result in significant personal injury or property damage even though no injury or damage actually occurred; **and**
- c. occur to any person on university premises; **or**
- d. occur to a university employee during the course of his/her work either on or off university premises.

The principal investigator is responsible for reporting all accidents/incidents involving X-ray sources:

- a. for incidents involving employees, the principal investigator must complete, and sign, the University "*Accident/Incident/Occupational Disease Report*" ----- copies of which are available from the Office of Environmental Health and Safety. The completed form must be faxed or hand-delivered to the Office of Environmental Health and Safety.
- b. for incidents involving students, visitors and others, the principal investigator must complete the "*CURIE*" *Accident Form* ----- copies of which are available from the Department of Insurance and Risk Management. The completed form must be faxed or hand-delivered to the Department of Insurance and Risk Management with a copy to the Office of Environmental Health and Safety.

Where a worker has received in one quarter a dose in excess of the annual limit set out in Column 4 of the Schedule of the Ministry of Labour X-ray Safety R.R.O. 1990, Reg. 861, the RSO will investigate the cause of exposure and will provide a report in writing to the Director of Ministry of Labour and to the joint health and safety committee of the findings and of the corrective actions taken.

When an accident, failure of any equipment or other incident occurs that may have resulted in a dose received by an X-ray worker is in excess of the annual limit set out in Column 3 of the Schedule of the Ministry of Labour X-ray Safety R.R.O. 1990, Reg. 861, the PI will notify immediately by telephone, telegram or other direct means the Director of the Ontario Ministry of Labour and the joint health and safety committee. The PI should also send to the Director of the Ontario Ministry of Labour, a written report of the circumstances of the accident or failure.

All reportable accidents/incidents must be reported to the Office of Environmental Health and Safety within 24 hr in order that the appropriate report is filed with the Workplace Safety and Insurance Board.

When a known or suspected accident is reported to the principal investigator/X-ray sources supervisor or the Office of Environmental Health and Safety, the X-ray sources worker with a suspected injury will be referred to the appropriate University Health Service or hospital.

7 PERSONAL DOSIMETRY

All X-ray workers, supervisors or PIs working with or within the vicinity of an open X-ray source shall wear a personal dosimeter. The dosimeter shall be ordered through the RPS by filling the form presented in Appendix 3 of this program. If the x-ray source is enclosed in cabinet no radiation dosimeter is required.

A Canadian Nuclear Safety Commission (CNSC) certified dosimetry service should be used to provide the dosimetry service for the U of T.

The RSO will verify that the dose recorded by the personal dosimeter is reasonable and appropriate in the circumstances and will notify an inspector of the Ontario Ministry of Labour of any dose that does not appear reasonable or appropriate

The RPS will retain the personal dosimeter records for a period of 3 years. The National Dose Registry of the Health Canada keeps the life time exposure records.

If, when using an X-ray machine for the diagnostic examination of animals, the animals are required to be held by hand, a protective apron and gloves providing shielding equivalent to at least 0.5 mm of lead shall be worn by the person providing the restraint or support. The person shall wear an extremity dosimeter (ring) under the gloves during the procedure. It is forbidden to hold the film cassette by hand. A record of radiographic exposures, including the date, kilo-voltage, tube current, and duration of each exposure shall be maintained and kept for at least one year.

Each declared X-ray pregnant worker will be provided with a Personal Electronic Dosimeter (PED). The weekly readings of the dosimeter will be communicated to the RSO at the end of each working week. Any unusual reading and anytime the alarm sounds will be communicated to the RPS immediately.

8 ENGINEERING CONTROLS

Engineering controls are physical barriers designated to keep the risks of using X-ray sources under control. When, due to the nature of the device these engineering controls are not applicable, the PI has the obligation to ensure that equivalent controls are in place. These controls should offer equal or greater protection than the ones described here.

8.1 Shielding

To reduce the dose received by X-ray workers according to ALARA and under the permissible limits, structural or other shielding shall be installed as is necessary.

The RSO will assist in calculating the thickness of the shielding for each individual application when asked by a PI.

If a lead apron and gloves are required when using an X-ray machine the material will provide a shielding equivalent to at least 0.5 mm of lead.

8.2 Diaphragms, Cones, Collimators

Diaphragms, cones and adjustable collimators or other suitable devices shall be provided and used as are necessary to limit the dimensions of the useful X-ray beam.

Each port shall be designed in such a way that the X-ray beam can emerge only when a camera or other recording device is in its proper position, wherever applicable.

All unused ports shall be secured in such a way as to prevent inadvertent opening.

8.3 Locks, Interlocks

When the air kerma in an area may exceed 100 μGy in one hour, access to the area should be controlled by:

- Locks or interlocks if the X-ray source is installed in a permanent location, and
- Barriers and X-ray warning signs if the X-ray source is portable or mobile and is being so used
- A guard or interlock which prevents entry of any part of the body into the primary beam path shall be used, wherever applicable

When an interlock terminates an exposure, it shall only be possible to restart the exposure from the control panel.

8.4 Shutter

A shutter is a mechanical device installed near the exit of the X-ray tube capable of blocking the beam when is necessary. The shutter may be used in connection with an interlock to stop the beam.

9 ADMINISTRATIVE AND PROCEDURAL CONTROLS

Engineering controls must be given primary consideration in instituting a control measure program for limiting access to X-ray sources radiation. If some of these engineering controls are impractical or inadequate, then administrative and procedural controls that provide equivalent protection shall be used.

Administrative and procedural controls are methods or instructions which specify rules, or work practices or both, which implement or supplement engineering controls and which may specify the use of personal protective equipment.

9.1 Standard Operating Procedures (SOPs)

Standard operating procedures (SOPs) for X-ray machines shall be maintained with the X-ray sources equipment and must always be available as a reference for all X-ray workers; SOPs may include the X-ray sources instruction manual (prepared by the manufacturer) and as appropriate, additional written information to ensure compliance with good work practices and safety.

9.2 X-ray Worker Training

Education and training shall be provided for all X-ray workers (see section 5 of this program). The level of training shall be commensurate with the level of potential hazard.

9.3 Authorized Personnel

X-ray sources shall be operated, maintained or serviced by authorized personnel. Authorization to operate, maintain or service an X-ray machine is be given by the PI responsible for the X-ray machine. The RSO will verify the list of authorized personal to confirm that the person/persons have the appropriate training.

9.4 Protective Equipment

When appropriate, lead apron and gloves will be worn by the X-ray worker to reduce the dose as low as possible. The personal dosimeters (whole body and ring, if required) will be worn under the lead apron or gloves to eliminate unreasonable dose recordings by the dosimeters.

9.5 X-ray Signs and Warning Signals

Each room having an X-ray source should have clearly visible signs on all doors indicating that this is an X-ray room (Appendix 3 of the U of T X-ray Safety Manual).

Each X-ray source shall have the appropriate signs indicating that X-rays are being produced, and that the moving of the X-ray source in a different room should be communicated to the RPS.

The control panel should indicate when the X-ray machine is producing X-rays.

A warning light shall be mounted near each X-ray tube in such a way as to be clearly visible from any direction from which the tube can be approached, which indicates when X-rays are being produced.

The condition of each shutter, open or closed, shall be clearly indicated at or near the X-ray tube.

In case of cabinet X-ray equipment, the warning signal should be mounted on or near the cabinet in such a way as to be noticeable from any position from where the cabinet can be opened.

Cabinet X-ray equipment that is intended to permit the entry of a person shall also be provided with:

- Suitable audible or visible warning signals within the cabinet that shall be actuated for at least 10 seconds immediately prior to the initiation of X-ray production after the closing of any door that is designed to permit human access into the cabinet
- Suitable audible or visible warning signals within the cabinet that shall be actuated during X-ray production
- Effective means within the enclosure to prevent or interrupt the production of X-rays, that cannot be reset from outside the enclosure and that be reached without having to pass through the primary X-ray beam.

10 PROGRAM AUDIT

The Radiation Protection Service of the Office of Environmental Health & Safety shall audit various components of the X-ray safety program (in conjunction with the LSO) on an annual basis and prepare a report to the UTRPA.

The audit may consist of but is not limited to the following:

- a. inspections of some X-ray sources facilities for compliance with the University's X-ray safety program;
- b. review of training records to confirm that X-ray sources supervisors/workers have had appropriate training to work with X-ray sources;
- c. review of records vs. inspections to confirm that the registration/ deregistration process is working effectively.

A Joint Health and Safety Committee may, as part of its inspection of the workplace and subject to access control procedures, inspect X-ray sources facilities.

REFERENCES

Occupational Health and Safety Act, X-ray Safety R.R.O. 1990, Regulation 861, Ontario
Ministry of Labour

Healing Arts Radiation Protection Act, Ontario Regulation 663/00 X-ray safety Code
Ontario Ministry of Health

APPENDIX 1 – X-RAY PERMIT APPLICATION FORM**X-RAY PERMIT APPLICATION****UNIVERSITY OF TORONTO RADIATION PROTECTION AUTHORITY**

1. **Name:** _____
2. **Department:** _____
3. **E-mail address:** _____
4. **Building:** _____
5. **Office room number:** _____
6. **Office telephone number:** _____
7. **Home telephone number:** _____
8. **Laboratory room(s) number(s):** _____
9. **University position:** _____
10. **Relevant qualifications (regarding X-Ray):** _____

11. **Previous training in X-Ray Safety:** _____
12. **X-Ray work experience:** (In detail)

13. X-Ray source(s) to be registered:

#	Building	Room	Manufacturer	Model #	Serial #
1					
2					

#	Type ¹	kVp	mA	Use ²	Use Freq. ³
1					
2					

Notes: ¹ XRD, Dental, Crystallographic, etc. ² Research, Teaching, etc

³ Daily, Weekly, Infrequently, 20 hr/week, etc

14. Plan location drawing:

A scheme of the laboratory (in scale) must be provided with the following information:

- the proposed location of the X-Ray source;
- the proposed location of the X-Ray control panel, if the location is different from that of the X-Ray source.
- the type and location of any safety devices such as warning lights, interlocks and cut-off switches.
- indicate the north direction.

15. Composition of the boundaries of the room, including windows and doors (give material types and thicknesses:

Floor: _____

Ceiling: _____

Walls: North: _____

East: _____

South: _____

West: _____

16. Occupancy:

Direction	Occupancy ⁴		Usage factor ⁵ Per cent
	Type	Per cent	
Down			
Up			
North			
East			
South			
West			

Notes: ⁴ Occupancy type is the nature of use of the area in the indicated direction relative to the X-Ray source (e.g. office, laboratory, hallway, etc). Occupancy per cent is the fraction, expressed as a percentage, of the time the area will be occupied while the source is on (omit if unknown).

⁵ The usage factor is the fraction of the time the beam will be pointed in the direction indicated, as a percentage of the total time the source is on. For un-collimated, panoramic or multiple beams, the sum may exceed 100 per cent.

Applicant's Signature: _____

Date:

Department Signature: _____

(Chair/Head of Department)

(Print Name of Chair/Head)

U of T Radiation Protection Service
Office of Environmental Health & Safety
Room 702, 215 Huron Street
University of Toronto
Toronto, Ontario, M5S 1A2

Or fax it to: 416-971-1361

Or e-mail to: <mailto:hector.rocca@utoronto.ca>

APPENDIX 2 – X-RAY SOURCE IN PERMANENT LOCATION REGISTRATION FORM

The PI will fill in form 2 (see next to pages) and submit it to the RPS together with a copy of the drawings of the room where X-ray sources will be located.

The plan location drawings shall:

- bear the name of the applicant (University of Toronto) and the address of the location;
- be on a legible scale that is not less than 1:100 and that is suitable for microfilming;
- indicate the north direction;
- show the proposed location of the X-ray source and, where applicable, the range of its motion;
- show the proposed location of the X-ray control panel, if the location of the control panel is different from that of the X-ray source;
- indicate the use of the rooms or areas that are adjacent, both horizontally and vertically, to the proposed location;
- indicate the type and thickness of the shielding installed or to be installed on the boundaries of the proposed location, or the type and thickness of the room's walls; and
- indicate the type and location of the safety devices such as warning lights, interlocks and cut-off switches.

Part B: Specific

Note: One copy of Part B required for each x-ray source for which review is sought.

1. This sheet refers to x-ray source number _____ of _____ x-ray sources located in the room designated as _____ and so marked on the accompanying drawings.

2. This x-ray source is used for

It is identified by:

Make/Model

Serial No.

and has the following operating characteristics:

- a) the maximum rated tube voltage is _____ kilovolts
- b) the maximum rated tube current is _____ milliamperes
- c) the anticipated maximum workload is _____ milliampere - minutes per week.

3. The composition of the boundaries of the room, including windows and doors, are (give material types and thicknesses):

Floor		Ceiling
Walls	North	
	East	
	South	
	West	

Direction	Occupancy (see note 1)		Usage Factor (See note 2)
	Type	Per Cent	Per Cent
Down			
Up			
North			
East			
South			
West			

Note 1: Occupancy type is the nature of use of the area in the indicated direction relative to the x-ray source (e.g. office, waiting room, parking lot, etc.) Occupancy per cent is the fraction, expressed as a percentage, of the time the area will be occupied while the source is on (omit if unknown.)

Note 2: The usage factor is the fraction of the time the beam will be pointed in the direction indicated, as a percentage of the total time the source is on. For uncollimated, panoramic, or multiple beams, the sum may exceed 100 per cent.

The information given in this Part must correspond with that given on the accompanying floor plans.

APPENDIX 3 – X-RAY TRAINING AND PERSONAL DOSIMETRY FORM



University of Toronto Radiation Protection Services Application for X-Ray TLD Monitoring Service

Application must be authorized by Permit Holder AND Badge Coordinator

The following information is required for CNSC licensing purposes.

Please complete the form and submit to Radiation Protection Services (Fax 416-971-1361).

Surname: _____ Full Given Name: _____

Work Phone: _____ E-mail: _____

Position: _____ Sex: Male Female

Date of Birth (mm/dd/yy): _____ Country and Province of Birth: _____

Social Insurance Number: _____ Personnel / Student #: _____

Have you worn a TLD previously? Y N If so, where? _____

Badges will be provided continuously until Radiation Protection Service is notified of a termination date.

Type of Thermo-Luminescent Dosimeter (TLD) Required:

Whole Body/Skin

Extremity (Ring)

Ring Size: S M L

Cost Centre*: _____ Central Fund Centre*: _____

Department/Division: _____ GLOBAL Account/Location Number*: _____

Badge Co-ordinator (Please print First name, Last name)*: _____

Phone Number: _____ Date: _____ Badge Co-ordinator Signature: _____

Permit Number: _____ Permit Holder Signature: _____

* Required

For Radiation Protection Service Use Only

Training requirements fulfilled: _____ Course #: _____

Series Code Number: _____ Badge Number: _____

APPENDIX 4 – X-RAY SAFETY INSPECTION CHECK SHEET

University of Toronto - Radiation Protection Service						
Environmental Health and Safety						
Analytical X-Ray Equipment Inspection Report						
Permit #:		Rev. #:				
Principal Investigator:		Dept:		Date:		
Building:		Rm #:		RSO:		
EQUIPMENT						
Manufacturer:		Type:		Max kV:		
Model No:		Serial#:		Max mA:		
				Y	N	NA
						Comments:
1. SIGNAGE AND POSTAGE REQUIREMENTS						
Drawing approved by MOL posted				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
List of authorized users, meters posted				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Room X-ray sign posted				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
X-ray source sign posted				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
"Do not move the equipment" sign posted				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
UT Emergency Numbers				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. SECURITY						
Access to X-ray source is controlled				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Unattended labs are locked				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Unattended X-ray sources are locked				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. SOPs & MONITORING						
Current SOPs are posted by the X-ray machine/sources				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
X-ray sources inspected by X-ray supervisor periodically				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
X-ray source leakage checked				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. ENGINEERING CONTROLS						
Appropriate shielding is available				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
X-ray machine key control used				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
X-ray tube ON warning light functional				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
ON/OFF X-ray tube energized sign on control panel functional				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Diaphragms, cones or collimators are provided if necessary				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Primary beam terminated				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Unused port flap shutter installed				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cabinet/shield/sample interlocks have been installed				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Interlocks are functional				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Dose rate does not exceed 5µGy/hr (0.5mR/hr) 5 cm from cabinet				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. ADMINISTRATIVE CONTROLS						
X-ray workers/supervisors are trained				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
TLD Badge worn				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
TLD stored away from active areas				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Dosimetry records are available for badge wearers to view				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lead apron or gloves available and worn if necessary				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
UofT X-ray Safety Manual is available to all users				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Principal Investigator or designate available to supervise				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Notes:						