X-RAY SAFETY PROGRAM

CONTENTS

UNIVERSITY OF WATERLOO

1.0 PURPOSE

This program outlines procedures and controls in place to ensure safe working conditions for those working with or near x-ray emitting devices at the University of Waterloo.

2.0 SCOPE

University of Waterloo's X-ray Safety Program encompasses all work with x-ray emitting devices and sources under use at the University.

3.0 ROLES AND RESPONSIBILITIES

In addition to the responsibilities as outlined in the University's Health and Safety Management System, the following responsibilities are required as per the X-Ray Safety Program.

3.1 PERMIT HOLDERS

X-ray permit holders are responsible for:

- Providing facilities, equipment, and supervision according to x-ray safety regulations and this X-ray Safety Program
- Contacting the x-ray safety officer (XSO)before purchasing any x-ray equipment so that the device can be registered with the Ministry of Labour, Immigration, Training and Skills Development
- Notifying the XSO of any location change or modification to any x-ray emitting device under their supervision
- Obtaining an x-ray permit prior to working with any x-ray equipment
- Developing written standard operating procedures (SOPs) and provide them to all workers under their supervision
- Maintain practical training records for the x-ray users on their permit
- Immediately report incidents of exposure or malfunction to the XSO
- Operating the x-ray device upon request by the XSO for the purpose of verifying annual leakage testing

The x-ray permit holder shall require all workers and students under their supervision to:

- Complete the required x-ray safety training
- Obtain authorization status for x-ray emitting devices they will be working with

- Comply with x-ray safety regulations and this X-ray Safety Program
- Immediately report incidents of exposure or malfunction to their supervisor
- Wear the appropriate radiation dosimeter (when required or assigned)

3.2 WORKERS

All workers, students or visitors who work with the x-ray equipment as permitted under this program shall:

- Complete X-ray Safety Training and be authorized to work with x-ray emitting devices
- Comply with x-ray safety regulations and the University's X-ray Safety Program
- Immediately report incidents of exposure or malfunction to their supervisor
- Wear the appropriate radiation dosimeter (when required or assigned)

3.2.1 DESIGNATION OF X-RAY WORKER

As defined by regulation, an x-ray worker is any person who, as a necessary part of employment or assignment, may be exposed to x-rays and may receive a dose in excess of 5.0 mSv per year whole body or more than 0.1 mSv per week from an enclosed x-ray source.

Workers must be provided with appropriate dosimetry to ensure dose limits are not exceeded and informed in writing of the following:

- Their status as an x-ray worker
- Limits on dose equivalent that may be received
- Limits of dose equivalents to pregnant x-ray worker

X-ray diffraction cabinets are the most common type of x-ray emitting device used at the University. The design and construction of these cabinets ensure the dose to a person is kept well below 5.0 mSv per year and 0.1 mSv per week. These workers are not designated as X-ray workers and thus will not need dosimetry.

3.3 SAFETY OFFICE

The Safety Office is responsible in appointing a competent individual the position of XSO, who shall administer the X-ray Safety Program by overseeing and coordinating all aspects of x-ray safety within the institution.

3.4 X-RAY SAFETY OFFICER

3.4.1 DUTIES OF THE X-RAY SAFETY OFFICER WITH RESPECT TO THE INSTITUTION

- Act as the agent of the institution in respect to x-ray registration

- Establish, implement, and maintain a safety control and assessment program in conjunction with the Radiation Safety Committee
- Annually review and survey x-ray emitting devices for radiation leakage. Maintain survey records and report to the Laboratory Safety Committee (LSC) and permit holder if issues are identified
- Implement a personnel monitoring program where needed
- Ensure radiation safety instruments are calibrated and serviced as required
- Control the purchasing, use, and disposal of x-ray emitting devices through the internal permit system
- Ensure appropriate radiation protection training is provided as part of an ongoing "radiation protection awareness program" for all users and those who come into contact with x-ray emitting devices
- Maintain x-ray registration and dosimetry records
- Ensure that each internal permit is amended when changes to facilities, equipment, policies, procedures, or personnel occur
- Investigate and report to the Ontario Ministry of Labour all over-exposures or accidents involving x-rays

3.4.2 DUTIES OF THE X-RAY SAFETY OFFICER WITH RESPECT TO THE LABORATORY SAFETY COMMITTEE

- Function as the link between the LSC and x-ray emitting device users within the institution
- Prepare or review in consultation with the LSC a comprehensive X-ray Safety Program
- Have input in matters on:
    - Facility and equipment design
    - Work practices and procedures
    - Evaluation, issuance, and enforcement of internal permits
    - Disciplinary action necessitated by non-compliance
    - X-ray Safety Training

3.5 X-RAY SAFETY COMMITTEE

The X-ray Safety Program is monitored by the X-ray Safety Committee, which is a sub-committee of the Laboratory Safety Committee. The Lab Safety Committee is advisory to the Vice-President, University Research, and the Safety Office and provides has the following duties:

- Oversees strategies to ensure ongoing and adequate surveillance, hazard identification, and risk evaluation of laboratory-related activities

- Assesses requirements for laboratory users training, laboratory safety procedures, and recommends revisions, when indicated
- Reviews reports related to laboratory safety services, activities, incidents, and interventions in laboratory areas and recommends corrective actions, when indicated
- Maintains subcommittees based on areas of expertise to receive, review, and approve reports and applications required by legislation and regulatory agencies
- Advise, as required, to the Laboratory Safety Committee

4.0 LEGISLATION

4.1 OPERATION

The operation of all x-ray equipment for non-human use in Ontario is covered under the Occupational Health & Safety Act, X-ray Safety Regulation.

4.2 NOTIFICATION

The construction and certification of X-ray producing equipment is controlled by Health Canada under the Radiation Emitting Devices Act.

Health Canada has also published the following safety codes as guides for construction and use of radiation-emitting equipment:

- Safety Code 35. Safety Procedures for Installation, Use and Control of the X-ray Equipment in Large Medical Radiological Facilities, 2008, 43 p
- Safety Code 26. Guidelines on Exposure to Electromagnetic Fields from Magnetic Resonance Clinical Systems, 1987, 20 p
- Safety Code 28. Radiation Protection in Veterinary Medicine, 1991, 38 p
- Safety Code 32. Safety Requirements and Guidance or Analytical X-ray Equipment, 1994, 33p
- Safety Code 34. Radiation Protection and Safety for Industrial X-ray Equipment, 2003, 55 p

5.0 PERMITS

Permit holders planning on purchasing an x-ray device should complete an X-Ray Permit Application (available on the X-Ray Safety website) and contact the XSO at xso@uwaterloo.ca to start the permitting process. Be aware, that depending on the type of source as well as the research location, additional controls may be required for the permit to be approved.

5.1 POSSIBLE X-RAY PRODUCING INSTRUMENTS

Instruments that produce x-rays as a secondary byproduct, such as Scanning Electron Microscropes (SEM's), may be exempt from this program based on dose rates. Upon purchase of these pieces of equipment, the PI should contact the XSO with the manufacturers dose rate for evaluation. All instruments will be evaluated based on manufactuers dose rates as per specifications and a contamination survey completed by the XSO. Instruments with either dose rates above 1 µSv/hr will be required to meet the expectations of the permitting process and X-Ray Safety Program.

5.2 DECOMMISSIONING

As most x-ray sources do not pose any risk when not exposed to power, the decommissioning risk is not extensive. X-rays should be disposed of through return to the manufacturer where possible. If return to the manufacturer is not possible,contact the XSO for alternatives. If you have not already, contact the XSO when the device has been disposed of to have the permit and x-ray registration updated.

6.0 TRAINING

All staff, faculty, and students working with x-rays must complete the following training:

1. Complete the online training course X-Ray Safety (SO1011). This requires reviewing the content as well as completing the quiz.
2. Complete one-on-one practical training provided by the X-Ray permit holder. This training must be documented in the lab. The training provided by the permit holder (*or competent designate) should include:
    1. Specific device the worker is allowed to use
    2. Safe operating procedures of the device
    3. Specific hazards of the device and how they are controlled
    4. Dose limits of the x-ray device (as provided by the manufacturer)

    **Competent designate refers to an individual who is an experienced user that has knowledge on the operational, safety AND permit requirements of the device. This individual should be a senior researcher (not undergraduate or coop), or a laboratory manager/technician.*

Complete X-Ray Safety Practical (SO1011-P) by completing the "Permit Specific Questions" quizzes. The XSO will review the submission in SO1011-P and contact the individual and the permit holder when the individual has been added to the permit. The XSO will review the information submitted in X-Ray Safety Practical (SO1011-P). Once a user has received confirmation from the XSO that they have been added to the permit, they can use the device.

University of Waterloo x-ray training is valid for three years. After three years, the online X-Ray Safety SO1011 course is re-taken as a refresher.

Please note, some of the x-ray flourescence devices on campus require additional operator certification from NRCAN before use. For more information, go to the NRCAN website, or contact the XSO, to learn more on how to get certified.

7.0 INSPECTIONS

X-ray devices are inspected yearly by the XSO. The yearly inspections ensure that the x-rays are still being operating as per their registration and all safety features such as interlocks and lights are functional. During the inspection, the XSO may request copies of the practical training records that maintained in the lab for review.

Any x-ray that has the ability to be turned on must be inspected. PIs can choose to lock-out their device and inactivate their permit as an alternative if they do not wish to power on their device.

8.0 RECORD OF REVISIONS

Date	Author/Editor	Change	Version
May 2025	Katelyn Versteeg	• Section 5.2, updated decommissioning procedures • Section 6.0 updated to transition to digital records • Added Section 7.0 Inspection	X-ray Safety Program v.3.0 MAY2025
January 2022	Katelyn Versteeg	• Updated the definition of an x-ray worker and the responsibilities of the X-ray Safety and Laboratory Safety Committees in Section 3.0 Roles and Responsibilities • Added SOP requirements to section 3.1 Permit Holders • Added section 5.0 Permits • Updated Section 6.0 Training • Added Section 7.0 Record of Revisions	X-ray Safety Program v.2.0 JAN2022
January 2021	Dhananjai Borwankar	• No changes	X-ray Safety Program v.1.0 JAN2021
January 2020	Dhananjai Borwankar	• Program release	X-ray Safety Program v.1.0 JAN2020