

X-RAY SAFETY PROGRAM

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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

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 it can be registered with the Ministry of Labor
- Ensuring an x-ray permit is obtained before working with any x-ray equipment
- Develop written standard operating procedures (SOPs) and provide them to all workers under their supervision

The x-ray permit holder shall ensure workers and students under their supervision:

- Complete X-ray Safety Training and are authorized to work with x-ray emitting devices
- Comply with x-ray safety regulations and this X-ray Safety Program
- Immediately report incidents of exposure or malfunction to the x-ray safety officer (ext. 37900)
- Notify the x-ray safety officer of any location change or modification to any x-ray emitting device under their supervision
- 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 the x-ray safety officer (ext. 37900) and their supervisor
- Wear the appropriate radiation dosimeter

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

Dose information is available on the University of Waterloo Information Memo to X-Ray Workers located on the [X-ray Safety page](#).

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 will not normally be designated as X-ray workers and would not have to wear a dosimeter.

3.3 SAFETY OFFICE

The Safety Office is responsible in appointing a competent individual the position of x-ray safety officer, 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 Laboratory Safety Committee (LSC) and principle investigator if issues are identified
- Implement a personnel monitoring program

- 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 required 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 Laboratory Safety Committee and x-ray emitting devices users within the institution
- Prepare or review in consultation with the Laboratory Safety Committee a comprehensive X-ray Safety Program
- Have major input in matters on:
 - Facility and equipment design
 - Work practices and procedures
 - Evaluation, issuance, and enforcement of internal permits
 - Disciplinary action necessitated by noncompliance
 - 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 on Analytical X-ray Equipment, 1994, 33p](#)
- [Safety Code 34. Radiation Protection and Safety for Industrial X-ray Equipment, 2003, 55 p](#)

5.0 PERMITS

Contact the X-ray Safety Officers at xso@uwaterloo.ca to start the permitting process. Identify the type of x-ray (source/device) to be purchased, the research timeline, and the location of use. 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 Microscopes (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 manufacturer's dose rate for evaluation. All instruments will be evaluated based on manufacturer's dose rates as per specifications and a contamination survey completed by

the XSO. Instruments with either dose rates above 1 $\mu\text{Sv/hr}$ 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-ray sources can be disposed of via typical machinery decommissioning processes. Contact the XSO when the source has been disposed of to have it removed from the permit.

6.0 TRAINING

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

1. Online [X-Ray Safety](#) course SO1011
2. Hands-on practical training must be completed for each x-ray that will be used. The training is to be provided by the supervisor (or suitable and designated alternate) and 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 x-rays (as provided by the manufacturer)
3. The worker should then complete a hands-on demonstration to show their competency to the principal investigator.

The Principle Investigator notifies the XSO that the worker has completed the theoretical and practical training by submitting a completed copy of the University of Waterloo [Information Memo to X-Ray Workers](#) to the XSO. The worker may then begin to use the X-Ray Unit.

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 Fluorescence (XRF) devices on campus require additional operator certification from NRCAN before use. For more information, go to the [NRCAN website](#), or contact and XSO, to learn more on how to get certified.

7.0 RECORD OF REVISIONS

Date	Author/Editor	Change	Version
January 2022	Katelyn Versteeg	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> No changes 	X-ray Safety Program v.1.0 JAN2021
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