

Ontario MLITSD X-Ray Application Support – Guidance Document

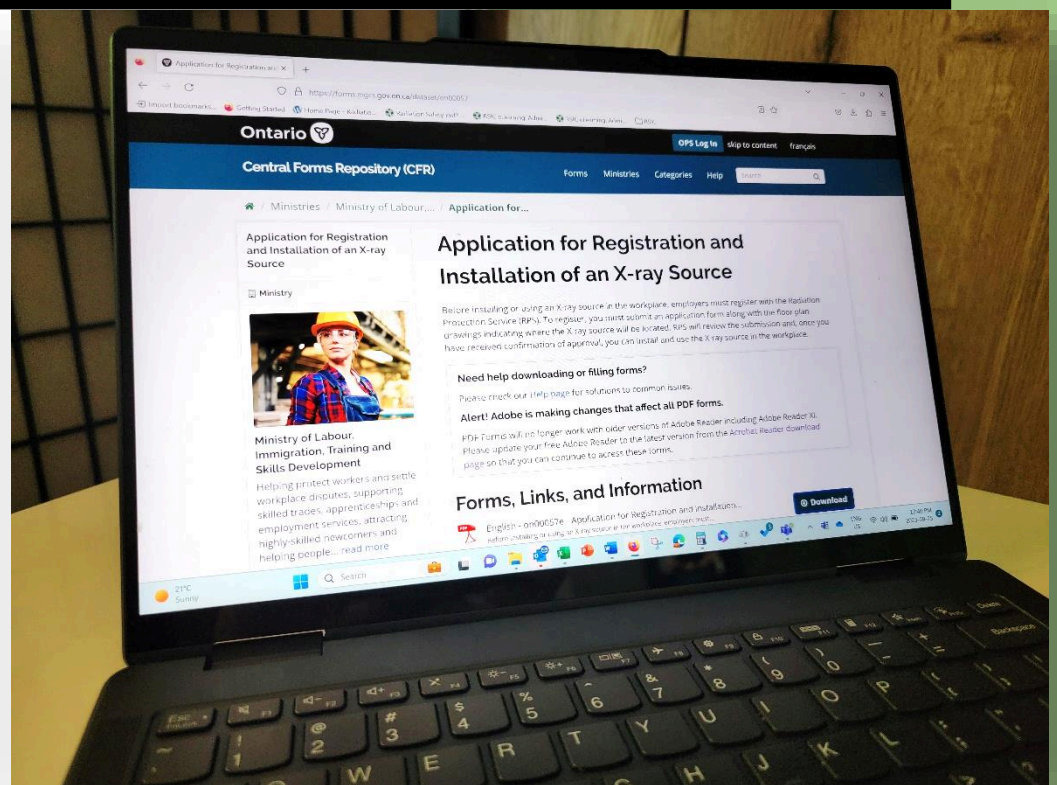


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Introduction

Purpose

The purpose of this guidance document is to support small businesses filling out the application to register their X-ray devices in conformance with regulation 861 under the Occupational Health and Safety Act of Ontario as enforced by the Ontario Ministry of Labour, Immigration, Training, and Skills Development (MLITSD).

Disclaimer

The material presented here is not legal advice. We take no responsibility or liability in the application of the content. But the content is correct to Ontario at the time of production (June 28, 2023).

Scope

This course is aimed at any workplace that has a device that is capable of producing X-rays. This includes the owners, employers, supervisors, and workers at these workplaces. Two categories of exceptions exist. They are 1) X-ray devices capable of producing X-rays with energies greater than 1 MeV, which are regulated by the Canadian Nuclear Safety Commission, and 2) X-ray devices intended to be used in the diagnosis or treatment of humans, which are regulated under the Healing Arts Radiation Protection Act.

Overview

You can find the form [here \(on00057\)](#). If you cannot open the form, or it does open but the content does not show properly, update your Acrobat or browser, and try again. Some browsers may not be able to open the file, but Adobe Acrobat will typically work. If you download the form, you will be able to save your progress. You can also print the form out and submit by mail, but the Ministry prefers to receive these applications electronically.

To complete the form, you need to be part of a business that owns (or is in the process of acquiring) an X-ray device. There should be a physical space for the installation of the X-ray device or, if the device is portable, a space for the storage of the device. The business also needs a person who is responsible for directing the safe use of the device. This person needs adequate training, education, or experience regarding X-ray safety and safe operation of the device. You will also need technical information about the device and some basic information on how the device will be operated so that you can calculate the workload and the amount of shielding necessary. You will also be required to provide a floor plan of the room which will house or store the X-ray device along with information about spaces neighbouring that room and about barriers between those spaces and the room.

As the guide breaks down the form step by step, key terms that appear throughout the form will be bolded for easier reference.

Guide

This section is the guide to completing the X-ray device registration form, on00057. It will be broken down into 5 subsections to help with navigation. The subsections are:

- I. Applicant Information
- II. X-ray Source Information
- III. Specifications and Calculations

- IV. Location, Responsible Person, Floor Plan
- V. Attestation and Submitting the Form

Form on00057 labels **Applicant Information** as **Section 1** and everything else as **Section 2**.

I. Applicant Information

In Section 1 of the form, you will need to enter information about the employer, who typically owns the X-ray device. The **Employer legal name**, **Business number** and **Employer operating name** refer to the corporate entity and should match the federal or provincial records.

The **Employer business address** should be the listed address of the corporation according to the federal or provincial records. Please note that the **Street number**, **Street name**, **Street type**, and **Street direction** are all separate fields. Do not put the whole address under **Street name**!

The **Employer contact information** must be a person who can represent the corporation (e.g., director, officer, or authorized representative). See Figure 1 for an example of a filled-out **Section 1: Applicant information** using information from the Radiation Safety Institute of Canada.

Section 1: Applicant information				
Employer information				
Employer legal name *			Business number	
Radiation Safety Institute of Canada			106861511RC0001	
Employer operating name				
RSIC				
Employer business address				
Unit number	Street number *	Street name *	Street type	
760	100	Sheppard	Avenue	
Street direction	City/town *	Province	Postal code *	Telephone number *
East	Toronto	ON	M2N 6N5	416-650-9090
Employer contact information				
Last name *		First name *		Telephone number *
Mozayani		Natalia		416-650-9090
Position/title		Email address *		
President & CEO		info@radiationsafety.ca		

Figure 1. A filled-out Applicant information section. © King’s Printer for Ontario, 2022. Reproduced with permission.

Under **Nature of the employer’s business**, please select only one category. Notice that *Medical (exposure of living)* is not an option because those machines are regulated by the Ontario Ministry of Health and Long-Term Care. **Applicant notes to reviewer** is for additional information and can include the X-ray’s usage frequency, or the purpose of the X-ray.

II. X-ray Source Information

Section 2: X-ray source is the bulk of the application. You will need to complete this section for each X-ray source that is operated by the employer. If you have multiple sources, there is a button at the end of **X-ray source number 1** to **Add another X-ray source**. If you are completing the form by hand, please add the spaces necessary for the additional sources before printing.

At the start of **Section 2**, please select the **Nature of the application** by checking all that apply. You must also indicate if you are completing this form because of the direction of an inspector from MLITSD.

For each source, indicate in which room the source will be located. The name of the room must match the designation on your floor plan. Then, indicate when that source is expected to begin operation (**Operation of X-ray source**).

Next, indicate the **X-ray source type**, by selecting between **Portable** X-rays, **Cabinet** X-rays, **Cabinet (walk-in)** X-rays, and **Fixed** X-rays. We have included here a few examples of each type of X-ray device (Figure 2–Figure 9).

Portable



Figure 2. [Portable X-ray Device](#), by Ron Reeves, [Public domain](#), via Wikimedia Commons



Figure 3. [Inspection of IED \(Improvised Explosive Device\) by X-ray](#), by RadXman, [CC BY-SA 3.0](#), via Wikimedia Commons

Cabinet



Figure 4. *"Image showing Pippa Pearce, MBE examining vessel prior to X-Ray", by The British Museum, CC BY 2.0, via Wikimedia Commons*



Figure 5. *"Image of bandage wrapped vessel in X-Ray cabinet at British Museum", by The British Museum, CC BY 2.0, via Wikimedia Commons*

Cabinet (walk-in)



Figure 6. [200kV Large Walk-In X-ray Cabinet](#), images provided by kind permission of Euroteck Systems UK Limited, www.euroteck.co.uk

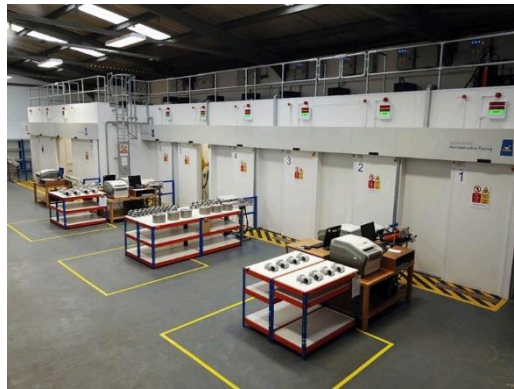


Figure 7. [A series of eight walk in exposure bays rated from 160kV to 320kV](#), images provided by kind permission of Euroteck Systems UK Limited, www.euroteck.co.uk

Fixed



Figure 8. [Vet X-ray, Veterinary care](#), by WiP-Studio, image used under license from [Shutterstock.com](https://www.shutterstock.com)



Figure 9. [X-ray cargo in truck / Area of caution ionizing radiation](#), by Bigc Studio, image used under license from [Shutterstock.com](#)

III. Specifications and Calculations

X-ray Source Specifications

Once you have selected the X-ray source type, you will need to enter the **Manufacturer, Model name and number**, and **Serial number** of the source. You must indicate how the source is identified on the floor plan (**Identified on floor plan as**). This will be necessary if you have multiple sources in a room, for example. You will also need to report the **Maximum rated tube voltage (kVp)** and the **Maximum rated current (mA)**. The **Anticipated maximum workload (mA-min/week)** is a calculated quantity, and you will see some examples of that calculation in the next subsection. You will also see a sample technical information sheet in Figure 10 that shows how this information may appear when you receive it from the manufacturer. Most of the time, this information is obtained from the manufacturer's documentation. If the necessary information is not supplied in the documentation, you will need to contact the manufacturer directly to request this information.

FakeCorp

Technical Data Sheet

Device information	
Device name:	Continuous X-Ray Gauge
Serial number:	CXG-291
Manufacturer:	FakeCorp Ltd.
Application:	non-medical use

High-voltage generator	
Device name:	XHVG-6000
Serial number:	21XV3U211
Manufacturer:	Made-up Electronics

X-ray tube	
Device name:	LEXM 701
Serial number:	05983233051
Manufacturer:	Generic X-ray Equipment Supplier
Anode material:	Tungsten

Max. operating values	
High voltage:	40 kV
Current:	3 mA

Normal operating values	
High voltage:	max. 22 kV
Current:	max. 1.2 mA
Power:	max. 8.3 W

Quality assurance	
Leakage radiation at 1m distance	<0.5 μ Sv/hr.

Figure 10. Sample technical specifications sheet for an X-ray gauge manufactured by a fictional company.

Near the beginning of the sheet should be the **Manufacturer, Device model name and number, and Serial number.**

Other information such as specifications for the components of the X-ray device (i.e., high-voltage generator, and X-ray tube) is not needed for the application.

The information sheet should contain maximum voltage and current. Note that you are looking for the maximum, not for normal operating values. If the maximum values are not included, you will need to contact the manufacturers directly for that information.

With the information given in this sample technical data sheet, the filled-out form is shown in Figure 11. The **Anticipated maximum workload** is left blank in Figure 11 as this is a calculated quantity and will typically not be provided in the data sheet. The next subsection will show two examples of this calculation.

X-ray source specifications		
Make, model, serial number: if the make, model and serial number are unknown at the time of the application, enter "unknown". Ensure that once the X-ray source is installed, the make, model and serial number are forwarded to the Ministry.		
Manufacturer * FakeCorp Ltd	Model name and number * Continuous X-Ray Gauge	
Serial number * CXG-291	Identified on floor plan as X-ray	
Maximum rated tube voltage (kVp) * 40	Maximum rated current (mA) * 3	Anticipated maximum workload (mA-min/week) *

Figure 11. A filled-out X-ray source specifications section. © King's Printer for Ontario, 2022. Reproduced with permission.

Anticipated Maximum Workload

There is a different calculation for pulse-type X-ray sources and continuous beam X-ray sources. A sample calculation is provided for each type below.

Pulse-type X-ray sources

$$workload = \frac{(i \text{ max}) * \left(\frac{time}{exposure}\right) * \left(\frac{exposure}{week}\right)}{60 \frac{sec}{min}}$$

To calculate workload for a pulse-type X-ray source, you will need the following: 1) the maximum current, indicated in this equation as *i max*; 2) *time per exposure*, which is the time needed to get one exposure, typically given in fractions or decimals of a second. This value depends on the application of the X-ray. Most machines will allow you to set the exposure time. Make sure the units for this are in seconds (for example, 150 milliseconds is equal to 0.15 seconds). 3) *exposure per week*, which is based on your expectations for your business. If you expect to take 20 exposures in a typical week, you will put 20 here.

With this information at hand, input the values into the equation, multiply all three terms in the numerator, then divide by 60. The result will be the **Anticipated maximum workload in mA-min/week**.

As an example, suppose a veterinary clinic is using a pulse-type X-ray with a maximum current of 2.6 mA. Each time they use the X-ray to take an image, the exposure time is 1/10 of a second. And they expect to do 15 exposures a week (3 each workday).

We input the information into the equation, multiply all the terms in the numerator, then divide the result by 60. The **Anticipated maximum workload** for this pulse-type X-ray is 0.065 mA-min/week. See Figure 12 for a summary of this calculation.



Figure 12. Sample Anticipated maximum workload calculation for a pulse-type X-ray source.

Continuous X-ray sources

$$workload = (i \text{ max}) * \left(\frac{\text{hours}}{\text{week}}\right) * \left(60 \frac{\text{minutes}}{\text{hour}}\right)$$

To calculate workload for a continuous beam X-ray source, you will need the following information: 1) maximum current, in milliamperes, shown in the equation as *i max*; 2) *hours per week*, representing how many hours the device is expected to be on and producing X-rays in a typical week.

With this information at hand, input them into the equation and multiply them, then multiply by 60 to get the **Anticipated maximum workload in mA-min/week**.

As an example, suppose an X-ray gauge is used to evaluate the thickness of particle boards on a production line. The gauge has a max current of 3 mA and is always on, 24/7. *i max* equals 3 mA; hours/week equals 24 hours a day multiplied by 7 days a week, giving us 168 hours/week of operation. Entering these into the equation and multiplying everything together, we get 30,240 mA-min/week. See Figure 13 for a summary of this calculation.

IV. Location, Responsible Person, Floor Plan

Location of X-ray Source

Next in this section is the location of the X-ray source. An inspector should be able to find the building or site of the X-ray source with this information. If there is a street address, enter the address; if there is no street address, include enough description so that an inspector can reach the location. The address you enter on the form must match what is stated on the floor plan.

Note that, like in Section 1, the **Street number**, **Street name**, **Street type**, and **Street direction** are all separate fields. Do not put everything under **Street name**.

Responsible Person

Next in **Section 2** is for the responsible person. Each source requires a competent person to exercise direction of the safe use and operation of the X-ray source. If you have multiple sources, you can use the same person.

Relevant radiation safety qualifications is where you list the training and qualifications of the responsible person. (e.g., X-ray safety officer training from the Radiation Safety Institute of Canada in September 2022.)

E.g., an X-ray gauge is used to evaluate the thickness of particle boards on a production line. The gauge has a **max current of 3 mA** and is always on, 24/7. *i max* equals 3 mA, hours/week equals 24 hours a day multiplied by 7 days a week, giving us **168 hours/week** of operation.



i max = 3 mA
hours/week = 168 hours/week



$$\begin{aligned} workload &= (i \text{ max}) * \left(\frac{\text{hours}}{\text{week}}\right) * \left(60 \frac{\text{minutes}}{\text{hour}}\right) \\ &= 3 \text{ mA} * 168 \frac{\text{hours}}{\text{week}} * 60 \frac{\text{minutes}}{\text{hour}} \\ &= 30240 \text{ mA-min/week} \end{aligned}$$

Figure 13. Sample Anticipated maximum workload calculation for a continuous beam X-ray source.

Floor Plans and Drawings

The last part of **Section 2** is about **Floor plans and drawings**. The floor plan must satisfy a list of requirements included here in Figure 14.

Floor plans and drawings
<p>An attached PDF (or hard copy if applying by mail) version of a plan location drawing should*</p> <ul style="list-style-type: none">• Be legible• Use a scale of at least 1:100• Have a maximum size of 356 mm by 216 mm (8 ½ " x 11")• Indicate the name of the employer and the address of the workplace at which the X-ray source is to be installed or used• Indicate the direction north• Show the proposed location of the X-ray source and the range of its motion if applicable• Show the proposed location of the control panel and exposure switch• Indicate the use of the rooms and areas that are adjacent, both horizontally and vertically, to the proposed X-ray source location• Indicate the type of thickness of the shielding proposed on all the boundaries of the X-ray source location including any doors and windows• Show the type and location of any safety devices such as warning lights and interlocks <p>Attach floor plans and drawings. If applicable also attach shielding calculations.</p>

Figure 14. Requirements for Floor plans and drawings from [Application for Registration and Installation of an X-ray Source](#). © King's Printer for Ontario, 2022.

The plan location drawing can be done internally or by a third party you have hired. It can be hand drafted or drawn digitally but must be legible. The floor plan does not need to show the whole building or facility, only the room with the X-ray source and spaces adjacent to that room. If the drawing satisfies the list of requirements above, it will be suitable.

The requirement of using a scale of at least 1:100 can be counterintuitive. For example, a scale of 1:50 is larger than a scale of 1:100 and commonly used. Another common scale is $1/4" = 1'$ which would be equivalent to a scale of 1:48. A scale of 1:200 is smaller than 1:100 and will be too small to be used in this application. And if you were to look at a plan made at a scale of 1:200 in real life, it would be too small to make out enough details to evaluate it. Think of it as comparing fractions, where 1:2 is larger than 1:3, and 1:4 is smaller than 1:3. The scale you choose for your floor plan or drawing must be larger than 1:100.

One way to check to see if your scale is larger than 1:100 is to turn that ratio into a fraction, then turn that fraction into a decimal. 1:100 can be written as a fraction of $1/100 = 1 \div 100 = 0.010$. Similarly, a scale of 1:48 would work out to be a decimal of 0.021, which is larger than 0.010. A scale of 1:200 works out to be a decimal of 0.005, which is smaller than 0.010.

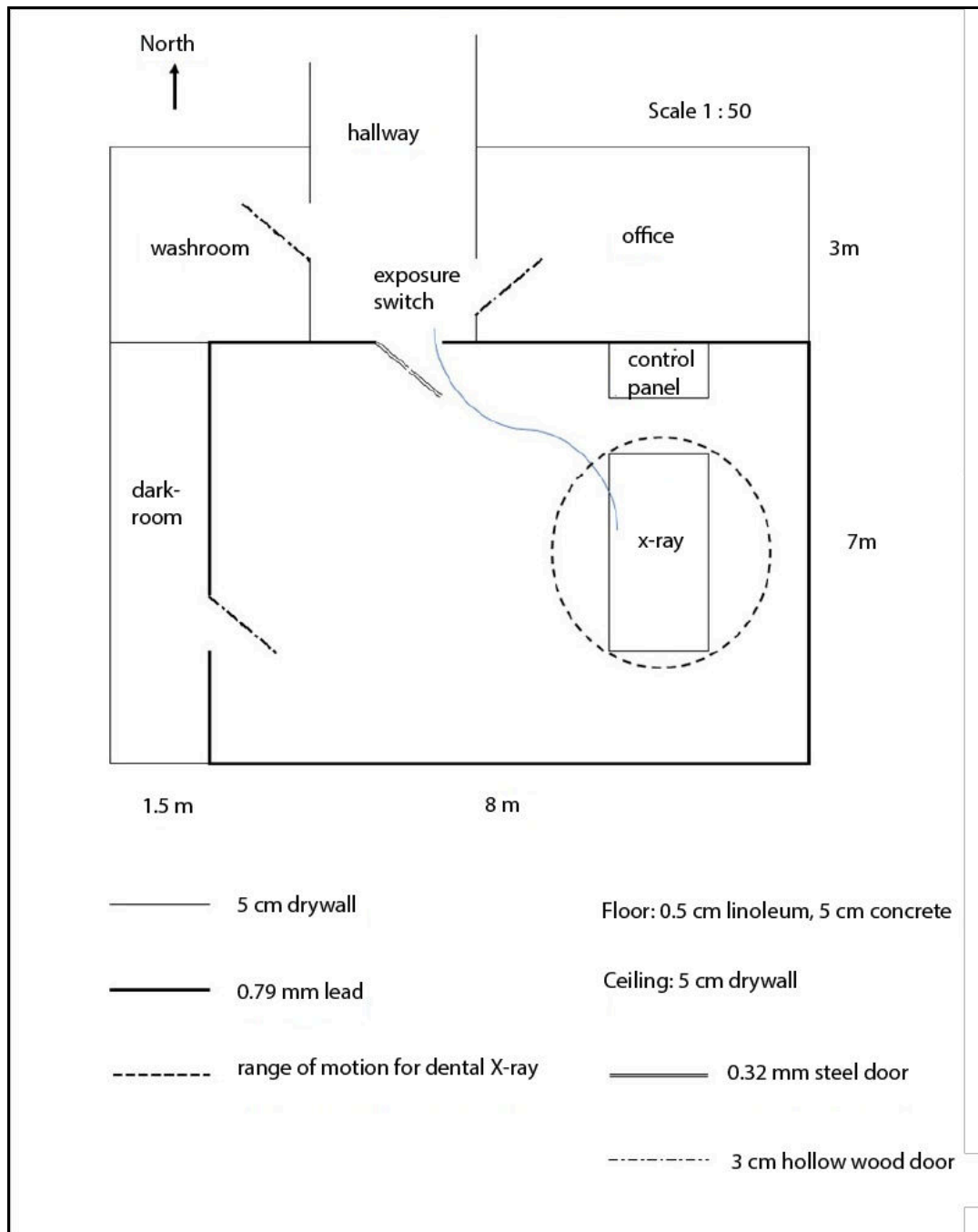


Figure 15. Sample plan drawing from [Guidance for completing the X-ray registration and application form](#). © King's Printer for Ontario, 2023.

The sample plan provided on the guide webpage is included here in Figure 15. *This sample plan contains the following requirements:* an indication of the direction north, a scale of at least 1:100 (1:50 is a larger scale than 1:100), location and range of motion of the X-ray source, location of the control panel and exposure switch, some of the adjacent spaces, shielding type and thickness. Note: a common omission is the material and thickness for all the walls, doors, ceiling, and floor. This information is how the Ministry

will evaluate your shielding requirements and if it is not included on the floor plan, you will be contacted for that information or be asked to resubmit the application.

The plan is also missing the following information: the name of the employer and address of this site, adjacent spaces to the east, south, above, and below (e.g., is it outside, an adjacent unit, a walkway, a parking lot), type and location of safety devices (e.g., safety lights, interlocks, warning signs), and, optionally, occupancy factors, which represent what percentage of the workweek each space is occupied. This is optional because there are default occupancy factors that you can see in the form, but if you anticipate alternate occupancy factors, you can include them under **Alternate occupancy factors**.

To determine the amount of shielding required, you can refer to Safety Code 28 or Safety Code 20A. Safety Code 28 is a bit easier to understand but both sets of instructions involve some math. This is generally only necessary for fixed X-rays since portable X-rays will not have permanent shielding, and cabinet X-rays will have shielding built into the cabinet. The calculations found in those safety codes are beyond the scope of this guide. If you are having difficulty understanding and following the safety codes, it might be more economical to engage a consulting service to help with that step.

V. Attestation and Submitting the Form

Lastly, after Section 2, we come to the **Attestation section**. This can be filled out by the employer or the responsible person or someone else authorized by the employer. Pay attention to the date format of year, month, and day.

Finally, after completing Section 1, Section 2, and the Attestation, you can save and submit the form, either electronically by emailing it to RadiationProtection@Ontario.ca, or printing the form out and mailing it to the Ministry of Labour, Immigration, Training, and Skills Development, Radiation Protection Service, at 81A Resources Road, Toronto, Ontario, M9P 3T1. The Ministry prefers electronic submissions. Mailed submissions are scanned and then evaluated the same way as electronic submissions. Therefore, electronic submissions are typically evaluated faster than mailed submissions.

End of Guide

This brings us to the end of this guide. Thank you for accessing this resource! If you have questions or require clarifications, please reach out to the Radiation Safety Institute of Canada. Our website is radiationsafety.ca, our email is info@radiationsafety.ca, our phone number is 416-650-9090, and our fax number is 416-650-9920. Good luck with your application!