

Safe Work Practices

Microtome Use

Scope and Purpose

This Safe Work Practice document covers some of the hazards and provides some general safety considerations for working with a microtome. The purpose of this document is to assist supervisors in the development of their lab-specific Standard Operating Procedure (SOP) for microtome work. This document does not take the place nor does it fulfill the role of a detailed work-specific, safety-focused SOP. Before any personnel works with a microtome they must have received in-house training and have reviewed their lab's specific microtome SOP.

As with the operation of any equipment, the manufacturer's instructions on safe use and required maintenance should be followed.

Introduction

Microtomes are devices used to cut extremely thin sections of tissue for microscopic study. They can be operated manually, semi-automatically or automatically. They use blades which are extremely sharp and there is a number of potential hazards involved in their use. These hazards may include cuts from the knives or blades, biohazards, cold burns, aerosol production, slips and falls, and repetitive strain injury. Before any work with microtomes can occur in your lab a Local Risk Assessment (LRA) needs to be completed and a work-specific SOP created.

Responsibilities

Principal Investigator/Supervisor:

- Perform a Local Risk Assessment (LRA) for the proposed work
- Create a written Standard Operating Procedure (SOP) for the safe operation of the microtome
- Ensure all users are trained in the safe operation and maintenance procedures of the microtome
- Document all training
- Validate the competence of users while operating the machinery and provide refresher training when appropriate

- Supervise microtome use when/if necessary
- Ensure that copies of the user instructions for the equipment are readily available
- Ensure that routine maintenance and repairs are conducted

Users:

- Complete a training session on microtome use and maintenance
- Read and follow all provided instructions (SOPs) for the safe use and maintenance of the equipment
- Wear required PPE
- Operate and maintain all microtomes according to the outlined safety procedure and lab protocol (SOP)
- Report any cause for concern or issues when operating the machinery to the responsible lab operator or supervisor
- Report any accidents (injuries, spills) or near-miss incidents to your supervisor immediately

Local Risk Assessment (LRA)

A risk assessment for the use of a microtome in your lab must be performed. This assessment should be prepared by an experienced person who is competent and knowledgeable in the operation of microtomes and potential risks and hazards. This assessment must identify the hazards and who might be harmed. The LRA must also assess the likelihood of injury and its consequences and outline measures to be used to reduce the risk of injury. The risk assessment can then be used to help create your lab's work-specific and safety focused SOP.

Standard Operating Procedure (SOP)

A Standard Operating Procedure is a detailed step-by-step procedural document on the safe operation of the particular microtome in your lab. It should contain precise, practical instructions on how to use the device and all the safety measures that should be followed including PPE requirements. It should also include maintenance and documentation requirements, waste and decontamination instructions, and emergency procedures, including those for emergency shut-down (if appropriate) and accident reporting.

Remember to check all manufacturer recommendations on safe use and maintenance and incorporate them into your SOP.

The SOP should be compiled by an experienced microtome user and updated if there are any changes in the equipment or procedures or as necessary. Principal Investigators are responsible for reviewing and approving all SOPs relevant to their laboratory operations. It must be reviewed, understood and followed by all users. The SOP should be included in your lab-specific biosafety manual and be available for review by all users.

You may decide to post the SOP or portions of the document near the microtome.

You may wish to have a log book for the microtome to track usage. This may assist in developing maintenance schedules, troubleshooting, and recording decontamination activities and other equipment issues and observations.

Personnel Training and Clearance

Personnel must know and understand the potential hazards of their work, and follow all operational practices and procedures. The fundamentals of safe biological work are discussed in the Laboratory Biosafety course (EHS601). Supervisors must also ensure that all personnel, have successfully completed an in-house training session on their lab's SOPs including equipment use, waste procedures and emergency response. Personnel must show understanding and competence in those procedures prior to working in the lab. This requirement is applicable to both new and experienced personnel. All in-house training must be documented, dated and signed by both the trainee and trainer, and available to view upon request by EHS personnel or external regulators. Documentation of all in-house training should be kept by the supervisor for a minimum of 5 years after the personnel has left the lab.

Review all microtome safety measures and emergency response procedures as part of your annual emergency response review (Canadian Biosafety Standard (CBS) 4.3.10).

General Safety

Personal Protective Equipment (PPE)

The PPE to be worn when working in any lab should be in accordance with the highest risk or possible hazard for the equipment, biological agents, material or chemical used in the procedure. The supervisor should advise what PPE is required based on a LRA to identify potential risks in any lab procedure. PPE must be worn at all times when working with biological agents. Check the Safety Data Sheet(s) (SDSs) for the chemicals that will be used in the procedure, to ascertain if any additional PPE is required.

Microtome usage may require specific and additional PPE which must be detailed in your SOP (based on your LRA).

- Lab coats must be long sleeved and knee length
- Long pants or skirt (the entirety of the legs must be covered)
- Shoes are to be closed toe and heel, low heeled (or no heeled) and have non slip soles (CBS 4.6.3) Wax shavings can cause the floor around microtomes to become very slippery, therefore disposable shoe covers, dedicated to the microtome area should be worn, slip-resistant shoe covers are recommended (Canadian Biosafety Handbook (CBH) 12.2)
- Gloves (CBS 4.4.4). Specific glove types may have to be specified for different procedures (based on your LRA). Some examples include nitrile/latex laboratory gloves for handling specimens, utility gloves such as wire mesh or cut-resistant gloves for handling blades and insulated utility gloves for handling freezing materials. Ensure gloves are compatible with possible hazards
- Safety goggles or face shield if there is a possibility of ocular splash, or flying debris (CBS 4.4.2). Safety glasses or goggles may be needed when sectioning tissues. If working with liquid nitrogen safety goggles and/or a face shield may be required. See the UofT liquid nitrogen standard for instructions: <https://ehs.utoronto.ca/wp-content/uploads/2015/10/Standard-for-Inert-Cryogenic-Liquid-Usage-in-the-Laboratory-Updated.pdf>
- Respirators may be required due to the potential exposure to aerosols outside of a primary containment device based on your LRA. Those personnel wearing respirators must be fit tested every 2 years, see: <https://ehs.utoronto.ca/training/respiratory-protection-training-fit-testing/> If working with infectious material or toxins that may have not been inactivated by fixation, respiratory protection should be worn if deemed necessary by your LRA. If working with unfixed tissue follow Universal Precautions and wear respiratory protection: <https://www.canada.ca/en/public-health/services/publications/diseases-conditions/routine-practices-precautions-healthcare-associated-infections/part-a.html>
- Personnel to remove PPE carefully to minimize possible contamination of their skin, hair or clothing when leaving the containment zone (lab) (CBS 4.5.14)
- Potentially contaminated clothing articles and PPE should be decontaminated prior to washing (CBS 4.8.5, 4.8.6): <https://ehs.utoronto.ca/wp-content/uploads/2015/10/Lab-Coat-Washing-Guidelines.pdf>

Additional information and resources on PPE are provided below:

General Laboratory PPE Assessment tool: <https://ehs.utoronto.ca/wp-content/uploads/2016/06/Laboratory-PPE-Assessment-Tool.pdf-Updated.pdf>

General information on PPE: <https://ehs.utoronto.ca/resources/personal-protective-equipment-ppe/>

Protective Glove Standard: <https://ehs.utoronto.ca/wp-content/uploads/2015/10/Hand-Protection-Gloves.pdf>

Protective Eye and Face wear Standard: <https://ehs.utoronto.ca/wp-content/uploads/2015/10/Eye-Protection-Standard.pdf>

Respiratory Protection Program: <https://ehs.utoronto.ca/wp-content/uploads/2015/10/Respiratory-Protection-Program.pdf>

Containment Level (CL) Requirements

The laboratory space in which you handle unfixed material must correspond to the highest Risk Group (RG) of the biological material. For example, if working with tissue that is RG2, then the lab space must be commissioned as a Containment Level 2 (CL2) lab and attached to your permit prior to beginning work. Contact the Biosafety Office (ehs.biosafety@utoronto.ca) if you have any questions.

Risks and Hazards

In this section are listed some of the hazards associated with microtome use and suggestions on risk reduction. It is very important that your LRA captures the hazards that are present in your proposed work procedures. Risk reduction precautions and techniques need to be explored and incorporated into your SOPs.

Sharps hazards

Microtome blades are extremely sharp and have the potential to cause serious injuries. They must be handled carefully at all times. Your SOPs must include detailed instructions on the proper placement, use, removal, cleaning and disposal of the blades.

- Microtomes should be inspected before use and any damage reported. Damaged units must not be used
- Blades need to be handled carefully when installing or removing. Always carry blades in their case to the microtome. Never leave blades on countertops or unattended
- During setup, position the sample first then put in the blade, never the other way around
- When applying the brake, ensure that it is tight to avoid potential accidents from brake slippage
- Keep hands free from moving parts, use forceps or a mounted needle and paint brush to lift tissue section ribbons or individual sections
- Check that the knife guard is in position and the microtome hand wheel is locked before positioning sample
- When operating microtome, ensure foot pedal is positioned in a manner to avoid accidental activation
- Do not clean the knife blade when it is mounted in the microtome except by using a long handled brush
- When not in use, the foot pedal of electrically powered microtomes should be guarded by a cover/guard to prevent unintended operation
- If using reusable blades, wear cut-resistant gloves when removing the blade for sharpening or cleaning
- When cleaning the knife blade, use a tissue, wiping away from the edge

- Do not leave the blade in the microtome when not in use
- Do not remove blade holder from the microtome with a blade present or transport the housing with the blade present
- Dispose of all blades and other sharps in an approved sharps waste container
- Clean and disinfect equipment between users. SOPs should give clear instructions on cleaning procedures and disinfectant (if appropriate). Disinfectant instructions need to include final dilution information, contact time and mixing instructions

Biohazards

Ensure that the hazards inherent in the samples to be used are known. Consider whether the samples are infectious/non-infectious, fixed/unfixed, and any hazards associated with the chemicals used. Infectious material or toxins may not always be inactivated by fixation as they may not have been processed optimally. You should always consider any infectious material as still potentially biohazardous and take the proper universal precautions.

- Personnel working with unfixed or fixed human tissues should take the Bloodborne Pathogen course, EHS 603
- Respiratory protection may be needed if tissue is potentially infectious
- If handling tissue that is potentially infected with pathogens or prions, then cut-resistant gloves should be worn to reduce the risk of exposure
- Perform microtome work with potentially infectious material in low traffic, dedicated areas
- Consider aerosol risk, as chemical freezing agents applied from pressurized cans may produce airborne hazards
- Universal precautions should be taken if handling human tissue
- Ensure the use of the appropriate disinfectant (e.g. one effective against bloodborne pathogens). SOPs should give clear instructions on disinfectant use including final dilution, contact time and mixing instructions

Cold hazards

Consider the potential freezing hazards if using a cryostat (freezing microtome). Precautions are needed to prevent skin exposure to extreme cold as this can cause cold burns.

- Wear appropriate PPE. Do not touch metal parts with bare hands
- Use the appropriate precautions when working with liquid nitrogen or dry ice. Follow the precautions outlined in the UofT standard for liquid nitrogen use: <https://ehs.utoronto.ca/wp-content/uploads/2015/10/Standard-for-Inert-Cryogenic-Liquid-Usage-in-the-Laboratory-Updated.pdf>

Ergonomic hazards

Repetitive strain injuries may occur due to the repetitive movements and awkward postures that are sometimes experienced when working at a microtome. Preventive measures should be done to reduce ergonomic stress on joints.

- Ensure adequate work space around the microtome work station
- Keep supplies within easy reach
- Position chair at the proper height for the work bench
- Feet should be flat on the floor, when sitting at the work bench
- Provide chairs with lumbar support
- Encourage personnel to take regular breaks to stretch and move around (every 20 minutes is recommended)

Reporting Injuries

Personnel must immediately inform their supervisor of any accident causing injury. Within 24 hours, the supervisor will have to file a report via the University of Toronto EHS website <https://ehs.utoronto.ca/report-an-incident/>. Appropriate medical evaluation, surveillance, and treatment must be sought and provided if needed.

Waste Management

All needle and blade waste for disposal must be carefully collected in an approved needle and blade waste container. Puncture-resistant plastic sharps containers must comply with CSA Standard Z316.6-14 for the collection and disposal of needle and blade waste generated at the University of Toronto. Their capacities range from 1.4 to 7.6 litres. Labs must purchase their sharps waste containers as they are not supplied by the university. These containers are commercially available for purchase and are also available at UofT med and chemical stores.

For an overview of waste procedures in bio labs see: https://ehs.utoronto.ca/wp-content/uploads/2019/04/Waste-Information-and-Procedures-for-Bio-Labs_v3.1-09-14-2020.pdf

Ensure that waste is disposed into the correct containers. This is a link to the university's various waste disposal streams: <https://ehs.utoronto.ca/wp-content/uploads/2015/10/Bucket-List-Poster.pdf>

For more information regarding sharp waste management, please refer to the following: www.ehs.utoronto.ca/laboratory-hazardous-waste-management-and-disposal-manual/5-5-sharp-waste-management

St. George campus

University of Toronto Environmental Health and Safety

To set up a pickup service or if you have any questions on hazardous material disposal/waste, contact Rob Provost, Manager, Environmental Protection Services (EPS) at 416-978-7000 or rob.provost@utoronto.ca, or contact the EPS directly at 416-946-3473, or hazwaste.ehs@utoronto.ca. EPS website: <https://ehs.utoronto.ca/our-services/environmental-protection-services>

UTM and UTSC campuses

Take your sealed sharps waste container to the hazardous waste storage area in your building/department for disposal. Ensure lid is secure and transport is done in a safe manner using secondary containment. If you have any questions, please contact the Manager of EPS at rob.provost@utoronto.ca or 416-978-7000.

Resources

Boston University, Environmental Health & Safety, Microtome Safety Guidelines:

https://www.bu.edu/ehs/files/2011/05/Microtome-Safety-Handout_Final.pdf

Lab CE: Microtomy and Injury Prevention: Biological and Ergonomic Hazards:

https://www.labce.com/spg605399_microtomy_and_injury_prevention_biological_and_erg.aspx

Leica Microsystems Education Series: Microtomy and Paraffin Section Preparation:

https://www.leicabiosystems.com/fileadmin/academy/2011/Microtomy_booklet_english_online.pdf

National University of Ireland Galway, Health & Safety Office, Guidance Note, Working with Microtomes and Cryostats: https://www.nuigalway.ie/media/healthsafety/f_7242_MicrotomeGuidelinesRev5.pdf

Public Health Agency of Canada, Canadian Biosafety Handbook: <https://www.canada.ca/en/public-health/services/canadian-biosafety-standards-guidelines/handbook-second-edition.html>

Public Health Agency of Canada, Canadian Biosafety Standard : <https://www.canada.ca/en/public-health/services/canadian-biosafety-standards-guidelines/second-edition.html>

Public Health Agency of Canada, Routine Practices and Additional Precautions for Preventing the Transmission of Infection in Healthcare Settings: <https://www.canada.ca/en/public-health/services/publications/diseases-conditions/routine-practices-precautions-healthcare-associated-infections/part-a.html>

University of California Berkley, EH&S Fact Sheet, Microtome Use: Hazards and Precautions:

<https://ehs.berkeley.edu/sites/default/files/lines-of-services/workplace-safety/87microtomeuse.pdf>

University of California Davis, Safety Services, SafetyNet 146: Microtome Use Hazards and Precautions:

<https://safetyservices.ucdavis.edu/safetynet/microtome-use-hazards-and-precautions>

University of California Irvine, EH&S Fact Sheet: Microtome and Cryostat Safety:

<https://www.ehs.uci.edu/salerts/Microtome%20and%20Cryostat%20safety.pdf>

University of Toronto Environmental Health and Safety

University of Toledo, Environmental Health and Radiation Safety, Microtome Safety Guidelines:

https://www.utoledo.edu/depts/safety/docs/lab_safety/Microtome%20Safety%20Guidelines.pdf

University of Toronto, Environmental Health & Safety: <https://ehs.utoronto.ca/>

University of Toronto, Environmental Protection Service, Laboratory Hazardous Waste Management and Disposal Manual: <https://ehs.utoronto.ca/laboratory-hazardous-waste-management-and-disposal-manual/>

For all additional safety and contact information, please visit our website www.ehs.utoronto.ca