

Health and Safety Considerations for the Management of Makerspaces

Makerspaces are facilities that encourage collaboration and hands-on learning, experimentation and creation, including DIY (do-it-yourself) projects. The types of activities and equipment may overlap with other facilities such as machine shops where activities are carried out by professional and technical staff but unlike those settings, the activities are self-guided by the user themselves.

The types of activities/equipment/machinery/tools at each facility will vary depending on the objectives of the space; the below guidance aims to provide high-level considerations for departments that are planning for or operating such a space and should not be interpreted as an exhaustive list. Departments can contact EHS (ehs.office@utoronto.ca) for assistance.

In Canada, products derived from maker spaces (e.g. 3D printing) is regulated in specific contexts, particularly concerning intellectual property, health and safety, and medical devices. While fabrication device use including 3D printers is commonly used for research and academic purposes, certain actions like replicating patented objects, mass production/high throughput for the purposes of commercial sale or infringing on copyrights/trademark can lead to legal concerns. Additionally, there are regulations regarding licensing of medical devices produced by 3D printing. Please ensure that for any of the above activities that you refer to the applicable regulations, legislation, guidance or directive. Some resources have been included in the below. Please contact EHS for any questions.

- <https://www.canada.ca/en/health-canada/services/drugs-health-products/medical-devices/activities/announcements/notice-licensing-requirements-implantable-3d-printing/draft-guidance-document.html>
- <https://www.canada.ca/en/health-canada/services/drugs-health-products/medical-devices/activities/announcements/notice-licensing-requirements-implantable-3d-printing/draft-guidance-document.html>
- <https://www.canada.ca/en/employment-social-development/services/health-safety/prevention/3d-printers.html>

In addition, the manufacturing of weapons, weapon parts and guns are prohibited. For more information on ghost guns and illegal manufacturer, please refer to:

<https://www.publicsafety.gc.ca/cnt/trnsprnc/brfng-mtrls/prlmntry-bndrs/20230201/011/index-en.aspx>

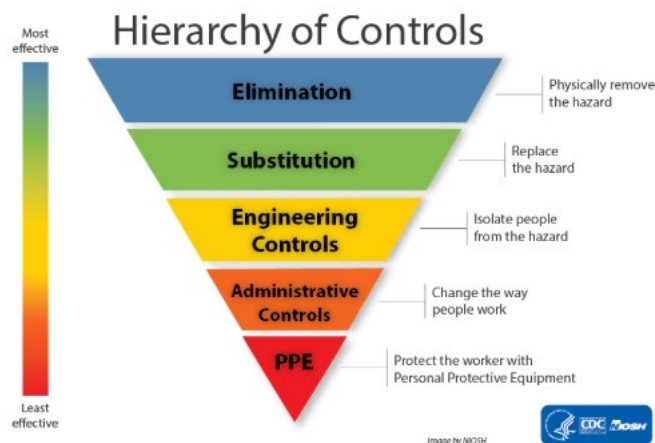
Design considerations

- Adequate space for movement, machinery and materials handling (ergonomics).
- Adequate room ventilation, and exhaust (including local exhaust ventilation), and filtration when applicable (e.g. chemicals, welding fumes, wood dust, heat generated from equipment).

- Include fume hoods in the design of the makerspace when dealing with volatile or hazardous substances to reduce exposure to chemicals.
- Adequate lighting, including task lighting over work areas and benches for small parts assembly.
- Electrical needs shall be adequate for the ESA (Electrical Safety Association)-certified equipment.
- Select furniture, with ergonomic features such as adjustability (worksurface), lumbar support, armrests, footrests, and tilt angles (chairs). Design for flexibility, using furniture that can be easily moved and reconfigured to suit changing Maker space needs. Look for furniture that can be easily adjusted to fit the height, weight, and posture of different users. Use finishes that can withstand spills, and repeated cleaning, e.g., avoid absorbent materials.
- Noise control (from equipment, activities, space infrastructure, etc.)
- Access control
- Fire Protection (at minimum, smoke and fire detection and alarm systems), extinguishers appropriate for the hazards
- Emergency Egress Routes
- Eyewash and emergency deluge showers, hand washing sink(s) based on the required activities.
- Adequate storage that is well-organized for personal protective equipment (PPE), tools, equipment, materials (including hazardous chemicals, storage of compatible chemicals) and waste.
- Signage and labels
- Floor markings to demarcate between hazard or work zones and walkways.
- Full-time workstations are located away from printers, including 3D printers, and other emissions.

Departments (and their designates) are responsible for providing supervision and implementing and developing health and safety programs applicable to their facility:

1. Develop and implement a shop-specific health and safety plan*.
2. Conduct a hazard assessment and develop standard operating procedures (SOPs) for equipment, activities and substances (Examples: [University of Washington](#)). Incorporate the [hierarchy of controls](#) into SOPs. Refer to manufacturer's instructions, safety data sheets (SDS), and industry best practices.
3. Develop mandatory training for staff and users (e.g., faculty, students, visitors, etc.) which includes facility-specific training (i.e. the exact types of equipment, protective measures, emergency procedures etc. in the facility). Maintain records of training/orientation (e.g. who attended, when, topics covered, etc.) and provide refresher training a regular basis (e.g. annual).
4. Develop rules and a process for reviewing and approving projects to avoid inappropriate objects from being made (e.g. weapons, weapon parts, items that can cause physical or emotional harm, etc.).
5. Identify a shop safety coordinator, or responsible person to provide supervision, advice, training, and enforce safety rules. Ensure workplace supervisors are knowledgeable about their roles and responsibilities (Resource - EHS [I am a Supervisor](#) webpage).
6. Control access so that only trained, authorized persons can use the space/equipment.
7. Conduct annual (or as frequent as needed) inspections, including checking first aid kits and fire extinguishers. (Resource: [JHSC Workplace Inspection Checklist](#). Note: departments are responsible for incorporating facility- and equipment-specific considerations into their site-specific checklist.)
8. Schedule and conduct routine maintenance of machinery, equipment and tools.
9. Contact UofT Risk Management to discuss whether waiver forms apply (e.g. personal projects vs. curriculum-based activities). Develop a document which outlines the hazards, the safety mitigations and expectations of Makerspace users.
10. Review and update the above on a regular basis (e.g. annually) and communicate changes/updates.
11. Include makerspace safety guidelines and procedures in access/user agreements to facilitate/communicate mandatory compliance.
12. Advise EHS (ehs.office@utoronto.ca) of any makerspaces.



Source: U.S. National Institute for Occupational Health and Safety (NIOSH)

*Examples of topics to include in a health and safety plan:

- Any required additional training. For information on EHS courses, please refer to EHS Training matrices for [Facilities & Admin](#) staff and Lab [Personnel](#).
- Checks/inspection/calibration of equipment before use
- Housekeeping measures
- Emergency procedures, including location/access to emergency equipment (e.g. first aid kit, emergency deluge shower, eyewash, fire extinguisher, spill kit, etc. when applicable), spill procedures and contact information based on materials used or allowed in the facility (e.g. Makerspace staff, Campus Safety, Environmental Protection Services)
- Location of important health and safety information and equipment (e.g. manufacturer manuals, Safety Data Sheets (SDSs), SOPs, personal protective equipment (PPE), lock-out tag-out equipment, etc.)
- Appropriate waste disposal procedures for both hazardous and non-hazardous waste. (Resources: EPS [Bucket List](#) poster and [EPS](#) webpage.)
- Report all injuries and near-misses to the supervisor/Makerspace U of T contact who will then submit an [Incident/Accident eForm](#).

Makerspace staff members and facility users

- Participate in applicable training/orientation.
- Inspect machinery, equipment and tools before each use. Do NOT use any damaged machinery, equipment and tools and immediately report the hazard to the facility contact or their workplace supervisor.
- Operate all machinery, tools and equipment safely and in compliance with training, applicable SOPs and manufacturer information/manuals.
- Use PPE and other safety equipment as required.
- Practice good housekeeping and hygiene.
- Report health and safety hazards, concerns and injuries to the facility contact or their workplace supervisor.

Machinery, Equipment and Tools

- Ensure equipment safety through safeguarding methods, air filters or exhaust ventilation, [lockout/tagout procedures](#), proper securing of non-portable equipment/machinery, regular calibration and/or preventative maintenance and inspection of equipment/machinery. Maintain a log of maintenance or inspection performed.
- Develop a process for reporting damaged machinery, equipment and tools and taking them out of service until repairs are completed/replacement is available.

- In addition to general ventilation, where applicable, provide local ventilation and/or equipment with dust collection has been considered based on the activity (e.g. wood dust, welding).
- Consult with [Fire Prevention](#) with regards to hot work such as welding, cutting with a torch, using equipment to melt materials, etc.
- Where applicable, ensure machine guarding and emergency stop buttons are in place to protect users. Power tools and milling machines controlled by a computer program and robotic equipment should be equipped with the manufacturer's certified guarding. Where applicable, consult with the manufacturer prior to making any changes to the guarding or to the equipment/machinery/tools.
- All electrical equipment must meet Canadian national safety standards and provincial codes and be certified by an accredited certification body such the Canadian Standards Association (CSA), the Underwriters Laboratories of Canada (ULC), etc. (Resource: [Electrical Equipment Guidance](#))
- Resources:
 - [Machine Safety Guidelines](#)
 - [Soldering Guidelines](#)
 - [Welding Guidelines](#)

3D Printers

- Only approved or comparable materials (manufacturer recommended) should be used in 3D printer.
- Ensure appropriate ventilation applicable to the emissions produced (e.g. ultrafine particles).
- Consider using feedstock that produces less toxic emissions (e.g. ABS, when compared to PLA, requires higher temperatures and results in more toxic byproducts such as hydrogen cyanide).
- Consider the power of moving heads and the requirements for safeguarding (e.g. some 3D printers with a powerful moving head will push objects (hand) out of the way).
- Consider how scaffolding will be removed and waste disposal considerations.
- Develop procedures for cleaning 3D printers and for removing items safely from the printers (e.g. burns from hot nozzle, cuts from shards or sharp edges).
- Some 3D printers use UV lights. If exposure to UV light may occur, consult with EHS regarding eye protection.
- Resource: <https://www.canada.ca/en/employment-social-development/services/health-safety/prevention/3d-printers.html>

Chemical Safety

- If there are Controlled Products that fall under WHMIS involved, take WHMIS training. For information on EHS courses, please refer to EHS Training matrices for [Facilities & Admin](#) staff and Lab [Personnel](#).
- Appropriate spill kits are available, and staff are trained in their use. For large spills, contact Environmental Protection Services (416-978-7000).
- Develop procedures for the storage of chemicals (e.g. approved flammable liquid cabinet, appropriate separation of incompatible materials).
- Ensure chemical Safety Data Sheets (SDSs) are in [HECHMET](#). (Resources: [Chemical Storage Flowchart](#) and [Chemical Storage Table](#).)
- Where available, eyewash is flushed weekly (logged) by the makerspace and emergency showers are tested annually by Facilities & Services. If a chemical fume hood is used, an annual certification by EHS is required. (refer to the sticker on the sash or contact ehs.office@utoronto.ca).

Additional Resources

- [EHS policies and procedures](#)
Note: Below is not an exhaust list. Please refer to the main page above for all policies and procedures.
 - [Chemical Storage Table \(PDF\)](#)
 - [Eyewash and Shower Needs Assessment Flowchart \(PDF\)](#)
 - [Laboratory PPE Assessment Tool \(PDF\)](#)
 - [Laser Safety](#)
 - [Respiratory Protection Program \(PDF\)](#)
 - [Working Alone Guidelines \(PDF\)](#)
- Fire Extinguisher Training on Campus: [Fire extinguisher training - Facilities & Services - University of Toronto](#)
- First Aid Training: [First Aid Training - Environmental Health & Safety](#)
- For staff who develop SOPs, EHS303 online Job Safety Analysis training (EHS303) is recommended: <https://ehs.utoronto.ca/training/my-ehs-training/>. This course teaches participants on how to use the [Job Safety Analysis](#) tool to break down tasks and identify hazards and controls to reduce/eliminate the hazard.
- [Creating a Culture of Safety in Makerspaces](#)
- University of Nevada: [Basic Makerspace safety](#)
- Harvard University: [Makespace Safety](#)