Environmental Health and Safety
Guidance for the use and management of makerspaces

Purpose and application

Makerspaces are areas to gather, exchange ideas, invent and create. These spaces are found at ASU in libraries, residential buildings and other workshops. Makerspaces provide access to resources and equipment that may not be regularly accessible by students and employees, such as 3D printers, welding and cutting tools, recording equipment, sewing machinery and more.

Employees and students may be exposed to hazardous machinery, physical hazards, hazardous materials or procedures that may result in injury. The ASU guidance for the use and management of makerspaces ensures the identification of makerspace hazards. It provides guidelines to ensure that ASU staff and students who use makerspaces are protected from exposure to these hazards.

Scope

This guidance applies to students, employees and building management who may use or manage makerspaces on any ASU premises. The managing body is responsible for implementing plans to prevent injury and exposure to hazardous materials in their specific makerspaces and ensuring that these areas and equipment are used and maintained safely. Makerspace managers may consult with ASU EHS to conduct a hazard assessment and evaluate the health and safety of equipment and processes housed in the space.

Roles and responsibilities

Makerspace responsible party or designee

The responsible party or the designee must:

- Conduct a hazard assessment for each job or task.
- Control shop access, limiting entry to trained, authorized persons.
- Create a makerspace safety plan outlining basic rules and safety procedures in an emergency.
- Develop standard operating procedures for hazardous equipment, activities and substances.
- Identify personal protective equipment needs. PPE is provided for ASU employees but not for students.
- Register the makerspace online in the Chemical Environmental Management System.
- Maintain a complete and accurate online chemical list used in the makerspace within CEMS.
- Perform self-inspections if the makerspace is recognized as a designated hot work area.
- Provide equipment and site-specific training and maintain rosters.
- Provide a safety data sheet for each chemical used in the space.
- Register any class 3B and 4 lasers and all 3D printers within CEMS.
- Report injuries or accidents to ASU Environmental Health and Safety.
- Review the hazard assessments annually or when new equipment or processes are introduced or changed.

ASU Environmental Health and Safety

ASU EHS is responsible for:

- Inspecting the makerspace periodically to determine compliance with local and federal regulations.
- Providing training on applicable topics including but not limited to:
    - Hazard communication.
    - Hot work safety awareness.
    - Incident investigation and reporting.
    - Machine shop safety.

- Responding to and investigating incident and injury reports.

Makerspace users

Individuals using the makerspace are responsible for the following:

- Completing any training required to work in or with tools and equipment in the makerspace.
- Completing the makerspace user agreement and the Release, Indemnity and Assumption of Risk form, if applicable, before accessing the makerspace.
- Ensuring PPE is in good condition.
- Only bringing approved materials and equipment into the makerspace.
- Preventing unauthorized guests from entering the makerspace.
- Reporting tool or equipment damage or malfunction immediately to makerspace staff.
- Taking care of the space by cleaning up after themselves and returning used equipment and tools to their rightful place.
- Using tools, equipment and other resources in the manner meant to be used.
- Working in a way that protects the safety of themselves and others utilizing the space.

Training

Individuals who want to use the makerspace must complete relevant safety training before using the tools, equipment and other resources within the makerspace. Working alone with specific hazardous equipment and processes may not be allowed. Follow ASU EHS Working Alone Procedures, establishing safe work practices to eliminate or minimize risks when students or employees are alone.

Makerspaces may have a two-person rule for using woodworking or shop equipment. Violators of the two-person rule could lose access to the makerspace. Makerspaces should only be accessed during scheduled open hours. Training will include proper PPE use.

Safety guidelines

General

Follow these general guidelines within the makerspace:

- Do not bring food or drink inside.
- Exercise caution when using any sharp or hot tools.
- Familiarize yourself with emergency exits, fire extinguisher locations and other safety equipment.
- Inform the principal investigator if a tool or equipment is malfunctioning.
- Keep the makerspace organized and clean. Keep materials off the floor to prevent slip, trip and fall hazards.
- Stop and ask questions when in doubt.
- Wear the correct attire and PPE for the task and process.

Hand tools

Follow these guidelines when using hand tools:

- Complete the EHS Hand and Power Tool Safety training.
- Inspect tools before each use, ensuring good condition with no cracks, rust or other damage.
- Report damaged tools to management immediately and do not use them.
- Return tools to their designated locations after use.
- Use the correct tool for the task.

- Wear the appropriate PPE based on the hazard assessment, which may include safety glasses, gloves and hearing protection if the task generates high noise levels.

Sewing and embroidery

Follow these guidelines when sewing or embroidering:

- Avoid pinch points where fabric or machinery could inadvertently trap fingers or hands.
- Dispose of broken needles and other sharps in a sharps disposal container.
- Turn off irons after use, and do not leave them unattended.
- Turn off the machine when adjusting or changing the sewing or embroidery needle.
- Use caution when cutting fabric and using cutting tables and rotary tools.
- When feeding fabric through the machine, keep your fingers clear of the needle.

Milling and cutting

Follow these safety rules when milling and cutting:

- Dremel or rotary tool:
    - Clamp small pieces or pieces that are likely to move into a vice.
    - Do not wear gloves, loose clothing or jewelry. Contain hair to prevent entanglement.
    - Ensure the bit is secure in the tool before turning it on.
    - Never touch the bit while it is spinning.
    - Unplug the tool when changing the bit.
    - Wear appropriate PPE, including safety glasses.
- Laser cutter:
    - Adhere to all interlock procedures and do not attempt to defeat or modify interlocks.
    - Do not leave the laser unattended while running.
    - Ensure ventilation is operating.
    - Only use the laser cutter with approved materials.
- Milling:
    - Do not wear gloves, loose clothing or jewelry. Contain hair to prevent entanglement.
    - Ensure guards are in place and functioning correctly.
    - Ensure proper workpiece holding using clamps or vice-grips to steady the material.
    - Familiarize yourself with the location of the emergency stop button.
    - Inspect equipment before use for any damage or defects.
    - Wear appropriate PPE, including safety glasses.

Soldering

Follow these guidelines when soldering:

- Confirm that solder material is allowed with the PI before use. Some makerspaces do not allow lead solder.
- Dispose of soldering waste in the proper hazardous waste container.
- Do not touch the iron tip, even if you believe it is cold.
- Never leave the soldering iron unattended.
- Unplug the soldering iron after use.
- Use proper ventilation during soldering work.

Welding and cutting

Follow these guidelines when welding and cutting:

- Ensure gas cylinders are turned off and stored correctly after use.
- Keep the area clear of flammable material.
- Only perform welding and cutting in a designated hot work area. If hot work is performed outside the area, you must obtain an approved hot work permit from ASU EHS Fire Safety and Prevention.
- Turn off welding equipment after use.
- Use proper ventilation during welding work.
- Utilize a welding screen if necessary to protect others in the area.
- Wear appropriate PPE, including eye protection.

3D printing

There are a variety of 3D printers. Special precautions may vary depending on the manufacturer or type. Follow this guidance when working with 3D printers:

- Ask the PI for assistance to remove parts from the print bed if needed.
- Do not touch the nozzle of the 3D printer. Always assume that the nozzle is hot.
- If using isopropyl alcohol to clean resin residues, properly dispose of used IPA and cleaning materials.
- Use caution when removing parts from a hot print bed or using sharp tools.
- Use gentle pressure or twisting to break parts loose from a print bed.
- Wear the appropriate PPE, including safety glasses.
- Work in a well-ventilated area.

Environmental concerns

Follow these steps to address environmental concerns:

- All waste should be placed in appropriate waste containers for hazardous disposal, including paints, aerosol cans and solvent-laden rags.
- Do not leave paints or solvent-laden rags out to dry or evaporate.
- Ensure chemical containers are closed and stored correctly when not in use.
- Keep sawdust waste in a closed bag when disposing of it in a dumpster.
- Tools used for oil-based painting should not be washed down the drain.
- Place used oil in a container labeled Used Oil to be picked up for hazardous waste disposal.

Appendix A: Definitions

Emergency: Any occurrence or event that could endanger or harm individuals.

Explosive: A chemical that causes a sudden release of pressure, gas and heat when subjected to shock, pressure or high temperature.

Flammable: A material which is easily ignited and burns with extreme rapidity.

Hazard: A situation, condition or object that may be dangerous to the safety or health of the person.

Hazardous chemical: Any chemical which poses a physical hazard or health hazard. This is determined by information in the safety data sheet.

Hot work: Operations such as welding, cutting, burning, heating, grinding or similar spark, slag or intense heat-producing activities that can ignite combustible materials or flammable atmospheres or provide a source of ignition for a fire. It is also defined as cutting and welding operations for construction or demolition activities that involve using portable gas or arc welding equipment, open flame or spark-producing apparatus.

Makerspace: Places to gather, exchange ideas, invent and create. Makerspaces may contain tools, equipment and digital resources that allow individuals to work on projects.

Personal protective equipment: Equipment designed to protect worker health and safety, such as chemical-resistant gloves, safety glasses or goggles, face shields, etc.

Safety data sheet: Written or printed material about a chemical that specifies its hazards, safe use and other information. It is prepared by the chemical manufacturer and is required by federal law.

Toxic: A substance that has a median lethal dose, LD50, of 50 to 500 mg/kg for ingestion, from 200 mg/kg to 1,000 mg/kg within 24 hours for contact and from 200 ppm to 2,000 ppm gas or vapor for inhalation.

Working alone: The performance of any work by an individual not directly supervised by another person or within audible or visible range of another individual and where assistance is not immediately available in the event of an injury, illness or emergency.

Appendix B: Makerspace self-inspection checklist

Self-inspections should be conducted annually to identify unsafe conditions and confirm the accuracy of standard operating procedures, training documentation and other administrative documents.

Building:	
Room number:	
Principal investigator:	
Date:	

Communication and emergency preparedness	**Yes**	**No**	**N/A**
All SDSs are on file and readily accessible to makerspace users.			
Chemical inventory is current.			
Flammable liquid over 10 gallons is stored within flammable storage cabinets.			
Emergency supplies, such as first aid and spill kits, are available.			
Makerspace registration is current.			
SOPs, safety plans, and training records are maintained and available for review.			
The contents and primary hazards are clearly labeled on all chemicals and waste containers.			
Housekeeping	**Yes**	**No**	**N/A**
Aisles, exits, and adjoining hallways are free of obstructions and trip hazards.			
The space is neat and dry with no slip, trip or fall hazards.			
Tools, chemicals and equipment are adequately stored when not in use.			
Tools and equipment	**Yes**	**No**	**N/A**
Blades, shafts, belts and other moving components are guarded to prevent injury during machine operation.			
Extension cords are in good condition, appropriately rated and used correctly. They should not be used as permanent wiring.			
Top-heavy machines are secured to prevent movement and falls.			