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EHS-317, STUDENT MACHINE SHOP GUIDELINES

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1.0 Introduction

1.1 Purpose

This safety guideline establishes safe work practices for work being performed in any academic machine shop. This document defines safety guidelines and training requirements to minimize injury when working in student machine shop areas.

1.2 Scope

This safety guideline covers the use of all academic machine shops irrespective of their location and departments. Machine shops managed by Facilities Maintenance are not covered by this policy unless they also are used by students.

1.3 Definitions

Buddy System. A procedure in which two people operate together as a single unit so that they are able to monitor and help each other.

Monitor. An experienced graduate student, postdoctoral associate or fellow, or staff member who has appropriate tool experience to oversee operations in shop areas.

Point of operation. The point where work is performed on a material, such as cutting, shaping, boring, or forming of stock.

Power transmission apparatus. All components of the mechanical system which transmit energy to part of the machine performing work. These components include flywheels, pulleys, belts, connecting rods, couplings, cams, spindles, chains, cranks, and gears.

Shop Supervisor. Staff or faculty member who has professional-level tool experience to oversee operations in shop areas.

1.4 Responsibilities

Environmental Health and Safety Office (EHSO)

As the administrative department for the Student Machine Shop Safety Guideline, EHSO is responsible for:

- Providing safety information, training and consultation to faculty and staff; and
- Conducting periodic audits of health and safety practices in student machine shops to ensure compliance.

Deans, Faculty, Faculty Advisors

Directors, managers, and faculty advisors have primary responsibility for the management and enforcement of these guidelines in their areas. They must:

- Ensure that adequate supervision is provided for shop users;
- Provide adequate resources for maintenance, repairs, and safe guarding of equipment; and
- Inform all shop users to follow University policy and safety rules.

Shop Supervisors and Shop Monitors

Shop supervisors and monitors have primary responsibility for the management and

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enforcement of these guidelines in their areas. They will:

- Complete EHSO Supervisor/Monitor Training;
- Ensure all users of the shop are familiar with general and shop-specific safety rules;
- Enforce all safety rules and make all users aware of the consequences of rule violations;
- Provide tool/equipment specific training to each user for the equipment they will be using;
- Halt unsafe operations at any time and restrict shop access for anyone who violates the rules;
- Ensure all accidents and near-miss incidents are reported at <http://emory.edu/incident> and ensure timely correction of unsafe conditions;
- Maintain training records for the trainings that they provide;
- Clearly display Shop Safety Rules signs and shop hours on the shop door;
- Report problems to the instructor, shop supervisor, and EHSO as appropriate; and
- Communicate to EHSO any difficulties with implementing this guideline so that the guideline can be updated as needed.

Students

Students are responsible for complying with the rules set forth by this guideline. Students must:

- Use the “Buddy System” when working in specified shops;
- Complete tool/equipment-specific training before using any machine;
- Observe all shop safety rules in this policy when working in machine shops;
- Observe all shop-specific rules beyond the scope of this policy;
- Report all injuries to a shop supervisor promptly, including minor injuries; and
- Promptly report unsafe conditions, actions, or near-miss incidents to the shop supervisor.

1.5 Training Requirements

- Machine-specific training is provided by the instructor or shop supervisor to anyone using a student machine shop at Emory.
- It is the responsibility of shop supervisors to ensure their students complete required safety training.
- Machine-Specific Training is hands-on training and includes the following:
 - Description and identification of the hazards associated with a particular machine;
 - Proper safety precautions when working with a particular machine;
 - Limitations of the tools/equipment;
 - Safeguards, protection they provide, and ensuring their presence before using a machine;
 - What to do (e.g., contact supervisor, tag the machine, etc.) if a damaged guard, missing part, unusual noise, etc., is noticed;
 - How to use emergency buttons and other measures, when needed; and
 - Maintenance and cleaning procedures.
- EHSO is responsible for providing EHSO Shop Safety Training to monitors and

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shop supervisors.

- EHSO will maintain documentation of attendance for training provided by EHSO which will include the employee's name, department, and date.
- EHSO Shop Safety training includes the following:
 - Machine Guarding Requirements
 - Roles and Responsibilities
 - Shop Inspections
 - Tool Classification and Access
 - Standard Shop Postings
 - Emergency Response Procedures
 - Personal Protective Equipment
 - Accident/Incident Reporting
 - Fire Prevention
 - Chemical Safety

1.6 Recordkeeping Requirements

Records for EHSO-conducted training are retained by EHSO and are available for five years.

1.7 Program Evaluation

The guideline shall be re-evaluated annually and revised as necessary.

2.0 Project Safety Review

The hazards associated with a student project involve multiple aspects, including the level of student training, the tools and materials being used, and potential hazards associated with the device being fabricated and its use (e.g., the project may be to build a device with electrical or engine power). Therefore, each student project involving Category 2 or above equipment must undergo a formal safety review with a shop supervisor, and where applicable, with the faculty advisor (See Attachment 1 – Tool and Equipment Classification System). EHSO and the Student Shop Safety Committee are to be consulted if any safety issue arises during the review. The shop supervisors and/or faculty advisor will:

- Review potential hazards and communicate with the student any concerns and changes to the project that are needed;
- Track progress and the quality of work during the course of the project to verify that the student has the requisite skills to safely perform the work; and
- Conduct a safety check prior to activation/use of the device.

3.0 Safety Audits

- EHSO conducts periodic safety audits of the student shops on campus and follows up by ensuring that any necessary remediation work is completed.
- The audit includes the following:
 - Verification of signage and postings, safety supplies, and required personal protective equipment, housekeeping, and waste management.
 - Review of training histories for professional staff and students.
 - Review of room and tool access policies and verification of tool condition and safeguarding.

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4.0 Working Safely with Chemicals

- Read and heed the Safety Data Sheets (SDS) before working with chemicals. Consult the shop supervisor or EHSO if you have any questions.
- When chemicals are transferred from the manufacturer's original container to a secondary container, label the new container with the chemical name (e.g. acetone) and associated hazards (e.g. flammable).
- Store corrosive compounds in areas that reduce the potential for accidents and contact with other chemicals.
- Use water-based cleaners instead of solvents and other less hazardous alternative products, when possible.
- Use solvents only in well ventilated areas. Do not work with solvents in a confined or unventilated area. Work in a chemical fume hood whenever possible.
- Do not use solvents around open flames.
- Avoid skin contact. Wear proper gloves; consult the manufacturer's glove guide on the EHSO website at www.ehso.emory.edu for compatibility. Check with the shop supervisor or EHSO if you are unsure.
- Do not dispose of chemicals down the drain or in the regular trash. Evaporation of volatile wastes is also unacceptable.
- Store chemical waste in containers made of compatible materials. For example, strong acids may not be stored in plastic bottles, and hydrofluoric acid may not be stored in glass bottles.
- Practice good personal hygiene habits. Wash your hands frequently in order to prevent chemicals from entering the eyes, mouth, or penetrating the skin.
- Report and clean up any small spills if you are trained to do so and dispose of spill clean-up materials appropriately. Contact EHSO at (404) 727-5922 for assistance with cleaning up large spills.

5.0 Machine Guarding

- Machine guards are provided to protect the operator and other employees in the machine area from hazards such as those created by point of operation, ingoing nip points, rotating parts (including the power transmission apparatus), flying chips, and sparks.
- Affix machine guards to the machine where possible and secure elsewhere if, for any reason, attachment to the machine is not possible.
- The guard cannot create any additional hazards.

6.0 Tool and Equipment Classification/Shop Access

- The Tool and Equipment Classification System determines the training, supervision, personal protective equipment and access controls required for each hazard level. See Appendix A – Tool and Equipment Classification System.
- Individual shop supervisors can apply rules and make decisions that are more restrictive than those indicated in the classification system.
- Shop hazards are categorized based on the potential hazards of the tools and equipment located within the shop. The classification system is designed on a scale of 1 to 5, with 5 being the highest hazard level.

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- The hazard category of a shop is defined to be the highest hazard category of any tool in the shop that is not disabled by a secure lock.
- Key aspects of the Tools and Equipment Classification System as they pertain to student access are summarized in the table below:

Table 1.0 – Summary of Tool and Equipment Classification System

SHOP ACCESS TABLE					
	CATEGORY 1	CATEGORY 2	CATEGORY 3	CATEGORY 4	CATEGORY 5
UNDERGRADUATE	Instructor/shop supervisor permission	Instructor/shop supervisor permission	Monitor/Shop Supervisor	Monitor/Shop Supervisor	Shop Supervisor
GRADUATE	Instructor/shop supervisor permission	Instructor/shop supervisor permission	Buddy System	Buddy System	Buddy System

7.0 Machine Shop Hours

- Machine shops are open during regular working hours. Access to shops may be limited during scheduled classes, holidays, or for other reasons. Contact the shop supervisor or monitor for shop hours and additional information.
- During busy periods in the semester, the shop may be opened by the shop supervisor, monitor, or other staff in the evening and/or on weekends. Always check with the shop supervisor for a change in schedule.

8.0 General Shop Safety Rules

The following are rules for using power tools and heavy machinery in shops and laboratories. These guidelines **DO NOT** serve as a replacement for formal training in lab techniques or shop safety. Only trained personnel should use shop equipment after they have been trained by the shop supervisor or instructor. Failure to follow proper precautions can result in serious injury or death.

- **Get approval from the instructor/shop supervisor:** All work to be done in the shop requires the instructor/shop supervisor's approval.
- **Never use machinery if you are not trained:** Training is required for the specific equipment you intend to use. Ask the instructor or shop supervisor for assistance if you are unsure about the use of any tool, machine, or shop procedure.
- **Never work alone – use the “buddy” system:** Use of power tools requires that at least two people be present.
- **Never work when you are impaired:** The use of alcohol or drugs prior to the use of shop machinery is strictly forbidden and is grounds for suspension or termination of shop access privileges. Be aware of other situations which may impair your ability to work safely, including illness, tiredness, stress, hurrying, or the use of medication that could make you drowsy.
- **No horseplay allowed.** Do not distract anyone using equipment.
- **If the job cannot be done safely, then it cannot be done:** There are limits to what you can build.

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- **Only the operator may start and stop a machine:** After a machine is turned off, the operator is required to stand by until it has stopped running.
- **Never remove machine guards:** Keep machine guards in place at all times. If you believe an operation requires removal of the guard, consult with the instructor.
- **Always wear closed-toe shoes:** Tools, chips, and fixtures are sharp and often hot. Closed-toe shoes will help protect your feet from injury. Leather shoes provide the best protection.
- **Always wear eye protection:** Wear safety glasses when using power-driven equipment. Wear face shield and safety glasses when using machines that may produce wood chips. Wear goggles if working with corrosive substances.
- **Always wear hearing protection:** Wear hearing protection when using powered equipment.
- **Restrain long, loose hair:** Long, loose hair can easily be caught in revolving machinery and ripped out, causing serious scalp lacerations. Have your hair under control, tied back or tightly covered.
- **Remove jewelry and personal electronic equipment (bracelets, rings, chains, beads, headphones):** Remove any accessory that can get caught in machinery.
- **Fasten or remove loose clothing:** Loose clothing (such as overly large smocks or ties), torn clothing, etc., may get caught in equipment and cannot be worn. Fasten or remove loose clothing before you operate any machine. Roll long sleeves above the elbows. Apron fastenings should be such that they will break if the apron becomes entangled in a machine.
- **Keep objects clear of machinery:** Keep rags away from machines that are in operation.
- **Never wear gloves when operating power-driven machinery:** Gloves may get caught in moving parts.
- **Keep your hands away from sharp tools:** Use push sticks.
- **Never remove chips and shavings from machine with your bare hands.** Use a brush or hook.
- **Clean up after yourself:** Return tools to their appropriate location before you leave each day. Clean the areas and equipment of all sawdust to avoid fire hazards.
- **Allow machines to come to a complete stop:** Allow machines to a complete stop and disconnect the power before oiling, cleaning, or adjusting.
- **Disconnect portable electric tools:** Disconnect all portable electric tools and appliances when not in use, when making adjustments, inserting cutters, bits, etc.
- **Properly unplug tools:** When disconnecting an electric tool from an electrical outlet, pull from the plug instead of from the wire.
- **Keep wiring in good repair:** Keep all machines and wiring in good repair and when possible avoid extension cords, which can pose a tripping hazard.
- **Use the dust collection system:** When possible cut all wood products using a dust collection system.
- **Report broken tools and equipment.** Inform the instructor of any broken tools and equipment.

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9.0 References

- OSHA Machinery and Machine Guarding – [29 CFR 1910 Subpart O](#)
- Columbia University Shop Policy Guidelines
- Yale University Student Shop Safety Policies and Practices

10.0 List of Associated Documents

- Band Saw Safety Rules
- Belt Disc Sander Safety Rules
- Circular Saw Safety Rules
- Drill Press Safety Rules
- Miter Saw Safety Rules
- Router Safety Rules
- Saber Saw Safety Rules

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Appendix A: Tool and Equipment Classification System

Classification System for Student Machine Shops					
	Category 1	Category 2	Category 3	Category 4	Category 5
Power	Low power hand/small bench tools	Medium power tools (includes specialized enclosed computer controlled tools)	Powerful portable and small benchtop tools	Light industrial tools (typically benchtop)	Large industrial tools (manual and NC-controlled) (Some may be off-limits to any student use) Highest hazard tools in bold
Common Examples	<ul style="list-style-type: none"> • Cordless drill under 18V • Palm sander • Soldering iron/gun • Heat guns • Glue guns • Sewing machines • 3D printers 	<ul style="list-style-type: none"> • Jig saw • 3/8" hand drill • Corded devices • <1/3 hp 8V-24V cordless drill 	<ul style="list-style-type: none"> • Circular Saw • Belt sander • Framing nailer • 1/2 hp geared drill • Reciprocating saw • >18V cordless tools • Chop/miter saws • Routers • Mini-lathe • Printing presses 	<ul style="list-style-type: none"> • Small band saw • Small drill press • Small benchtop milling machine • Small/benchtop lathe • Belt/disc sander • Horizontal saw • Scroll saw • Planer, jointer • Bench grinder • Saw Stop-style table saw 	<ul style="list-style-type: none"> • Full sized milling machine • Full sized metal lathe • Table saw (non-Saw Stop style) • Radial arm saw • Large drill press • Large band saw • Surface grinder • Large jointer/plane
Tool Use Restrictions and Oversight	Undergrads & Grads – Instructor / Supervisor Permission	Undergrads – Instructor / Supervisor Permission Grads - Buddy System	Undergrads – Monitored Grads - Buddy System	Undergrads – Monitored Grads - Buddy System	<ul style="list-style-type: none"> • Undergrads - Only under professional supervision after extensive training • Grads - Buddy system



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Classification System for Student Machine Shops

	Category 1	Category 2	Category 3	Category 4	Category 5
Tool Access Controls	Locked cabinet	Locked cabinet	Locked cabinet/ tool lockout	Tool lockout	Tool lockout
User Training	<ul style="list-style-type: none"> • Introduction to shop safety and individual tools by shop monitor/ supervisor • Directions in manual or on wall postings 	<ul style="list-style-type: none"> • Introduction to shop safety and individual tools by monitor/ shop supervisor • Directions in manual or on wall postings 	<ul style="list-style-type: none"> • Basic shop safety orientation by monitor/ shop supervisor • Individual tool instruction 	<ul style="list-style-type: none"> • Basic shop safety orientation by monitor/ shop supervisor • Individual tool instruction • Hands-on use training 	<ul style="list-style-type: none"> • Basic shop safety orientation • Individual tool instruction • Extended hands-on use
Monitor Supervisor Training	Tool experience	Tool experience	<ul style="list-style-type: none"> • Tool experience • EHSO Shop Safety Training 	<ul style="list-style-type: none"> • Tool experience • EHSO shop safety training 	<ul style="list-style-type: none"> • Professional-level experience • EHSO shop safety training