Subject: Machine Shop Safety	**Date**: 10/04/2017
EH&S Program: Occupational Safety	**Next Review**:
Scope: University wide	**Original**: 12/12/2011

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Policy:

Department heads and machine shop supervisors are responsible for ensuring that all employees, students and visitors work safety in machine shops or when working with any machine or tool that can cause injury. The safety requirements include, but are not limited to, access control, training and work rules and procedures.

Definitions:

Independent Authorized User: A person qualified to work in a Machine Shop. This person must have (**please check B.2 and B.3 for specific instructions for students*):

- Stony Brook University ID
- Successfully completed specific shop course or work under the supervision of the supervisor
- Successfully completed EH&S Shop Safety course EOS 029
- Signed Machine Shop Safety Rules (or other equivalent documents) and agree to abide by all rules

Machine Shop: A workshop or area where tools are used for making, finishing, or repairing machines or machine parts. Machining processes include, but are not limited to turning, drilling and milling, shaping, planning, boring, broaching and sawing. Advanced machining techniques include electrical discharge machining (EDM), electro-chemical erosion, laser cutting, or water jet cutting to shape workpieces.

Personal Protective Equipment (PPE): Equipment worn to minimize exposure to hazards that may cause serious workplace injuries and illnesses. These injuries and illnesses may result from contact with chemical, radiological, physical, electrical, mechanical, or other workplace hazards. Personal protective equipment may include items such as gloves, safety glasses and shoes, earplugs or muffs, hard hats, respirators, or coveralls, vests and full body suits.

Procedures:

A. Responsibilities

1. **Machine Shop Supervisor must**:
   a. Enforce the EH&S and shop specific “Machine Shop Safety Rules” (or other equivalent documents).
   b. Maintain records, which include:
      1) Training records for the shop specific safety training

2) Safety agreements signed by students
3) Sign in book showing who is using equipment
4) Safety Data Sheets (SDSs) and chemical inventory for all hazardous materials in the shop
5) Accident forms for any accident that occurs in their area

c. If emergency shut off switches or buttons are available on hazardous machines (such as a lathe), ensure they are visible and accessible.
d. Enforce the use of Personal Protective Equipment (PPE) by everyone working on or near the tools and ensure the PPE is appropriate for the hazards.
e. Maintain and regularly inspect all equipment for safe operating conditions, adjustments and repairs in accordance with the manufacturer's information. The *Machine Shop Inspection Checklist* in Appendix 2 can be used as part of the inspection. This inspection shall also include:
    1) All power cords
    2) Machine guards and safeguarding devices
f. Establish Lock-Out Tag-Out (LO/TO) procedures for machines when appropriate.
g. Provide instruction on machine use to all shop users according to manufacturer's requirements. *The Machine Shop Tool Risk Assessment* in Appendix 1 can be used as part of this training. At a minimum, this training must include:
    1) The function, location and use of controls
    2) Specific startup and stopping procedures
    3) A safe method for installing, removing, and adjusting tooling
    4) The location and method for installation and adjustment of protective devices and guards, and method to test the proper function
    5) Safe working procedures
    6) The control strategy designed to eliminate or reduce the identified hazards
    7) How to report if there is any apparent defect, damage, malfunction or inconsistent or unpredictable performance of the machine, and to whom
    8) Any specific training recommended by the manufacturer
    9) Methods to identify when equipment is "out of service" , when appropriate
    10) Location of safety/emergency supplies (eyewash station, fire extinguisher, etc.)
    11) How to prepare and respond to laboratory emergencies.
h. Make minor repairs to machines or take machine "out of service" until repairs are made by qualified technician/staff.
i. Keep doors to shop locked or secured when no one is working.

j. Investigate all accidents and near-miss accidents and ensure timely correction of unsafe conditions.

2. Environmental Health & Safety (EH&S) will:

a. Develop and maintain EOS 029 Machine Shop Safety course. (https://ehs.stonybrook.edu/services/training/training-course-list-and-descriptions#eos029)
b. Audit machine shops for compliance with this policy. The Machine Shop Inspection Checklist in Appendix 2 will be used for these audits.

B. Procedure

1. Everyone working on machines must:
   a. Have a Stony Brook University ID
   b. Successfully complete specific shop course or work under the supervision of the supervisor
   c. Successfully complete EH&S course EOS 029
   d. Sign the Shop Safety Rules (or other equivalent documents) and agree to abide by all rules

2. No undergraduate student is permitted to work on machines unless there is someone else with appropriate safety training present. All others are strongly discouraged from working alone.

3. Graduate students and Postdoctoral Associates must discuss their planned activities with their Principal Investigator (PI) and supervisor prior to conducting the work alone and the practice should only be allowed after a careful risk-based determination.

4. Everyone must be appropriately dressed for working on machines:
   a. No loose garments
   b. Long pants
   c. Closed-toe shoes
   d. No jewelry, rings, hanging earrings, neckties, chains, hoodie drawstrings, etc.
   e. Shoulder length or longer hair must be tied up and secured (not hanging), or in a hat or hair net

5. Everyone working in machine shops with eye hazards must wear appropriate eye protection (safety glasses must have side protection and be stamped “Z87+” to confirm that they are in compliance with ANSI Z87.1 for high impact).

6. Any personal tools brought by students/staff must be inspected by supervisor before they are permitted to be used in the shop.

7. All machine shop users must follow all appropriate policies, procedures and instructions for working with the tools.

8. Machine guards must be kept in place while operating equipment, when

appropriate. If machine guards need to be adjusted or removed under special circumstances, permission must be granted by machine shop supervisor. Once the task is completed, machine guards must return to their original position.

9. Do not leave a machine running unattended unless they are designed for that purpose.

10. The use of any personal electronic device (ipads, phones, MP3 players, etc.) is prohibited while operating power driven equipment, apparatus or hand tools.

11. Tools are to be used only for the purpose for which they are designed. Always consult the shop supervisor for troubleshooting or other uncertainties with a machine.

12. Machine tools and hand tools that are unsafe must not be used, and should be reported immediately to shop supervisor. Any equipment or hand tool that needs repair must be identified; Red “Out of Service” tags are recommended to be attached.

13. Before working with any machine, ensure the work area is clean, free of debris and clutter.

14. Maintain good housekeeping. Items should not be placed where they may cut or fall on someone, into a machine or where they may cause a tripping hazard. Sharp-edged or pointed tools should be sheathed or stored in tool boxes.

15. When working with solvents, resins or other chemicals, students, faculty and staff must complete ELS 002 Lab Safety Chemical Hazards and ENV 001 Hazardous Waste Management. Be aware of the hazards associated with each chemical. Review safety data sheets (SDSs) and manufacturer instructions. Minimize the potential for exposure using all available controls, and collect all chemical wastes as per EH&S hazardous waste management policy.

16. Report all accidents (https://ehs.stonybrook.edu/programs/laboratory-safety/laboratory-emergencies/accidents-injury-reports).
All rules will be strictly enforced and violations will be documented following established disciplinary procedures. Non-compliance can result in loss of “independent authorized user” status and no longer being allowed to work in the machine shop.

17. Every machine shop must have:

    a. Door sign stating: “Authorized Personnel Only”
    b. First Aid Kit in compliance with ANSI/ISEA Z308.1 "Minimum requirements for workplace first aid kits and supplies"
    c. Fire Extinguisher available in close proximity to the shop – this is generally located in the corridor (any questions, please contact EH&S Fire Safety)

d. Emergency eyewash if the eyes of any person may be exposed to injurious corrosive materials.
e. Emergency phone numbers posted (including emergency numbers of University Police and the Machine Shop Supervisor)
f. Rules specific to the machine shop must be posted
g. Operating manuals or other equivalent resources for each piece of equipment
h. Compressed air guns reduced to 30 psi or less (reduce pressure at compressor *OR* use safety nozzle)

Forms:

A. Machine Shop Risk Assessment (Appendix 1)
B. Machine Shop Safety Audit (Appendix 2)
C. Student Accident Form (http://www.asa.stonybrook.edu/asa/asaforms/EHSD0333/$FILE/EHSD0333.pdf)
D. State Employee Injury/ Illness Incident Report (http://www.asa.stonybrook.edu/asa/ASAForms/Document/267)
E. Research Foundation Work-Related Employee Injury/Illness Incident Report (http://www.asa.stonybrook.edu/asa/asaforms/HRSF0122/$FILE/HRSF0122.pdf)

Policy Cross Reference:

EH&S Policy 3-2 Control of Hazardous Energy (Lock-Out/Tag-Out)

Relevant Standards/Codes/Rules/Regulations/Statutes:

A. Occupational Safety and Health Administration (OSHA)
1. 29 CFR 1910. xxx
a. 212 Machinery and Machine Guarding
b. 243 Hand and Portable Powered Tools and Other Hand-Held Equipment
c. 147 The control of hazardous energy (lockout/tagout)
d. 242(b) Compressed Air Guns
***e.* 144 Safety Color Code for Making Physical Hazards**
***f.* 151 Medical and Frist Aid**

B. American Nation Standard Institute (ANSI)
1. ANSI B11.0-2010
Safety of Machinery – General Requirements and Risk Assessment
2. ANSI B11.6-2001 (R2007)
Safety Requirements for Manual Turning Machines with or without Automatic Control

3. **ANSI Z308.1-2014**
   Minimum requirements for workplace first aid kits and supplies
4. ***ANSI Z87.1-2015***
   American national standard for occupational and educational personal eye and face protection devices.

C. **NFPA 79 (2015) Electrical Standard for Industrial Machinery**

References and Resources:

NA

APPENDIX 1. MACHINE SHOP RISK ASSESSMENT

This list is not all-inclusive. Not all hazards will apply to a particular machine. Always refer to the manufacturer's instruction manual for specific information.

Hazard Class	1	2	3	4	5
Power	Low power hand/small bench tools (2-4 amp @ 120 VAC, <9V cordless)	Medium power tools (1/4 to 1/2 hp; <10 amp @120 VAC; 14-18V cordless; specialized enclosed NC- computer tools)	Powerful portable and small benchtop tools (<1/2 hp; 10-15 amps @ 120 VAC; 24-36V portable, pneumatics, hydraulics)	Light industrial tools (typically benchtop; >1/2 hp, pneumatics, hydraulics)	Large industrial tools (manual and NC-controlled)
Common Examples	• Dremel tool • Cordless drill under 18V • Palm Sander • Soldering iron/gun • Heat gun • Hot melt glue gun • 3D printer (closed frame)	• Jig Saw • Corded devices <1/3 hp • 18-24V cordless drill • Laser cutter/engraver • Thermal foam cutter	• Circular saw • Hand held belt sander • Framing nailer • ½ hp geared drill • Reciprocating saw • >18V cordless tool • Chop/miter saw • Router • Mini-lathe • Angle grinder • Small press	• Small bandsaw • Small drill press • Small/benchtop milling machine • Small/benchtop lathe • Belt/disc sander • Horizontal saw • Scroll saw • Sewing machine • Planer/jointer • Bench grinder • SawStop style tablesaw	• Full sized milling machine • Full sized metal lathe • Table saw (non-SawStop) • Radial arm saw • Large drill press • Large band saw • Surface grinder • Large jointer/planer • Shaper/moulder • Power shear • Industrial press
Potential Injuries	Cuts Eye injuries Abrasions Minor burns Minor struck-by flying objects Electric shock	*As for Class 1, plus*: Lacerations Punctures Minor crushing injuries	*As for Class 2, plus*: Severe bleeding Minor amputations Minor entanglement	*As for Class 3, plus*: Entanglement	*As for Class 4, plus*: Immediately life threatening injury or death
Potential Severity	Low: First Aid	Medium: First Aid or minor injury; requiring emergency room visit	High: Immediate emergency room visit; Permanent disability of disfigurement		Highest: Serious injury or death

Task	Hazard	Danger Zone	Risk Reduction Methods
Workpiece clamping	Crushing	Between fixed and moving part including work clamping (chuck or tailstock) and tool magazine	Safeguarding: *Guards:* Fixed, interlocked, adjustable, moveable *Devices:* Movable barrier devices; Light curtains/beam device; Two-hand operating lever, trip and control device; Safety mat device *Awareness:* Barriers; Signals; Safety signs *Other measures:* Safe-distance guarding Equipment: Emergency Stop device (palm or push button) Safety blocks, locking pins or limiting pins Slide locks Work holding equipment Process malfunction, detection & monitoring equipment Safety interface/relay modules Shields Enabling devices Hold-to-run controls Measures for isolation and energy dissipation Information and Training: Signage Instruction Operating Manuals Safe Work Procedures Supervision Permit-to-work system Personal Protective Equipment
Whipping bar stock	Crushing	Either end of spindle	
Moving axis	Shearing	Between tool/spindle and table	
Spindle or tool running or cutting	Cutting or severing	At spindle or tool	
Part feeding	Entanglement	By moving part including bar feed and tool magazine	
Rapid travel of table or spindle head	Drawing in or trapping	Envelope of movement of workpiece on table axes or tool in spindle head	
Moving or rotating tool	Impact	At spindle or tool	
	Stabbing or puncture	At sharp tool faces	
Maintenance or repair	Electrical contact (direct or indirect) Crushing Cutting Trapping	Direct or indirect contact with normally live parts	
		Near moving parts	
		Electrical noise	
		Electrostatic discharge	
		Arc flash hazard	
		Improper wiring or grounding	
		Liquid or wet locations	
		Overvoltage or overcurrent	
		Insulation failure (vibration or thermal cycling)	
Control system failure: Modification of control system Defect or failure of one or several components of the control system Variation or failure in power supply to control system Inappropriate selection, design or location or control devices	Crushing Shearing Cutting Severing Entanglement Trapping Impact Puncture Electrical contact	Dropping or ejection of a mobile part of the machine or of a workpiece clamped by the machine	
		Failure to stop moving parts	
		Machine action resulting from defeating or failure of safeguarding devices	
		Uncontrolled speed change	
		Unintended or unexpected start-up	

This list is not all-inclusive. Not all hazards will apply to a particular machine. Always refer to the manufacturer's instruction manual for specific information.

Based on Yale EH&S Student Shop Safety Policies & Procedures, ANSI B11.0 and B11.6

APPENDIX 2. MACHINE SHOP INSPECTION CHECKLIST

Location:	Date:
Shop Supervisor:	Inspected By:

	General Safety			**Not applicable to this Shop☐**
1.	Do employee(s)/student(s) have SBU ID?	☐Yes	☐No	☐N/A
3.	Is the student(s) authorized to work alone?	☐Yes	☐No	☐N/A
4.	Are the employee(s)/student(s) appropriately dressed for working on machines?	☐Yes	☐No	☐N/A
5.	Did the employee(s)/student(s) successfully complete EH&S (On-Line/Live) Machine Shop Safety	☐Yes	☐No	☐N/A
6.	Did the student(s) read the "Machine Shop Safety Rules" and sign the "Machine Shop Safety	☐Yes	☐No	☐N/A
7.	Did the student(s) receive proper safety training by machine shop supervisor prior to using	☐Yes	☐No	☐N/A
8.	Long loose hair must be contained in a scarf, under a cap or other fashion when operating machinery.	☐Yes	☐No	☐N/A
9.	Loose clothing, loose neck wear and jewelry are not being worn when operating or in close	☐Yes	☐No	☐N/A
10.	Are safety signs (danger, warning or caution, etc.) posted where necessary?	☐Yes	☐No	☐N/A
11.	Is an "Authorized Personnel Only" sign posted?	☐Yes	☐No	☐N/A
12.	Is student(s) access limited to regular hours of operation if appropriate?	☐Yes	☐No	☐N/A
13.	Is protective eyewear worn when working on or near any machine creating eye hazard?	☐Yes	☐No	☐N/A
14.	Are there manufacture's manual or other reference manuals available?	☐Yes	☐No	☐N/A
	Housekeeping *Inspect **all** shop areas for the following:*			**Not applicable to this Shop☐**
15.	Is the shop floor free from slip, trip, and fall hazards (water, oil, debris, etc.)?	☐Yes	☐No	☐N/A
16.	Are shop materials, including scrap, stored in a safe manner?	☐Yes	☐No	☐N/A
17.	Are shop tools safely stored away and not left on machines?	☐Yes	☐No	☐N/A
18.	Are oily rags stored in appropriate metal containers?	☐Yes	☐No	☐N/A
	Electrical Safety *Inspect **all** power tools, machinery, electrical receptacles and extension cords for the following:*			**Not applicable to this Shop☐**
19.	Have damaged, defective equipment been removed from service? (Ex. missing ground prongs, cut/pinched cords, etc.)	☐Yes	☐No	☐N/A
20.	Are hand-held power tools either grounded or marked as "double insulated"?	☐Yes	☐No	☐N/A
21.	Are GFCIs used in wet or damp locations?	☐Yes	☐No	☐N/A

22.	Is the area free of recognized electrical hazards that are likely to cause death or serious physical harm? (Ex. missing knockouts, missing circuit breakers, missing/broken/damaged covers, exposed live electrical components, open/unlocked electrical panels, etc.)	☐Yes	☐No	☐N/A
23.	Are circuit breaker panels unobstructed?	☐Yes	☐No	☐N/A
24.	Extension cords rated for "heavy duty"?	☐Yes	☐No	☐N/A
25.	Extension cords in good condition? (i.e. no missing ground prongs, cord not damaged)	☐Yes	☐No	☐N/A
26.	Extension cords protected from damage (i.e. not run through doors, windows, on floors where	☐Yes	☐No	☐N/A
Eyewash Stations *Inspect **all** eye wash stations for the following:*		**Not applicable to this Shop☐**		
27.	Is the required eye wash station available?	☐Yes	☐No	☐N/A
28.	Eyewash flushed on a weekly basis?	☐Yes	☐No	☐N/A
29.	Eyewash station ready to use? (i.e. access not blocked)	☐Yes	☐No	☐N/A
30.	Eyewash station clearly labeled?	☐Yes	☐No	☐N/A
31.	Eyewash station functioning properly? (i.e. water flows at the appropriate rate)	☐Yes	☐No	☐N/A
Fire Safety *Inspect flammable liquids and combustibles and other fire issues for the following:*		**Not applicable to this Shop☐**		
32.	Flammable liquids (total load >25 gallons) stored in approved flammable liquid cabinets?	☐Yes	☐No	☐N/A
33.	Flammable liquid cabinets located away from ignition sources and exits?	☐Yes	☐No	☐N/A
34.	Combustibles minimized and stored properly (i.e. at least 3' away from ignition sources, not violating proper ceiling clearances)?	☐Yes	☐No	☐N/A
35.	Exits, corridors, stairways, and aisles unobstructed?	☐Yes	☐No	☐N/A
36.	Exits, where not obvious, marked with appropriate exit sign(s)?	☐Yes	☐No	☐N/A
Hazard Communication *Inspect hazardous chemical products for the following:*		**Not applicable to this Shop☐**		
37.	Is there a chemical inventory list of all hazardous chemicals readily available?	☐Yes	☐No	☐N/A
38.	Are Safety Data Sheets (SDS) readily available for all hazardous materials in the shop?	☐Yes	☐No	☐N/A
39.	Are all hazardous substances properly labeled, used and stored?	☐Yes	☐No	☐N/A
40.	Are satellite accumulation areas properly maintained?	☐Yes	☐No	☐N/A
41.	Is universal waste (used florescent bulbs/batteries) labeled and stored properly?	☐Yes	☐No	☐N/A
Machinery *Inspect each piece of machinery for guarding and safety issues:*		**Not applicable to this Shop☐**		
42.	Are all machines and rotating equipment properly adjusted and guarded?	☐Yes	☐No	☐N/A
43.	Are all machines free of debris?	☐Yes	☐No	☐N/A
44.	Are all machines securely anchored to prevent "walking"?	☐Yes	☐No	☐N/A
45.	Do dust-generating tools and machinery have adequate controls to minimize dust?	☐Yes	☐No	☐N/A
46.	Are all emergency shut-off switches, brakes, etc. working properly and labeled?	☐Yes	☐No	☐N/A
47.	Is there a hook or a brush available to remove debris from machinery?	☐Yes	☐No	☐N/A
Personal Protective Equipment *Inspect **all** PPE use:*		**Not applicable to this Shop☐**		
48.	Are safety glasses made available to visitors before entering the shop area?	☐Yes	☐No	☐N/A
49.	Is PPE available and being worn by shop personnel and students?	☐Yes	☐No	☐N/A

50.	Are signs for PPE use posted?	☐Yes	☐No	☐N/A
Compressed Air		**Not applicable to this Shop☐**		
51.	Is compressed air used for cleaning regulated to 30 psi?	☐Yes	☐No	☐N/A
52.	Clothes are not being cleaned (dusted off) with compressed air?	☐Yes	☐No	☐N/A
Welding/Cutting (Hot Work) *Inspect welding/cutting areas for the following:*		**Not applicable to this Shop☐**		
53.	Are protective screens or dividers provided to protect against welding arc, sparks and slag?	☐Yes	☐No	☐N/A
54.	Is the area free from flammables and combustible materials?	☐Yes	☐No	☐N/A
55.	Are welders wearing appropriate clothing and PPE to protect from sparks, slag, and UV light?	☐Yes	☐No	☐N/A
56.	Is there adequate ventilation in the area?	☐Yes	☐No	☐N/A
57.	Are the welding leads in good condition?	☐Yes	☐No	☐N/A
Compressed Gas Cylinders *Inspect all compressed gas cylinders for the following:*		**Not applicable to this Shop☐**		
58.	Oxidizers and fuel gases in storage separated by at least ☐ 20 feet or by a ☐ 5-foot wall with a 30-minute fire resistance rating (if not supplied on demand) (Exception: oxygen and acetylene)?	☐Yes	☐No	☐N/A
59.	Are individual cylinders labeled as to their contents?	☐Yes	☐No	☐N/A
60.	Cylinders properly secured by a chain or stand to prevent tip over and damage?	☐Yes	☐No	☐N/A
61.	Oxygen/acetylene cylinders in use kept in an approved cart?	☐Yes	☐No	☐N/A
62.	Regulators removed and replaced with cylinder caps when not “in use”?	☐Yes	☐No	☐N/A
63.	Are all regulators at 0 psi when off?	☐Yes	☐No	☐N/A
Overhead Cranes, hoists, etc. *Inspect all cranes, hoists, chain falls, etc. for the following:*		**Not applicable to this Shop☐**		
64.	Rigging (i.e. slings, shackles, etc.) in good condition? (no broken strands, kinking, damage,	☐Yes	☐No	☐N/A
65.	Are chains & hoists inspected in accordance with manufacturer’s requirements?	☐Yes	☐No	☐N/A
66.	Are load capacity signs clearly posted?	☐Yes	☐No	☐N/A
67.	Crane/hoist and the lift path properly barricaded?	☐Yes	☐No	☐N/A
68.	Hard hats available and used during lifts?	☐Yes	☐No	☐N/A