MACHINE SHOP SAFETY GUIDELINE

**APPROVAL:**

<table>
<thead>
<tr>
<th>Signature on file</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Institution Safety Committee Chair</td>
<td>4/15/2020</td>
</tr>
<tr>
<td>Signature on file</td>
<td>Date</td>
</tr>
<tr>
<td>Director of Environmental Health &amp; Safety</td>
<td>3/10/2020</td>
</tr>
</tbody>
</table>

1.0 PURPOSE AND SCOPE

1.1 The purpose of this guideline is to establish the requirements for safely working in machine shops. This guideline applies to all personnel that use machine shops at WHOI. Machine shops include carpentry shops, engineering shops, fabrication shops, temporary inside or outside shops, and any other shops with any of the machinery listed in Attachment A.

1.2 This Guideline does not apply to marine operations that are addressed by applicable U.S. Coast Guard regulations.

2.0 ROLES AND RESPONSIBILITIES

2.1 Environmental Health and Safety (EH&S) Office

- Maintains this guideline.
- Provides Machine Shop Safety Online training.
- Conducts periodic safety inspections of machine shops and investigates accidents/incidents.

2.2 Shop Supervisors

- All departments shall ensure that each machine shop with machinery classes 2-3 (Attachment A) has a designated and qualified Shop Supervisor with adequate funding to oversee machine shop operations and implement all applicable requirements of this guideline. There can be more than one Shop Supervisor assigned to a given machine shop to allow for oversight backup and continuity of operations.
  - Shop Supervisors must be experienced and competent in the safe use of all tools and machinery in the machine shop, meet the definition of a competent person, and are familiar with the safe operation of all shop machines, equipment, and tools.
  - U.S. OSHA defines qualified as one who, by possession of a recognized degree, certificate, or professional standing, or who by extensive knowledge, training and experience, has successfully demonstrated his/her ability to solve problems related to the subject matter, the work, or project.
  - The Facilities Director or his designee can determine if a person is qualified to be a Shop Supervisor.
- Attends required training to provide effective oversight of machine shop operations.
- Implements, follows, and enforces all applicable requirements of this Guideline and the Shop Safety Rules (Attachment B). Ensures that all personnel using machinery in classes 2-3 review and sign the Shop Safety Rules, which must be conspicuously posted in the machine shop.
- Ensure that the machine shop is conspicuously posted with the Shop Notice that includes the Shop Supervisors name (see Attachment C). When possible, the Shop Notice should be posted on the doors to the machine shops.
• Controls access to the machine shop(s) under their oversight. Stops any machine shop operation that is not safe or that involves unauthorized personnel.
  o Access control can be accomplished by controlling access to the shop (door locks, direct supervision), machinery lockout devices, or a combination of both controls.

• Conducts self-inspections of the shop. Maintains an inventory of machinery in the shop, ensures machinery is properly maintained, and in good working order. It is the responsibility of the departments that use the machine shop(s) to provide adequate funding to properly maintain and operate the shop in compliance with this Guideline.

• As needed, trains and certifies personnel as Authorized Operators on machinery classes 2-3. Maintains a list of Authorized Operators to use the shop and/or the machinery in classes 2-3 and removes personnel from this list if they cannot safely use the machinery.

• Ensure personnel protective equipment is available for the operators, appropriate for the hazards, in good condition, and is being properly used by the operators.

2.3 Authorized Operators and all WHOI Personnel

• Only operate machinery that you are trained and authorized to operate.

  NOTE: You are authorized if your name is on the Authorized Operators list for a particular machine(s) or if you are on the list for the entire shop. These Authorized Operator lists will be posted in the machine shops and will be maintained by the Shop Supervisor.

• Follow this Guideline, the Shop Safety Rules, and all instructions/procedures from the Shop Supervisor and/or machinery owner.

• The Shop Supervisor must be present during operation of class 3 machinery.

• When the Shop Supervisor is not onsite, Authorized Operators may use machinery in class 2 provided that they take on the machine shop oversight responsibilities of the Shop Supervisor (refer to section 2.2).

3.0 DEFINITIONS

• Authorized Operator – An operator of shop machinery who is authorized by the Shop Supervisor to operate a given piece of machinery and is listed on the Authorized Operator list for the given piece of machinery or the machine shop. To be an Authorized Operator for the entire machine shop, the operator must be approved by the Shop Supervisor for each piece of machinery in classes 2-3 (Attachment A).

• Machine Guarding – Moving machine parts have the potential to cause severe injuries, such as crushed fingers or hands, amputations, burns, and death. Any machine part, function, or process that may cause injury must be safeguarded, including: pinch points, rotating, reciprocating, traversing, cutting, punching, shearing, bending, and other potential hazards. Machine guarding may be needed for point of operation (area where machine performs work on material), at the power transmission apparatus (e.g., belts, gears, flywheels, chains, pulleys, spindles, couplings, cams, etc.) and other potentially hazardous machinery parts.
• Machinery – includes, but is not limited to, all of the machines, equipment, and tools listed on Attachment A.

4.0 AUTHORIZATION PROCESS AND TRAINING,

• Machinery Classes 1-3: All personnel that use any of the equipment listed on Attachment A (Machinery Hazard Classification System) are required to complete the following:
  o Machine Shop Safety Online Training initially and every two years
  o Obtain permission from the Shop Supervisor or space representative/owner to use this equipment.

• Machinery Classes 2-3: Personnel must be certified by the Shop Supervisor as Authorized Users to operate this machinery and must review and sign the Shop Safety Rules.

• With the exception of the online safety training records, the Shop Supervisor is responsible for maintaining all Authorized Operator records that are required by this Guideline.

5.0 MACHINERY MAINTENANCE AND SAFEGUARDING

• The Shop Supervisor is responsible for ensuring that all machinery is properly maintained and in good working order.

• Machinery that is unsafe to operate shall be locked and tagged out of service by the Shop Supervisor. Out of Service tags should be obtained from the EH&S Office (ext. 2242 or 2244).

• The Shop Supervisor shall ensure that WHOI’s Lockout Tagout Guideline is followed during machinery repair and maintenance activities:

• In accordance with U.S. OSHA regulations, machine guarding (a.k.a., safeguarding) is required where moving machine parts have the potential to cause injuries.
  o Any machine part, function, or process that may cause injury must be safeguarded, including: pinch points, rotating, reciprocating, traversing, cutting, punching, shearing, bending, and other potential hazards.
  o Machine guarding may be needed for point of operation (area where machine performs work on material), at the power transmission apparatus (e.g., belts, gears, flywheels, chains, pulleys, spindles, couplings, cams, etc.) and other potentially hazardous machinery parts.
  o Machine guards must be effective and provide adequate protection, e.g., cannot be easily removed and with maximum opening to hazard zone of ¼ inch or less.

• All table saws used at WHOI should be protected with SawStop® technology or equivalent.

6.0 SHOP SAFETY RULES, POSTINGS, AND PERSONAL PROTECTIVE EQUIPMENT

• Shop Safety Rules with hours of operation (Attachment B) and the Shop Notice (Attachment C) must be conspicuously posted at all machine shops. When possible, the Shop Notice should be posted on the doors to the machine shops.
• Shop Safety Rules must be reviewed, signed, and followed by all personnel using equipment in machinery classes 2-3.

• Attachment B provides a template for the shop safety rules and includes the minimum required information that must be included on the Shop Safety Rules.

• Within each machine shop, the Authorized Operators must be listed for machinery in classes 2-3. The Authorized Operators lists must be conspicuously posted within the machine shop.

• At a minimum, safety glasses and closed-toe shoes shall be worn by all personnel using equipment in machinery classes 1-3.

• All operators shall conduct a hazard analysis of the operations involving machinery classes 1-3 to identify the required personal protective equipment (PPE). Examples of PPE that may be required are listed below:
  
  o **Protective footwear (safety toe shoes)** is required when there is potential for foot injury from rolling or dropped objects.
  
  o **Eye and face protection (face shield)** is required when there is a potential for flying materials (e.g., lathe, grinder, table saw, etc.).
  
  o **Hearing protection (ear plugs, ear muffs)** may be needed during cutting, grinding, and other noisy operations. NOTE: if you must raise your voice to communicate at arm’s length from someone the noise levels could be damaging to your hearing.
  
  o **Head protection (hard hats)** is required when working with an overhead crane or if there is a potential for head injury from falling objects.

• **WARNING:** Certain machinery (such as lathes, milling machines, drill presses, etc.) can catch hair, watches, jewelry, clothing, and gloves and pull the operator into the rotating parts. Therefore care must be taken by the operators to minimize these hazards.

### 7.0 FIRE PREVENTION AND EMERGENCY RESPONSE

• **Combustible dust** is a fire and explosion hazard. Finely-divided metal, plastic and wood dusts can cause an explosion. Keep all dust collection systems and related ductwork clean. Do not allow excessive dust to build up on horizontal surfaces.
  
  o **WHOI’s Combustible Dust Safety Procedure:** [http://ehs.whoi.edu/ehs/labsafety/combustibleDust.pdf](http://ehs.whoi.edu/ehs/labsafety/combustibleDust.pdf)

• **Hot work** includes operations such as electric arc and gas welding, brazing, torch cutting, grinding (large portable grinders on metal), and torch soldering with an open flame. These operations create heat, sparks, and/or hot slag that have the potential to ignite flammable and combustible materials in the work area. Hot work must be conducted in Authorized Controlled Areas or under a Hot Work Permit.
  
• Oil, gas, or solvent-soaked rags present a fire hazard because they have the ability to spontaneously ignite and catch on fire. If it can be avoided, these rags should not be saturated prior to disposal. These rags must be collected in a FM or UL listed oily waste can that is metal and has a self-closing lid. When the can is full, submit a hazardous waste pickup request: http://ehs.whoi.edu/ehs/DesktopDefault.aspx?tabindex=0&tabid=1&itemID=19

• Machine shops must be equipped with portable fire extinguishers. Contact the Director of Facilities for the proper size, type, and quantity of portable fire extinguishers that are needed.

• Machine shops must be equipped with a land-line phone and a fully stocked first aid kit.
  o WHOI’s First Aid Kits: http://ehs.whoi.edu/ehs/DesktopDefault.aspx?tabindex=2&tabid=3&itemID=382

8.0 SHOP INSPECTIONS AND REPORTING

• The Shop Supervisor shall conduct periodic self-inspections of the machine shop(s) under their oversight to ensure compliance with this Guideline and the Shop Safety Rules.

• The Shop Supervisor shall report all accidents, injuries, and near misses with the online accident/incident reporting form: http://ehs.whoi.edu/ehs/DesktopDefault.aspx?tabindex=0&tabid=1&itemID=15

• The EH&S office conducts routine and for cause (after an injury, concern, etc.) safety inspections of the machine shops.

9.0 PERSONAL USE OF MACHINERY

• WHOI owned tools, equipment and shops are for the purpose of enabling WHOI to execute its mission. Any other use of this property is secondary to this purpose. Any such secondary use of this property can be allowed only after due consideration of the impacts and liabilities created by the practice. Not all items are suitable or available for loan and all loans are at the discretion of the Shop Supervisor.

• Personal use of machine shops and related tools/equipment is subject to WHOI’s Tools/Equipment/Shop Personal Use Procedure. See WHOI’s Insurance & Risk Management website for this procedure: http://www.whoi.edu/website/risk-management/home.

10.0 Waste Management

• Maximize the recycling of metal shavings, turnings, chips, and waste pieces. Use caution when handling these items as they can be razor sharp.

• If hazardous waste will be generated during shop operations it must be properly managed. If needed, a satellite accumulation area can be established by the EH&S office. Contact wastepickup@whoi.edu or x2242 for assistance.
## ATTACHMENT A: MACHINE SHOP HAZARD CLASSIFICATION SYSTEM

<table>
<thead>
<tr>
<th>Criteria</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Power/Type</strong></td>
<td>Portable tools (corded and cordless)</td>
<td>Industrial tools/machines</td>
<td>Higher hazard industrial tools/machines</td>
</tr>
<tr>
<td><strong>Examples</strong></td>
<td>• Circular saw</td>
<td>• Full-size drill press</td>
<td>• Full-size milling machine</td>
</tr>
<tr>
<td></td>
<td>• Belt sander</td>
<td>• Full-size band saw</td>
<td>• Full-size metal lathe</td>
</tr>
<tr>
<td></td>
<td>• Reciprocating saw</td>
<td>• Small benchtop milling machine</td>
<td>• Table saws that are not SawStop-type or equivalent</td>
</tr>
<tr>
<td></td>
<td>• Miter saw</td>
<td>• Small benchtop metal lathe</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Router</td>
<td>• Small benchtop woodworking lathe</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Angle grinders</td>
<td>• Bench grinder, surface grinder</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Small (mini) benchtop drill press</td>
<td>• Planer, jointer</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Small (mini) benchtop band saw</td>
<td>• Horizontal saw, radial arm saw</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Power sheer, shaper/molder</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Waterjet</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Laser cutter/engraver (enclosed and eye-safe)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• SawStop-type table saw</td>
<td></td>
</tr>
<tr>
<td><strong>Shop Access Control</strong></td>
<td>Standard door lock</td>
<td>Door lock approved by Director of Facilities</td>
<td>Door lock approved by Director of Facilities</td>
</tr>
<tr>
<td><strong>Tool Access Control</strong></td>
<td>Permission from space owner</td>
<td>Permission from Shop Supervisor</td>
<td>Permission from Shop Supervisor</td>
</tr>
<tr>
<td><strong>User Restrictions</strong></td>
<td>Certified as Authorized User by Shop Supervisor</td>
<td>• Shop Supervisor present</td>
<td>• Certified as Authorized User</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Buddy system recommended</td>
<td>• Buddy system recommended</td>
</tr>
<tr>
<td><strong>User Training</strong></td>
<td>• Machine Shop Safety Online Training</td>
<td>• Machine Shop Safety Online Training</td>
<td>• Machine Shop Safety Online Training</td>
</tr>
<tr>
<td></td>
<td>• Follow manufacturer’s instructions</td>
<td>• Tool-specific training from Shop Supervisor</td>
<td>• Tool-specific training from Shop Supervisor</td>
</tr>
<tr>
<td><strong>Shop Supervisor Training</strong></td>
<td>Approved by Director of Facilities</td>
<td>Approved by Director of Facilities</td>
<td>Approved by Director of Facilities</td>
</tr>
</tbody>
</table>
ATTACHMENT B: SHOP SAFETY RULES

Shop Location:__________________

Shop Supervisor:___________________

Hours of operation:

<table>
<thead>
<tr>
<th>Sunday</th>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
<th>Saturday</th>
</tr>
</thead>
</table>

- Unless specifically approved by the Shop Supervisor, access to this shop during non-hours is strictly prohibited. You must complete all required training before using machinery, including Machine Shop Safety Online Training and tool-specific training for Class 2 and 3 machinery.

- Only work with tools and machines that you have been authorized by the Shop Supervisor to use.

- Do not use any tool or machine if you are impaired in any way, including drugs, alcohol, or medications.

- Avoid working alone in the shop. Use the buddy system. Shop Supervisor must be present during operation of Class 3 machinery.

- Avoid entanglement. Do not wear loose clothing, jewelry, long hair, floppy sleeves, jewelry, watches, or other items that could be caught by or pull you into rotating machinery. Long hair must be tied back.

- Safety glasses must be worn at all times when machinery is in operation. Appropriate footwear is required. Open toed shoes are not permitted. Consult with the Shop Supervisor for other personal protective equipment that may be required, e.g., hearing protection, hard hat, face shield, etc.

- Machine guarding or safeguards must be in place at all times during operation of machinery. Keep blades covered as much as possible. Belts, pulleys, and pinch points must be properly safeguarded.

- Do not use machinery that is damaged or otherwise unsafe to operate. Immediately report damaged machinery to the Shop Supervisor.

- Immediately report any safety issues or concerns to the Shop Supervisor, Director of Facilities, and/or the Director of EH&S.

- Good housekeeping is critical. Keep area around machines clean, dry, and free of obstructions. Clean up after yourself. Do not leave tools and materials on the floor, such that they create tripping hazards or obstruct walkways. Do not obstruct doors or safety equipment (fire extinguisher, electrical service panel, first aid kit, fire alarm pull station, eye wash station, etc.).

- Put tools and materials away when you are done using them.

- Never leave operating tools unattended.

- Only one person may work on a machine at a time.

- Never make heavy/deep cuts with planners, jointers, routers, and lathes.

- Use the appropriate machinery for the job (hand tools vs. larger machinery).
• Always secure the work piece with a vise or clamp.
• Follow lockout/tagout procedures during equipment maintenance and repair.
• Never use compressed air without an OSHA safety nozzle (reduces outlet pressure to 30 PSI).
• No eating in the shop area.
• Report all injuries and near-miss injuries to the Shop Supervisor.
• Personal use (non-WHOI usage) of machinery must be approved by the Shop Supervisor and be in accordance with WHOI’s Tool Equipment Shop Personal Use Procedure.
• First Aid Kit location:__________________________
• Emergency eyewash stations location:____________________________
• For emergency call: x2911 (land line) or 508-289-2911 (cell phone).
• Land line phone location:___________________________

By signing below, I have reviewed and will comply with the above requirements.

<table>
<thead>
<tr>
<th>Name</th>
<th>Signature</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
NOTICE

Only trained and authorized personnel may operate the equipment, machines, and tools in this machine shop.

All Shop Safety Rules must be reviewed and followed.

Shop Supervisor: ________________________________

Contact numbers:________________________________

Shop Location (building/room):_____________________