A. Purpose
This policy establishes safe work practices for students, staff and visitors working in any Academic Machine Shop. It defines safety guidelines, training requirements and response procedures in case of emergency to minimize injuries and illness when working in a machine shop.

B. Applicability/Scope
Applicability: This policy covers users of all Academic Machine Shops irrespective of their location or department. Facilities and Research Machine Shops are not covered by this policy. Additionally, this policy does not apply to Facilities activities related to infrastructure maintenance and custodial support in academic shops. These activities are arranged in advance or regularly scheduled by the Shop Manager.

This policy is applicable to all University campuses including Morningside (MS), Lamont-Doherty Earth Observatory (LDEO), Medical Center (CUMC) and Nevis.

C. Definitions
Academic Machine Shop means any shop for academic pursuits or research are the primary function and students, faculty and staff may work with shop equipment under the supervision of a Shop Supervisor. Such work may include instruction, required machine work for Columbia University curriculum, or research activities by Columbia University students, faculty, or approved visitors under the supervision of a Shop Supervisor. Laboratories with large pieces of machinery with the potential to cause serious harm may qualify as an academic machine shop. Equipment users in these labs would be subject to this policy.

Buddy System is a term used to describe working with a partner to ensure the safety of both parties. For the purposes of this policy, Buddy System signifies NOT working alone in a Machine Shop.

Facilities Machine Shop means any shop staffed and used by Columbia University Facilities employees. No students are permitted to work in these shops, as these shops primary function is for use by professional trades.

Research Machine Shop means any department shop working for research projects. These shops are usually staffed by trades. Students, faculty, and other non-shop workers are not permitted to perform work on machinery in such shops.

Superuser is an experienced equipment user, other than a shop supervisor, who can provide technical support to students in the shop.

Visitors who are not affiliated with Columbia University may occasionally use machine shops.

Other users of machine shops include faculty, staff and visitors. All users must comply with section D of this policy.

D. Responsibilities
1. Students
   a. Never work alone in the shop.
   b. Complete General Shop Safety Training on RASCAL, present the training certificate to the Shop Supervisor to arrange machine-specific training before using any machine.
c. Adhere to the clothing standard set forth in each shop – including a minimum expectation of long pants, closed-toe and back shoes, and protective eyewear.
d. Observe all shop safety rules in this policy when working in the machine shop.
e. Observe all shop-specific rules beyond the scope of this policy.
f. Report all injuries to a Shop Supervisor promptly, regardless of seriousness.
g. Promptly report unsafe conditions, actions or near-miss incidents to Shop Supervisor.

2. Other Users
   a. Obtain a valid Columbia UNI or arrange another means to take general shop safety training.
   b. Complete general shop safety training and machine specific training provided by the Shop Supervisor before using any machine.
   c. Observe all shop safety rules when working in the machine shop.
   d. Never work alone in the shop.
   e. Report all injuries to the Shop Supervisor promptly, regardless of seriousness.
   f. Work with a Shop Supervisor for specific needs.

3. Shop Supervisor
   a. Ensure that all users of shop are familiar with general and shop-specific safety rules.
   b. Enforce all safety rules and make all users aware of the consequences of rule violations.
   c. Ensure that all users of shop have attended general shop safety and machine-specific training before starting their work in the shop.
   d. Provide tool/equipment specific training to each user of the equipment they will be using.
   e. Investigate all accidents and near-miss incidents and ensure timely correction of unsafe conditions.
   f. Give full support to all safety procedures, activities and programs.
   g. Maintain all training records
   h. Maintain access to Safety Data Sheets for all chemicals used in the shop.
   i. Clearly display Shop Safety Rules signs and shop hours on the shop door.

4. Department
   a. Ensure that adequate supervision is provided for the shop staff.
   b. Provide adequate resources for maintenance, repairs and safe guarding equipment.
   c. Direct all shop users to adhere to University policy and safety rules.

5. Environmental Health and Safety (EH&S)
   a. Periodically review and update this policy and training.
   b. Conduct periodic audits of various shops.
   c. Provide respirator fit testing, if deemed necessary.

E. Procedures
Training.
Anyone using an academic machine shop at CU is required to attend two types of training:

1. **General Shop Safety Training**
   A web based RASCAL training is available at the ([www.rascal.columbia.edu](http://www.rascal.columbia.edu), Course No. TC 0600). After completing training the user must complete the test, print a certificate of completion and provide a copy to the Shop Supervisor to arrange for machine-specific training.

2. **Machine Specific Training**
   Hands on training is provided by the Shop Supervisor before using a machine. This training will NOT be offered unless general safety training is completed. The training should involve instructions and hands-on demonstration in 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 and when and what NOT to use;
   - Safeguards, protection they provide, and ensuring their presence before using a machine;
   - What to do (e.g., contact supervisor, tag the machine) if a damaged guard, missing part, unusual noise, etc., is noticed.
   - How to use emergency buttons and other measures, when needed.
   - Maintenance and cleaning procedures

**General Shop Safety Guidelines**

Columbia University Environmental Health and Safety (EH&S) has developed General Shop Safety Guidelines for those who currently, or might in the future, use 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 their supervisor. Failure to follow proper precautions can result in serious injury or death.

1. **Never Use a Machine without proper training**
   In addition to general safety training, shop users must attend specific training on the machine to be used.

2. **Never Work Alone**
   At least two adults must be in the shop when power tools are being used. You must get permission from your Supervisor for off-hours and weekend work.

3. **Never Use a Machine When 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. Shop users must also be aware of other situations which cause impairment. These include: illness, tiredness, stress, or the use of medications.

4. **Always wear proper work attire in the shop**
   a. **Footwear**: Closed-foot shoes only. Sandals, flip-flops or other open-toe and/or open-back shoes are prohibited at all times in machine shops.
   b. **Eye Protection**: The minimum standard for protective eyewear is safety glasses
with side-shields. Eyewear which offers additional protection against splashing or other hazards may be indicated based on a risk assessment of the process or procedure. Prescription glasses with plastic lenses must meet ANSI Standard Z87.1 for safety.

c. **Clothing and Accessories**: long pants must be worn in machine shops. Remove or secure any items that can become entangled in a machine. These items include: loose clothing, Long hair, gloves, ID badges, jewelry, etc.

5. **Maintain Good Housekeeping**
   Maintaining a clean and orderly workplace reduces fire hazards as well as slip & fall hazards. Good housekeeping promotes safety and professionalism in the shop.

6. **Excersise Caution When Working With Machines**
   Maintain awareness of moving parts and sharp edges which can cause injury.

7. **Be aware of dust and fume hazards**
   Any procedure in which the operation of a machine produces dust or fumes must be conducted in an appropriately ventilated area.

8. **Always consult the shop supervisor or an equipment superuser for troubleshooting or other uncertainties with a machine**
   Adjustments or repairs must only be made under the supervision of a competent professional who is highly familiar with the safe operation of the machine.

9. **Never Remove Safety Guards**
   Machine guards are present for the protection of the user and must not be removed or altered.

10. **Always report damaged equipment to the shop supervisor**
    Broken parts or equipment can result in serious injuries. compromised machines must not be used until repairs have been made.

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

**Visitors Use of Shops**
Any visitor user of a machine shop who is not CU employee must obtain a written permission from the Shop Supervisor and adhere to all rules applicable to students, staff and faculty. Visitor users must follow guidelines delineated in the Responsibilities section for “Other Users.” No exceptions are made for visitors.

**Working Safely with Solvents, Resins and Other Chemicals**
1. Be aware of the hazards associated with each chemical. Review safety data sheets and manufacturer instructions.
2. When possible, work with less hazardous chemicals. For example, water based cleaners could be used in place of solvents.
3. Minimize the potential for exposure using all available controls
   - Work with chemicals in a fume hood whenever possible. Always work in
well ventilated areas

ii. Follow proper handling and storage procedures for all chemicals. Consult Standard Operating Procedures and work accordingly in a manner that minimizes the potential for exposure.

iii. Proper work attire must be used when working with chemicals. Consult the shop supervisor for the proper eyewear and gloves for the chemical you are using.

4. Any use of a respirator must be in accordance with the Respiratory Protection Policy

5. Never work with chemicals when impaired. Conditions which can cause impairment include: the use of alcohol or drugs, illness, tiredness, stress, or the use of medications.

6. Minimize the risk of fire. No smoking is permitted in the shop. Never work with chemicals near ignition sources such as electrical outlets, hot surfaces or open flames

7. Collect all chemical waste for removal by EH&S

8. Wash hands thoroughly after work to minimize the potential for contamination.

Emergency Procedures

11. Be familiar with the location and use of all emergency equipment present in the shop, including fire extinguishers, eye washes and spill kits, etc. Know the location of all exits and stairwells near the shop.

12. Each user must have a plan of action in case of emergency based on shop-specific emergency procedures, standard operating procedures, safety data sheets and guidance from the shop supervisor

13. Any injuries must be immediately reported to the shop supervisor. Medical attention is available and should be sought for injuries

14. In the event of a chemical exposure, remove contaminated clothing and rinse the affected area. Follow first aid guidelines from the chemical’s safety data sheet. When seeking medical attention, bring a copy of the safety data sheet. Report exposures immediately to the shop supervisor

1. Report and clean up any manageable spills immediately. For unmanageable spills contact Public Safety

F. Emergency Contacts

- MS Campus: Call 99 or (212) - 854-5555 from a cell phone
- CUMC Campus: Call (212)-305-7979 or (212)-305-8100
- Lamont Campus: Call 555 or (845)-359-2900 from a cell phone
- Nevis Campus: Call 911

In case of serious injury or if Public Safety cannot be reached, call 911. Always notify your Supervisor as soon as possible. You may be required to complete an Accident Form.

G. Medical Surveillance –n/a

H. Recordkeeping

- General safety records shall be maintained by the RASCAL.
Machine specific training records shall be maintained by the Shop Supervisor using form comparable to that in Appendix II.

I. Appendices
   Appendix I. Sample Machine Specific Training Record Form
   Appendix II. Carleton Lab - Floor Marking Guidelines
   Appendix III. Mechanical Motions and Actions

J. Forms

K. References
   1. OSHA Standard 29 CFR 1910.22. General requirements
   12. UCSB and U of Florida Shop Policy Guidelines
APPENDIX I
COLUMBIA UNIVERSITY
SAMPLE MACHINE SPECIFIC TRAINING RECORD FORM
The employee listed below has satisfactorily been trained on the safe use and operation of the specified shop equipment.

<table>
<thead>
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<th>Shop Equipment</th>
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APPENDIX II

Carleton Lab - Floor Markings Guidelines

1. **Traffic Area** – main traffic routes through lab; keep area clear of obstructions; beware of moving vehicles.

2. **Physical Hazard Area** – this area contains a physical hazard, entry by laboratory staff only (yellow cones are equivalent to yellow lines).

3. **Clean Area** – enter area only if authorized by lab staff. Enter only with clean clothes and shoes, and do not bring soiled tools into space.
APPENDIX III
Hazardous Mechanical Motions and Actions

A wide variety of mechanical motions and actions may present hazards to the worker. These can include the movement of rotating members, reciprocating arms, moving belts, meshing gears, cutting teeth, and any parts that impact or shear. These different types of hazardous mechanical motions and actions are basic to nearly all machines, and recognizing them is the first step toward protecting workers from the danger they present. The basic types of hazardous mechanical motions and actions are:

Motions
- rotating (including in-running nip points)
- reciprocating
- transverse

Actions
- cutting
- punching
- shearing
- bending

Brief examination of each of these basic types:

Motions:
Rotating motion can be dangerous; even smooth, slowly rotating shafts can grip clothing, and through mere skin contact force an arm or hand into a dangerous position. Injuries due to contact with rotating parts can be severe.

Collars, couplings, cams, clutches, flywheels, shaft ends, spindles, and horizontal or vertical shafting are some examples of common rotating mechanisms which may be hazardous. The danger increases when bolts, nicks, abrasions, and projecting keys or set screws are exposed on rotating parts.

In-running nip point hazards are caused by rotating parts on machinery. There are three main types of in-running nips.
1. Parts can rotate in opposite directions while their axes are parallel to each other. These parts may be in contact (producing a nip point) or in close proximity to each other. In the latter case the stock fed between the rolls produces the nip points. This danger is common on machinery with intermeshing gears, rolling mills, and calendars.
2. Another nip point is created between rotating and tangentially moving parts. Some examples would be: the point of contact between a power transmission belt and its pulley, a chain and a sprocket, or a rack and pinion.
3. Nip points can occur between rotating and fixed parts which create a shearing, crushing, or abrading action. Examples are: spooked hand wheels or flywheels, screw conveyors, or the periphery of an abrasive wheel and an incorrectly adjusted work rest.

Reciprocating motions may be hazardous because, during the back-and-forth or up-and-down motion, a worker may be struck by or caught between a moving and a stationary part.

Transverse motion (movement in a straight, continuous line) creates a hazard because a worker may be struck or caught in a pinch or shear point by the moving part.
Actions

**Cutting action** involves rotating, reciprocating, or transverse motion. The danger of cutting action exists at the point of operation where finger, head, and arm injuries can occur and where flying chips or scrap material can strike the eyes or face. Such hazards are present at the point of operation in cutting wood, metal, or other materials. Typical examples of mechanisms involving cutting hazards include bandsaws, circular saws, boring or drilling machines, turning machines (lathes), or milling machines.

**Punching action** results when power is applied to a slide (ram) for the purpose of blanking, drawing, or stamping metal or other materials. The danger of this type of action occurs at the point of operant where stock is inserted, held, and withdrawn by hand. Typical machinery used for punching operations are power presses and iron workers.

**Shearing action** involves applying power to a slide or knife in order to trim or shear metal or other materials. A hazard occurs at the point of operation where stock is actually inserted, held, and withdrawn. Typical examples of machinery used for shearing operations are mechanically, hydraulically, or pneumatically powered shears.

**Bending action** results when power is applied to a slide in order to draw or stamp metal or other materials, and a hazard occurs at the point of operation where stock is inserted, held, and withdrawn. Equipment that uses bending action includes power presses, press brakes, and tubing benders.