



HUMAN RESOURCES
ENVIRONMENTAL HEALTH AND SAFETY

MACHINE SHOP SAFETY PROGRAM

IMPROVE LIFE.

REVISION HISTORY

Revision Number	Document Section	Details of Amendments	Date
0		New Program	
1	All	Review & Update	October 2017
2	All	AODA Compliance	February 2020

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1.0 PURPOSE

Workers and students working within University of Guelph (University) machine shops, or using machines and power tools in other areas, are presented with unique hazards that could result in injury if not controlled. This document sets forth the minimum safe work practice requirements for the University's machine shops. It is intended to provide University departments that have machine shop areas and/or machine shop-type equipment and power tools with general guidance on developing or improving their own safe work practices and procedures based on the types of hazards, activities, machines and power tools present.

2.0 OBJECTIVE

Consistent with the University Environmental Health and Safety (EHS) Policy, each University department that operates a machine shop, or areas using machines and power tools, is responsible for its safe operation and shall implement this program. It is the responsibility of every Shop Supervisor to adhere to the safe work practices listed in this document and to provide a safe working environment that complies with the Ontario Occupational Health and Safety Act (OHSA) and applicable regulations, standards, and guidelines.

3.0 SCOPE

This program is applicable to any University departments that operate machine shops and/or machine shop-type equipment and power tools.

4.0 MACHINE SHOP SAFE WORK PRACTICES

The following are generalized safe work practices and should be developed to fit the particular types of hazards, machines, power tools and activities that occur at the machine shop.

- 4.1 Administrative Responsibilities
- 4.2 Controlled Access to Shops and Equipment
- 4.3 Training and Authorization for Use
- 4.4 Workshop Design
- 4.5 Fire Safety
- 4.6 Welding and Cutting
- 4.7 Housekeeping
- 4.8 First Aid
- 4.9 Emergency Planning and Training
- 4.10 Industrial Hygiene
- 4.11 Hazardous Materials Management
- 4.12 Procedures for Equipment Use
- 4.13 Records

4.1 Administrative Responsibilities

4.1.1 University Departments

Each University Department shall be responsible for:

- Designating a competent* Shop Supervisor(s) to implement these safe work practices (Shop Supervisor responsibilities are further clarified in the body of this document)
- Providing resources to implement and maintain an effective machine shop program that is commensurate with the size and usage of the shop
- Verifying that a machine shop program is reviewed by the Shop Supervisor(s) and their management on an annual basis, or when circumstances dictate otherwise, to provide for ongoing safety in a machine shop

*Occupational Health and Safety Act (OHSA) defines “competent person” as - a person who is qualified because of knowledge, training and experience to organize the work and its performance, is familiar with the OHSA and the regulations that apply to the work and, has knowledge of any potential or actual danger to health or safety in the workplace.

4.1.2 Shop Supervisors

Shop Supervisor(s) shall monitor all shop operations and be experienced and competent in the safe use of all machinery and tools in the shop. Shop Supervisor(s) shall be responsible for:

- Implementing and managing the machine shop safety program
- Reviewing the machine shop program to provide for the ongoing safety in the shop
- Ensuring only authorized personnel have access to the shop and operate machine tools
- Implementing machine-specific competency testing and general shop safety orientations before permitting unsupervised use of shop facilities by authorized personnel
- Providing safety orientation and training for all persons authorized to use machine shop facilities and tools
- Conduct a machine safety assessment and implement appropriate standard operating procedures for all new machinery and machine tools
- Scheduling the use of the machine tools as appropriate
- Ensuring machine tools are maintained in a safe working condition
- Ensuring shop users comply with all safety regulations and procedures
- Enforcing the use of personal protective equipment (PPE) required for the safety of shop users, and ensuring a notice concerning requirements for wearing PPE in the shop is conspicuously posted near the entrance to the machine shop

- All injury and near miss incidents are reported to Occupational Health and Wellness (OHW) using the University's incident and illness reporting procedure
- Establishing machine-specific lockout/tagout procedures and enforcing the use of such procedures when inspecting or repairing machines
- Conducting and documenting safety inspections of the machine shop area
- Establishing and enforcing standard operating procedures that specify individuals do not work alone with designated machine tools
- Authorizing all after-hours access and use of shop facilities
- Maintaining training program and training records documentation
- Ensuring emergency procedures are posted in the machine shop and first aid kits are conspicuously situated in the shop

4.1.3 Authorized Shop Users

Persons authorized to use machine shop facilities and machine tools and shall be responsible for:

- Complying with all safety rules and procedures related to the use of machine shop facilities and machine tools
- Wearing personal protective equipment as required
- Providing the Shop Supervisor with information regarding their certification and training
- Reporting to the Shop Supervisor any machine that does not have a safeguard for all points of operation or rotational motion, pinch points, and cutting, shearing, punching, and forming mechanisms
- Reporting to the Shop Supervisor any machine tools that exhibit signs of excessive wear or have damaged or misused parts immediately
- Reporting to the Shop Supervisor an injury or near miss incident immediately
- Maintaining shop work areas in a clean and safety condition
- Working in compliance with the University's Working Alone Policy

4.1.4 Environmental Health and Safety

Environmental Health and Safety provides support to machine shops by:

- Monitoring and communicating proposed safety regulations and standards
- Providing advice regarding the development of standard operating procedures for working safely in machine shops
- Updating and maintaining these guidelines on a regular basis or when new information pertinent to the safe operation of the university's machine shops becomes available

4.2 Controlled Access to Shops and Equipment

Departments shall maintain controlled access to all machine shops. Only employees and students registered in specific programs shall be authorized to access the University's machine shops.

Shops shall develop a method for controlling access of unauthorized personnel, and at a minimum, shall implement a means to prevent unauthorized use of dangerous machinery and tools.

4.3 Training and Authorization for Use

Individuals will be classified as "authorized shop users" upon completion of training commensurate with their use of the machine shop facilities and the safe and proficient use of the machines and tools.

The Shop Supervisor shall be responsible for providing training and ensuring shop users are trained in the proper inspection, use and maintenance of all tools and machines that the user is required to use. Such training, at a minimum, shall include the following topics:

- A review of the machine shop general rules (see Appendix A)
- A review of the machine tool-specific safety rules (see Appendix A)
- A review of the hazards associated with specific machinery and tools in that shop
- A review of the safeguards, how they provide protection, and the hazards for which they are intended to guard against
- How and under what circumstances safeguards can be removed and who may remove them
- What to do if a safeguard is damaged, missing, or unable to provide adequate protection
- Personal protective equipment requirements
- Lock out/tag out procedures
- Emergency procedures for events such as, but not limited to, medical incidents, chemical spills, loss of building electrical power, fire alarms
- Workplace hazardous materials information system (WHMIS)
- Equipment use demonstration

4.4 Workshop Design

4.4.1 Spatial Arrangements

General Location - Machines shall be located and operated such that they do not interfere with the general scheme of traffic. Operators shall not be required to stand in or near an aisle.

Kickback Protection - Machines, the operation of which may result in kickbacks, shall be located such that no employee is working in line with a possible kickback unless a suitable barricade is erected.

Clearances - Clearances on each working side of any machine shall be greater than the size of the largest material being processed.

Access for Maintenance - Adequate clearance shall be provided for maintenance of the machine.

4.4.2 Securing Machines

Mounting Machines - Machines shall be firmly mounted on substantial floors or foundations. Smaller units shall be secured to benches, tables, or stands of adequate strength. Such units shall be designed to prevent tipping.

Vibration - Machines which cause vibration or cause excessive noise shall be cushioned as recommended by the manufacturer.

4.4.3 Floors and Aisles

Floors - Floors shall be maintained and shall be free of tripping hazards such as holes, unevenness, loose boards, and the like. Floors shall be provided with an effective means to prevent slipping. Openings or pits in the floor shall be guarded to prevent any person from falling into such an opening. Edges of non-slip mats shall be beveled to minimize tripping hazards.

Aisles - All places where work is performed shall have safe means of access and egress. Aisles shall be of a width to allow pedestrian traffic to bypass material loads safely. Aisles shall be kept free of obstructions and spilled materials. Aisles shall not be slippery from wear or humidity.

4.4.4 Illumination/ Lighting

Lighting shall be so placed as to reduce glare and prevent too much contrast between work areas and adjacent areas.

Illumination shall be sufficient for general safety and ordinary visual needs.

Lighting fixtures shall be located and guarded such that there will be no hazard to persons should there be accidental breakage of the lamp or fixture.

Where failure of primary lighting can result in hazards to any person, emergency lighting shall be provided.

4.4.5 Ventilation

General Exhaust System - Machine shops shall be adequately ventilated and heated. Adequate supply air shall be maintained. General exhaust systems shall not be used as a substitute for local exhaust systems for the removal of contaminants.

Local Exhaust System - Where a process may produce dust, mists, fumes, or vapors that are hazardous or may form explosive mixtures, the hazardous material shall be removed by means of a local exhaust system at the point of generation of the contaminant. Local exhaust systems shall remove contaminated air directly outside and shall not be mixed with the general building ventilation system. Respirators shall not be used as a substitute for local exhaust systems.

Dust Collectors - Dust collectors shall be installed in compliance with O. Reg. 851 Industrial Establishments Section 65, under the Occupational Health and Safety Act, and O. Reg. 213/07 Fire Code Section 5.10 Combustible Dust Producing Processes, under the Fire Protection and Prevention Act.

A collector that collects aluminum, magnesium or other fine dust of an easily ignitable nature shall be located outdoors or in a room used solely for the housing of dust-collecting equipment. Such room shall be separated from the rest of the building by a dust-tight partition with a minimum fire-resistance rating of one hour and equipped with explosion venting to the outdoors.

A dust collector need not meet the above requirements if it uses an inert liquid as a medium to collect dust; is used for wood-working and has less than 0.47 cubic meters per second capacity; will safely contain explosions; or will resist explosions and has effective explosion venting to the outdoors.

4.4.6 Material Storage

Stock Materials - Stock materials such as lumber and piping shall be secured against tipping or falling. Cylindrical material stored on its side shall be piled symmetrically and each unit in the bottom row shall be chocked or wedged to prevent motion. All materials shall be piled in a manner which will prevent the pile from shifting and creating a hazard whether materials are being added to or removed from the pile.

Hazardous Materials - Hazardous materials shall be stored and labelled in accordance with all applicable legislation.

Scrap Material - Scrap materials shall be contained in bins or containers such that they do not present a hazard.

4.4.7 Electrical Installations

All electrical equipment and installations shall be certified by the Canadian Standards Association or the Electrical Safety Authority.

Power supplies and breaker panels shall be unobstructed.

Extension cords shall not be used as a substitute for permanent wiring. Extension cords used in wet and/or outdoor locations shall be protected by ground fault circuit interrupters. Extension cords shall not be placed across aisles or used in a manner that will create a hazard.

4.4.8 Sound Level

Engineering Controls - The level of noise exposure shall be controlled at source where possible such that it does not exceed the prescribed limit of 85 decibels. Where engineering and administrative controls do not maintain noise exposure within the prescribed levels, then hearing protection shall be worn.

Signs - Prescribed clearly visible warning signs shall be posted at the approaches to an area where the sound level is more than 85 decibels.

4.4.9 Machine Controls

Power Control - A conspicuously identified mechanical or electrical power control shall be provided on each machine within easy reach of the operator which will enable the operator to cut off the power from a safe operating position. In the event of a power failure, the machine shall not automatically restart when power is restored.

Start-up Control - Start-up controls shall be located in a safe position within easy reach of the operator's normal working position and away from the line of operation. The start-up control design shall minimize the chance of the control being operated accidentally.

Disconnect Switch - Every electrically driven machine tool shall have a main disconnect switch that can be locked in the "off" position before making adjustments or repairing the machine.

Foot-operated Controls - Foot-operated controls and levers shall be located or protected such that they cannot be shifted or accidentally tripped. Each foot-operated control shall be covered by an inverted U-shaped metal guard securely fastened and of such a size to prevent an accidental start-up or stoppage of the machine.

Emergency Stop Controls - An emergency stop control on a power-driven machine shall be conspicuously identified and be located within easy reach of the operator.

Operating Controls as Machine Guards - An operating control that acts as a guard for a machine not otherwise guarded shall be in a location where the safety of the operator is not endangered by moving machinery, be arranged so that it cannot be operated accidentally, and not be made ineffective by a tie-down device or other means.

4.4.10 Machine Guarding

General Requirements - Every machine that has exposed moving, rotating, electrically charged or hot parts or that process, transports or handles material that could constitute a hazard to an employee shall be equipped with a machine guard that:

- a) Prevents the person from coming into contact with the parts or material;
- b) Prevents access by the person to the area of exposure to the hazard during the operation of the machine; or
- c) Where practicable, makes the machine inoperative if the person or any part of his/her clothing is in or near a part of the machine that is likely to cause injury.

Nip Hazards - Every machine that has an in-running nip hazard or part that may endanger the safety of a person shall be equipped with and guarded by a guard or other device that prevents access to the pinch point.

Process Material - A machine shall be shielded or guarded so that the product, material being processed or waste stock shall not endanger the safety of any person.

Belts, Pulleys, Gears, Shafts, Sprockets, and Drive Chains - All belts, pulleys, gears, shafts, sprockets, drive chains, and moving parts shall be guarded in such a manner to protect persons from becoming entangled.

Anti-kickback Devices - Machines which are susceptible to kickbacks shall be equipped with anti-kickback devices such as in-feed rolls or anti-kickback fingers.

Removing Guards - To the extent that is reasonably practicable, a machine guard shall not be removable.

4.4.11 Grinding Wheels

Grinding wheels shall be used in compliance with O. Reg. 851 Industrial Establishments Regulation Sections 29 and 30, under the Occupational Health and Safety Act.

Maximum Speed - A grinding wheel shall be marked with the maximum speed at which it may be used. The wheel shall be operated at a speed which does not exceed the manufacturer's recommendations.

Mounting - A grinding wheel shall be checked for defects and cracks using a ring test before mounting and shall be mounted in accordance with the manufacturer's specifications.

Guarding - A grinding wheel shall be provided with a protective hood that encloses the wheel as closely as the work will permit.

Eye Protection - A grinding wheel shall be operated only by persons wearing eye protection.

Storage - A grinding wheel shall be stored where it is not subjected to extreme heat, cold, or damage from impact.

Work Rest - A work rest for a grinding wheel shall have a maximum clearance of three millimeters from the grinding wheel; be in a position above the center line of the grinding wheel; and not be adjusted when the grinding wheel is in motion.

Airborne Contaminant Control - Users shall be protected from airborne contaminants caused by the grinding operation by means of an engineered ventilation system or other method as deemed appropriate by the Environmental Health and Safety Department.

Starting the Wheel - New abrasive wheels and used wheels that have been remounted shall be run at operating speed with the safety guard in place for at least one minute before applying work. During this time no one shall stand in front of or in line with the wheel. Wheels that are out of balance shall not be used.

Side Grinding - Side grinding shall only be performed with wheels designed for that purpose.

Wheel Discard Size - Wheels shall not be worn down to a size that allows the mounting flange assembly to contact the workpiece or fixture.

Damaged Wheels - Cracked or damaged wheels shall be discarded.

Wheel Breakage - All incidents of wheel breakage shall be reported to the Shop Supervisor.

4.4.12 Explosive Actuated Tools

Explosive actuated tools shall be used in compliance with O. Reg. 851 Industrial Establishments Regulation Section 36, under the Occupational Health and Safety Act.

Tool Design - An explosive actuated tool shall,

- Have a firing mechanism that will prevent the tool from being fired while being loaded, during preparation for firing, or if dropped;
- Be capable of being operated only when the muzzle end is held against a working surface with a force of at least 22 Newtons greater than the weight of the tool;
- If required to be dismantled into separate parts for loading, be capable of being operated only when the separate parts are firmly locked together;
- Be used, only when equipped with a protective guard or shield suitable for the particular fastening operation being performed, mounted at right angles to the barrel, at least seventy five millimeters in diameter, and placed in a central position on the muzzle end of the tool except where the fastener is intended to be driven into a surface at a point within thirty-eight millimeters of another surface that is at an angle to the surface into which the fastener is intended to be driven; and
- Be capable of being operated when the guard is placed in the central position only when the bearing surface of the guard is tilted not more than eight degrees from the working surface

Storage - An explosive actuated tool shall be stored in a locked container.

Training - An explosive actuated tool shall be used only by a person who has been instructed in the proper and safe manner of its use by the manufacturer or the manufacturer's authorized and qualified agent.

Use - An explosive actuated tool shall,

- When in use, not be left unattended;
- Not be pointed directly at any person; - not be loaded unless it is being prepared for immediate use;
- Be used only after it has been inspected to confirm that the tool is clean, all moving parts operate freely, the barrel is free from any obstruction, the tool is adequately equipped for its intended use, and it is not defective;
- Be used in accordance with the instructions of the manufacturer;
- Be used only with an explosive load of a strength adequate to perform the intended work without excessive force;
- Be used only to drive a stud or other fastener suitable for insertion in the tool; and
- Not be used in an atmosphere containing flammable vapours, gases, or dusts

Personal Protective Equipment - Persons using explosive-actuated tools shall wear eye and head protection.

Misfired Loads - A misfired cartridge that has been removed from an explosive actuated tool shall be placed in a water filled container until the cartridge has been removed from the workplace.

4.4.13 Explosive Loads

Explosive loads shall be used in compliance with O. Reg. 851 Industrial Establishments Regulation Section 37, under the Occupational Health and Safety Act.

Storage and Use - An explosive load shall,

- Be marked such that its strength is easily identified;
- Not be stored in a container where an explosive load of a different strength is stored;
- When in use, not be left unattended;
- Stored in a locked container

4.5 Fire Safety

4.5.1 Fire Extinguishers

Fire extinguishers shall be suitable for the three classes of fires common to machine shops:

- Class A - Combustibles (paper, wood, cardboard)
- Class B - Flammable Liquids and Gases (solvents, oil-based paints, gasoline)
- Class C - Electrical Equipment fires

Class D fire extinguishers for combustible metals shall be supplied if determined appropriate by the University Fire Safety Division.

4.5.2 Storage and Use of Flammable Liquids

Flammable liquids shall be managed in accordance with the Ontario Fire Code and O. Reg. 851/90 Industrial Establishments under the Occupational Health and Safety Act. Persons are also referred to consult their departmental chemical safety manuals and safe operating procedures for more detailed direction on storing and using flammable liquids safely.

Oily Rags - Oily rags shall be kept in approved waste containers. Such containers shall be emptied daily.

4.6 Welding and Cutting

Welding and cutting operations shall be performed in accordance with the Ontario Fire Code, National Fire Protection Association Guidelines, and CSA Standard W117.2-12 Safety in Welding, Cutting, and Allied Processes. Persons are also referred to the University of Guelph Hot Work Policy.

All welding and cutting operations shall be performed by authorized personnel.

4.6.1 Permits

All welding and cutting operations require authorization in the form of a Hot Work Permit except in cases of designated approved hot work areas or approved work instructions or procedures.

4.6.2 General Precautions

Precautions to be taken prior to cutting/welding operations:

- a) Where practicable, the object should be moved to a safe location.
- b) If the object cannot be moved, all movable fire hazards in vicinity shall be moved to a safe location or covered by noncombustible material.
- c) If a & b cannot be accomplished, guards such as welding curtains shall be used to confine heat, sparks, and slag to protect immovable fire hazards.
- d) If requirements of items a through c cannot be satisfied, then the cutting or welding shall not be performed without the approval of the Shop Supervisor or Fire Safety Division.

4.6.3 Special Precautions for Cutting and Welding

Whenever there are holes, openings, or cracks in floors, walls, etc., adequate precautions shall be taken to prevent combustible materials on other side from igniting.

Suitable fire extinguishing equipment shall be maintained in a state of readiness for instant use.

Gas welding/cutting: Prior to use, the welder will perform a visual inspection of the welding equipment. The welder shall:

- Confirm that compressed gas cylinders are secured in an upright position
- Inspect full length of hoses and remove from service any hose with evidence of wear or damage
- Inspect regulators and their associated gauges; confirm regulators are in proper working order, and gauges are functioning and easily visible; and remove from service any defective regulators or damaged gauges or site glass.
- Verify that cylinders are kept far enough away from the actual welding or cutting to prevent hot slag, sparks, or flame from reaching them
- Confirm that torches shall be inspected for leading shutoff valves, hose couplings and tip connections and that defective torches are removed from service

- Verify that oxygen cylinders and fittings are kept free of oil and grease substances and are not handled with oily hands or gloves

4.6.4 Fire Watch

A fire watcher shall be required for all cutting and welding operations in locations where a fire may develop, such as in the following:

- a) Combustible material is located within 11 metres of operation and cannot be removed or protected
- b) Wall or floor openings are located within 11 metres of operation
- c) Combustible materials may be ignited by conduction or radiation through a floor, wall, ceiling or roof

NOTE: Fire watcher shall be in position to observe opposite side of the wall or floor.

Procedures for Fire Watchers - Fire watchers shall:

- a) Have fire extinguishing equipment readily available and be trained in its use
- b) Be familiar with the procedures for reporting fires
- c) Try to extinguish fire only within the capacity of available equipment
- d) Activate the fire alarm when necessary; and
- e) Maintain the fire watch for at least 30 minutes after completion of welding or cutting operations to detect and extinguish any smoldering fires

4.6.5 Ventilation

Ventilation shall be provided for all welding and cutting operations to reduce the hazards associated. Special ventilation procedures or respiratory protection may be required for operations involving:

- Fluorine compounds
- Zinc
- Lead
- Beryllium
- Cadmium
- Mercury
- Cleaning Compounds
- Stainless Steel
- Aluminum (ozone generation)

4.6.6 Personal Protective Equipment

Eye Protection - Persons in the welding workplace shall wear appropriate eye and face protection to protect against radiant energy and spatters. Such protection shall be in conformance with CSA Standard Z94.3 Eye and Face Protectors.

CSA-certified goggles or safety glasses with side shields shall be worn by welders and welding personnel in addition to other eye and face protection.

During arc welding and cutting, helmets or hand shields with appropriate filter lenses and cover plates shall be used. During gas welding, resistance welding, and oxygen cutting, goggles shall be worn. During brazing and torch soldering, face shields or goggles or safety glasses shall be worn.

Contact lenses should not be worn.

Respiratory Protection - Welders shall be protected from fumes and gases by an appropriately engineered ventilation system. Where this is not possible, appropriate personal respiratory protection shall be used as prescribed by the Environmental Health and Safety Department.

Skin Protection - Clothing shall be worn to protect the welder from sparks, radiation, and spatter. Such clothing shall be flame resistant and free from oil or grease. Synthetic fabrics that can melt or burn shall not be used.

Protective clothing shall consist of:

- Flame resistant gauntlet gloves
- Apron or leggings
- Cape or shoulder cover when welding or cutting overhead
- Fire resistant skull cap
- Fire resistant ear plugs when sparks may enter the ears
- CSA-certified safety boots

Clothing shall not have cuffs, pockets, or rolled up sleeves; sleeves and collars shall be buttoned; trousers shall overlap boots.

Flammable or combustible materials, e.g. matches, shall not be carried on a person where sparks or spatter may come in contact.

4.7 Housekeeping

- Aisles, workstations, access to emergency equipment, and exits shall be kept free of obstructions at all times
- Machines shall be brushed off and wiped down after use or at the end of each day
- Scrap materials shall not be allowed to accumulate and shall be removed from the work area promptly
- Compressed air shall not be used to clean persons or equipment
- Floors shall be cleaned regularly and maintained free of debris
- Spills shall be cleaned up immediately

4.8 First Aid

4.8.1 Training

Shop Supervisors shall have a current first aid certificate. In addition, it is recommended that all shop employees be certified. It is also recommended that at least one person be certified in cardio-pulmonary resuscitation (CPR).

4.8.2 First Aid Kit

A first aid kit shall be readily accessible to all shop users at all times of occupancy. Such kit shall contain items as prescribed by Regulation 1101/90 respecting First Aid Requirements, under the Workplace Safety and Insurance Act. The Shop Supervisor shall validate that the first aid kit is maintained.

4.9 Emergency Planning and Training

Shop Supervisors shall develop written emergency plans in consultation with Emergency Services. Such plans shall be available to all shop occupants. Such plans shall be reviewed whenever new procedures, materials, or equipment are introduced or at least annually.

4.9.1 Medical Emergencies

Shop Supervisor shall develop a medical emergency plan in consultation with Emergency Services.

4.10 Hazardous Material Spills

Shop Supervisor shall develop plans for control of hazardous material spills. Appropriate spill control materials shall be available at all times that the shop is occupied.

All persons using hazardous materials shall be trained in spill control and cleanup for the various types of materials used.

4.10.1 Evacuations

Shop Supervisor shall develop plans for shutdown of equipment and orderly evacuation of personnel in the event of an evacuation alarm. Such plans shall be developed in consultation with Emergency Services.

4.10.2 Power Failures

Shop Supervisor shall develop action plans in the event of a power failure.

4.10.3 Fire

Shop Supervisor shall develop a fire emergency plan in consultation with the Fire Safety Division.

4.10.4 Training

All shop personnel shall be trained in the implementation of the emergency plan. Such training shall include but not be limited to the following information:

- Location of the written plan
- Use of fire safety equipment
- Familiarization with audible alarms
- Evacuation routes and assembly points
- Emergency telephone numbers
- Location of critical switches, valves, etc.
- Hazardous material spill control procedures
- Incident reporting procedures
- Shutdown of equipment as necessary

4.11 Industrial Hygiene

4.11.1 Personal Protective Equipment

Eye Protection - All persons, including visitors, entering the machine shop and exposed to eye injury hazards shall wear eye protection appropriate to the hazard. All such eye protection shall be CSA certified. For impact hazards, safety spectacles with side shields shall be worn. For liquid chemical protection, chemical splash goggles shall be worn. For more specialized eye protection such as welding lenses or protection from laser hazards, persons shall consult the appropriate University policy, CSA Standard, or EHS for assistance. Persons are also referred to the University of Guelph Personal Protective Equipment (PPE) Guidelines.

Foot Protection - All persons, including visitors entering the machine shop and exposed to foot injury hazards shall wear foot protection appropriate to the hazard. Foot protection shall comply with CSA Standard Z195-14 Protective Footwear.

Protective Clothing - A workshop coat shall be worn whenever there is a potential exposure to hazardous materials or radiant energy. Persons working near possible points of entanglement shall not wear loose clothing and shall roll up long sleeves.

Hearing Protection - Where it is not practicable to reduce sound levels below 85 decibels, then persons exposed to such sound levels shall wear hearing protection as prescribed by EHS.

Respiratory Protection - Persons requiring respiratory protection shall be assessed by EHS.

Head Protection - Persons exposed to head injury hazards shall wear CSA-certified head protection.

Sanitary Facilities - Every machine shop shall have hot and cold water for washing, soap, and paper towels or hand dryer.

4.11.2 Emergency Showers and Eyewash Stations

Eyewash Stations - Where a person is exposed to a potential hazard of injury to the eye due to contact with a biological or chemical substance, an eyewash fountain conforming to ANSI Standard Z358.1 Emergency Eyewash and Shower Equipment shall be installed at the machine shop. Persons are also referred to the University of Guelph Personal Emergency Eyewash and Shower Equipment Guidelines.

Emergency Deluge Showers - Where a person is exposed to a potential injury to the skin due to contact with a substance, a quick-acting deluge shower shall be provided. Such shower shall conform to the ANSI Standard Z358.1 Emergency Eyewash and Shower Equipment. Persons are also referred to the University of Guelph Personal Emergency Eyewash and Shower Equipment Guidelines.

4.11.3 Eating Facilities

No food or drink shall be taken into, left or consumed in the workshop.

4.12 Hazardous Materials Management

Hazardous materials and hazardous waste shall be managed in accordance with the Ontario Fire Code, Occupational Health and Safety Act and Regulations, all applicable legislation, standards and codes.

4.12.1 Paints, Varnishes, and Finishes

Paints, varnishes, and other surface finishes shall be used only in a manner that shall not expose users to hazardous concentrations of vapors and that vapors are not re-entrained into the building air supply system.

4.12.2 Stock Materials

Stock quantities of toxic materials shall not be used without permission of the Shop Supervisor. A written hygiene plan shall be developed before commencing work with such materials. For designated substances an assessment is required. Contact EHS for assistance.

4.12.3 Cutting Oils

Exposure to cutting oils shall be minimized by appropriate work practice and respiratory protection where appropriate.

4.13 Procedures for Use of Equipment

4.13.1 Shop Rules

Shop Supervisor shall be responsible for making shop users aware of all rules and for enforcement of such rules. Shop Supervisors shall develop rules specific to the shops for which they are responsible. Examples of shop rules may be found in Appendix I.

4.13.2 Standard Operating Procedures for Equipment

It is the responsibility of the Shop Supervisor to maintain a manual of Standard Operating Procedures (SOPs) for each type of portable electric tool, portable air-powered tool, explosive actuated tool and machine. The manual shall be made available at or near the machine for examination by a person who is required to use the tool or machine.

4.14 Records

It is the responsibility of the Shop Supervisor to maintain the following records:

- Up-to-date training records for all persons authorized to work in a machine shop or required to use the machine shop facilities in the course of their studies
- Up-to-date inventories of all hazardous materials stored in a machine shop

APPENDIX I

General Shop Rules

1. Machines and tools shall be cleaned after each use.
2. Tools shall be returned to the appropriate storage area clean and in good condition.
3. Any damaged or defective equipment/tools shall be reported to the supervisor and tagged as out of service immediately.
4. Users shall select the proper size and type of tool for the work.
5. Floors shall be kept clear of scrap and excessive litter. Spills shall be cleaned up immediately.
6. Work shall be mounted in a vise, clamp, or holder whenever possible. Edged tools shall be handled carefully and shall be sharpened regularly.
7. Machines shall be stopped when making adjustments or measurements. Lockout/tagout procedures shall be followed when repairing machines or changing blades.
8. Cuttings and chips shall be removed by using brushes or pliers, never by hands.
9. Machine users shall not wear jewellery or gloves. Long hair shall be tied up; long sleeves shall be rolled up.
10. Ear protection shall be worn when noisy machines are operating.
11. Eye protection shall be worn by all persons in the work area when machines are being used.
12. Compressed air shall not be used to clean tools, machines, or persons.
13. Persons shall not engage in horseplay or cause distractions.
14. Supervisors shall have final authority over access to tools and equipment.
15. All injuries and "near misses" shall be reported immediately to the supervisor.

Machine Safety Rules

Lathe

1. Eye/face protection shall be worn.
2. All work shall be solidly clamped with an appropriate size work-holding device.
3. Boards shall be laid across the ways when changing chucks to protect fingers and the lathe bed. After installation of the work piece, the chuck or faceplate shall be turned by hand such that there is no binding or danger of the work striking any part of the lathe.
4. The machine shall be stopped before making adjustments or measurements.
5. Chips shall be removed with pliers. Air hoses shall not be used to clean the machine.
6. All work shall be solidly supported. Small diameter work shall not be permitted to project too far from the chuck without support from the tail stock center.
7. The lathe shall not be stopped by reversing its direction of rotation.
8. Tools shall not be run into the chuck or lathe dog.
9. The chuck shall not be run on or off the spindle by using power.

10. Automatic feed shall not be engaged until the user is aware of the direction and speed of the carriage or cross-feed.
11. Tools shall not be placed on the lathe ways.
12. The key (T-handle) shall never be left in the chuck; it shall be placed in the designated storage location before starting the machine.
13. Files shall be used only with handles.
14. If vibration or odd noise develops, the machine shall be stopped immediately.
15. Work piece surfaces shall not be touched while the machine is running.

Mill

1. Eye protection shall be worn.
2. Heavy attachments such as the vise, dividing head, or rotary table shall not be moved without help.
3. Chips shall be removed with a brush, not the hand. Air hoses shall not be used to clean the machine.
4. The machine shall be stopped before removing chips.
5. Users shall not reach over or near the rotating cutter.
6. The holding device shall be solidly mounted to the table and the work firmly held before commencing work.

Grinder

1. Eye protection shall be worn.
2. Users shall keep hands clear of the rotating grinding wheel.
3. The wheel shall be stopped before making adjustments.
4. Work shall not be forced against the wheel.
5. The wheel shall not be operated at a speed that exceeds the posted limit.

Shear

1. Eye protection shall be worn.
2. Shear may be used to cut soft metals up to sixteen gauge only.
3. Scraps shall be removed promptly and deposited in the appropriate scrap bin.

Drill

1. Eye protection shall be worn.
2. The speed setting shall be appropriate for the work.
3. The bit shall be mounted securely to the full depth of the chuck and in the center. The key shall be removed immediately.
4. The feed stroke shall be adjusted so that there is no possibility of the bit striking the table. Work shall be placed on a wood pad when holes will go through the work piece.
5. Work shall be solidly clamped.

6. The bit shall be fed smoothly into the work, allowing chips to clear the work and keep the bit cool.
7. The drill spindle shall be allowed to stop of its own accord.
8. The machine shall be cleaned of chips and cutting fluid after use.

Band Saw

1. Eye protection shall be worn.
2. The upper guide assembly shall be adjusted to 1/4 inch above the work.
3. The saw shall be full speed before starting to feed in work. Stock shall be fed into the saw only as fast as the teeth will easily remove material.
4. Stock shall be held flat on the table.
5. The machine shall be stopped before making adjustments or measurements.
6. Proper speeds and blades shall be used for the material being cut. Curves shall be large enough to prevent binding the blade.

Jointer

1. Eye protection shall be worn.
2. The maximum cut for jointing an edge is 1/8 inch and for a flat surface 1/16 inch.
3. Stock shall be at least 12 inches long. Stock to be surfaced shall be at least 3/8 inch thick unless special feather boards are used.
4. Work shall be fed such that the knives will cut with the grain. Stock material that has knots, splits, or checks shall not be used.
5. End grain shall not be planed unless the board is at least 12 inches wide.
6. A push stick shall be used when planing a flat surface. Hand pressure shall not be used over the knives.
7. A 4-inch margin of safety shall be maintained.

Wood Lathe

1. Eye protection shall be worn.
2. Before the machine is started, spindle work shall have the cup center properly imbedded, the tailstock and tool rest shall be securely clamped, and proper clearance for the rotating stock verified.
3. Before the machine is started for faceplate work, the faceplate shall be checked to confirm it is tight against the spindle shoulder and that the tool support has proper clearance.
4. Turning speed shall be appropriate for the work. Low speed shall be used to rough out work.
5. Wood with knots and splits shall not be turned. Glued up stock shall be cured at least 24 hours.
6. The tool rest shall be kept close to the work. The machine shall be stopped before moving the tool rest.
7. The tool rest shall be removed for sanding and polishing operations.
8. A scraping cut shall be used for all faceplate work.

9. The spur and cup centers shall be removed when not in use.
10. The cup center shall be lubricated regularly.
11. Tools shall be kept sharp and held firmly in the proper position.
12. Work sleeves shall be rolled up. Jewellery and watches shall not be worn; long hair shall be tied back.

Table Saw

1. Eye and hearing protection shall be worn.
2. The blade shall be set so that it is 1/4 inch above the stock to be cut.
3. Operators shall stand to one side of the operating blade and shall not reach across it.
4. Operators shall maintain a 4-inch margin of safety. Push sticks shall be used where appropriate.
5. The position of the stock shall be controlled either by the fence or the miter gauge. They shall not be used in combination as this will cause binding and kick back. Stock shall not be cut free hand. The table shall be large enough to support the work.
6. Stock should be free of knots, splits, and warps.
7. The saw shall be stopped before making adjustments to the fence or blade.
8. Small scrap cuttings shall not be allowed to accumulate; a push stick shall be used to push them away.
9. Dado or special blades shall be removed and stored in the designated area after use.
10. The saw shall be cleaned after use and scraps placed in the appropriate scrap bin. The floor shall be vacuumed clear of sawdust and scraps.
11. The splitter and guard shall not be removed without permission of the supervisor.
12. The dust collector shall be turned on before commencing work.

Belt Sander

1. Eye protection shall be worn.
2. The belt shall be free of tears or defects and correctly mounted. The belt shall track in the center of the drums and platen.
3. Small irregular pieces shall be held in a hand clamp or special jig.
4. Work shall be supported against the table when sanding the end grain of narrow pieces
5. A pad or push block shall be used when sanding thin pieces on the belt sander.
6. Only clean new wood shall be sanded; glues or finished on the surface will load and foul the abrasive.

Portable Circular Saw

1. Eye protection shall be worn.
2. Stock shall be well supported such that the kerf will not close and bind the blade during or at the end of the cut.

3. The depth of the cut shall be adjusted to the thickness of the stock plus 1/8 inch.
4. The saw base shall be placed on the stock with the blade clear before turning the switch on.
5. The saw shall be unplugged while changing blades or making adjustments.
6. The operator shall stand to one side of the cutting line during the cut.

Portable Electric Drill

1. Eye protection shall be worn.
2. Appropriate drill bits shall be used for the type of work. The bit shall be mounted securely to the full depth of the chuck. Drill bits shall be kept sharpened.
3. Stock to be drilled shall be held in a stationary position such that it cannot be moved during the operation.
4. The drill shall be momentarily turned on to confirm the bit is properly centered and running true.
5. The drill shall be aligned with the direction of the hole during the operation.
6. The drill shall be withdrawn several times when drilling deep holes in order to clear the cuttings
7. Drill bits shall be removed from the drill when work is finished and shall be stored in the designated area.

Portable Router

1. Eye and noise protection shall be worn.
2. The bit shall be securely mounted in the chuck to a depth of at least 1/2 inch and the base shall be tight.
3. The work piece shall be securely clamped.
4. The router base shall be placed on the work or template with the bit clear of the stock before turning on the power. The router shall be firmly held to overcome starting torque.
5. When the cut is complete, the router shall not be lifted from the work until motor has stopped.
6. The router shall be unplugged when mounting bits or making major adjustments.
7. The router shall be held with both hands when operating. It shall be fed smoothly through the cut in the correct direction.

Saber Saw

1. Eye protection shall be worn.
2. Appropriate blades shall be used for the work.
3. The saw shall be unplugged when changing blades or making adjustments.
4. The base of the saw shall be placed firmly on the stock before starting the cut.
5. The switch shall be in the OFF position before plugging in.
6. The motor shall be turned on before the blade contacts the work.
7. Curves shall be shallow enough to prevent twisting the blade.
8. The work shall be well supported. Care shall be taken not to cut into the supports.