

Minnesota Career and Technical Education (CTE) School Laboratory/Shop Safety Manual 2nd Ed.



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Safety Curricula and Answer Key Requests

The Minnesota Career and Technical Education (CTE) School Laboratory/Shop Safety Manual is available to all Minnesota CTE teachers. Complete safety curricula, including student worksheets, parts identification, and safety test keys are available upon request. To request the complete safety curricula, please send an email with the subject line "CTE Safety Curriculum Request" to mde.cte@state.mn.us.

Purpose Statement

To reduce and eliminate accidents in educational laboratory/shop and the workplace by:

- Making instructors aware of dangers and risks to themselves, the students, and visitors.
- Providing instructors with the knowledge to be able to make the laboratory/shop, classroom, and workplace a safe environment and meet the legal standards of federal OSHA, as well as the state labor and industry (DLI) and education departments (MDE).
- Providing recommendations to improve the safe environment for learning or working
- Providing examples of essential records and forms for evidence of compliance.
- Providing a basic understanding of the educator's legal responsibilities.
- Providing rules and regulations of Labor and Industry.
- Provide a framework for teachers to include safety awareness or safety training in their curriculum and daily instructional practices.

History

In the fall of 2018, the Trade and Industry (T&I) and Agricultural, Food, and Natural Resources (AFNR) Education staff at MDE formed a committee of high school and college CTE teachers and instructors. The mission of the committee was to improve safety instruction in Minnesota CTE laboratories/shops. After a year of exploring the best course of action, a writing team was formed to begin the work that created this manual. To MDE's knowledge, the last CTE laboratory and safety manual is from 1978, sold for \$1.00, and was a near-direct copy of the Washington state guide that was released two years earlier. In preparation for this manual, the committee reviewed dozens of laboratory/shop safety manuals from other states, colleges, and government organizations. Once again, the writing team used a great deal of material found in the other manuals it reviewed.

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Introductory Materials

Key Definitions

- Safety – The freedom from danger, risks, or accidents that may result in injury, death, or property damage (*CTE Health and Safety Education Guide* [Washington, 2002]).
- Laboratory/Shop - A space utilized for instruction or maintenance activities, including (but not limited to) power-driven tools used for fabricating, machining, finishing, and repairing physical objects and electronic items. Work may include woodworking, equipment development, glasswork, material handling, metalwork, plastics, plumbing, surface modification, electrical work, mechanical work, and agricultural/food activities (Adapted from Shop Safety Manual [Iowa State]).

State Statutes

Numerous State Statutes govern your classroom, making you legally responsible for knowing them and enforcing them. If you are not enforcing the statutes, you could be held liable. A comprehensive list of education laws can be found at the [Minnesota Legislature](#). Below is a list of the common statutes relating to school CTE laboratories and shops. These laws are an excellent reference for talking with students, parents, and administration.

- [121A.29 REPORTING; CHEMICAL ABUSE](#)
- [121A.30 PESTICIDE APPLICATION AT SCHOOLS](#)
- [121A.31 SAFETY REQUIREMENT GUIDELINES](#)
- [121A.32 EYE PROTECTIVE DEVICES](#)
- [121A.61 DISCIPLINE AND REMOVAL OF STUDENTS FROM CLASS](#)
- [123B.57 HEALTH AND SAFETY PROJECTS](#)
 - [Health, Safety and Environmental Management: Management Program, A List of Possible Hazards Found at School District Sites](#)
- [123B.595 LONG-TERM FACILITIES MAINTENANCE REVENUE](#)
 - [Long-Term Facilities Maintenance Revenue Guide for Allowable Expenditures](#)
- [126C.44 SAFE SCHOOLS LEVY](#)
- [3505.2550 MINIMUM STANDARDS FOR INSTRUCTIONAL PROGRAM APPROVAL](#)
- [3512.5200 CODE OF ETHICS FOR SCHOOL ADMINISTRATORS](#)
- [5207.0600 LOCKOUT DEVICES](#)

Legal Matters

Originally derived from English common law, the term *in loco parentis*—Latin for in the place of a parent—refers to the legal responsibility of a teacher or school to take on some of the functions and duties of a parent. The law holds teachers to a higher standard than parents because they are trained professionals in supervision and discipline. A CTE teacher must provide a safe learning environment and protect students against any danger an ordinary person in their position should be able to foresee.

A teacher is negligent when a lawyer can prove that a teacher failed to act as a reasonable and normal person would act in the time preceding an accident, injury, or death. This negligence results in the teacher and often administration being liable for the accident, injury, or death. Liability is the state of being legally responsible or under obligation. As a result, teachers will often have a financial lien on themselves, their future earnings, and their property, as well as possible jail time and the loss of their teaching license. One study found that in all the cases brought against schools for student injuries over seven years, the schools and teachers were found liable in approximately two-thirds of the cases, and the average payout was around \$560,000.00. If evidence shows that the teacher acted appropriately and an accident occurred, then the teacher might not be considered negligent. However, if evidence shows that actions or inactions by the teacher were not reasonable and normal, then liability might be established. CTE educators who act reasonably, follow current best practices, and use good common sense regarding laboratory/shop safety can decrease their chances of being found negligent.

While teachers are unable to prevent all accidents and injuries, they are expected to establish a safety program that will help prevent accidents and, in the event of legal action, serve as proof that the teacher made every reasonable attempt to provide a safe environment. When teachers are found liable, it is most likely from failing to carry out an obligation, provide safety instruction, or eliminate hazards. The liability of the teacher is typically higher than the school administrator. The teacher is the subject matter expert and is in immediate contact with the students. The teacher is responsible for the tools, equipment, materials, and processes involved in most of the accidents. School administrators may assume more liability when they are aware of a safety hazard or lack of safety instruction and fail to assist the teacher in correcting the situation.

Students in a CTE program must also assume responsibility for their own safety. They are expected to adhere to all safety rules and to use tools and equipment properly. When a student willfully disobeys established rules and is injured, the student may be partially or entirely liable. However, the court will also consider whether rules were enforced, if the student had been taught proper procedures, if the equipment was in good condition, and where the teacher was at the time of the accident. After all, the students are minors, so the supervising adult is still responsible for their actions.

Another type of liability in school accidents is called strict liability. Strict liability is when a court finds a school or teacher not responsible for the accident but still orders them to pay the injured party an award to help offset costs incurred from the accident (e.g., medical expenses). The court is acknowledging that no one is legally responsible because the incident was an unforeseeable accident. Still, the injured party is granted a monetary award for their losses.

This sub-section is adapted from *16 ways to Lawyer-Proof your Lab* by Richard Sullivan, *Safety and Liability in STEM Education Laboratories* by Tyler S. Love, [Safety in the Laboratory...CYA](#) by Dr. Ryan Saucier, and Wikipedia.

Legal Self-Assessment

Legal experts in school safety designed the following tools to further aid CTE teachers:

“Can You Be Charged with Negligence?” by Dr. Joseph C. Robinson. Published in *Industrial Education*.

To determine if you are managing your classroom and shop in a manner that will guard you against a ruling of negligence, answer "Yes" or "No" to the following questions.

- ☐ Yes ☐ No Have I allowed a student to operate a machine that I knew was defective?
- ☐ Yes ☐ No Have I allowed students to work on shop projects with no faculty/staff supervision?
- ☐ Yes ☐ No During school hours, have I allowed a student who was not enrolled in the class to use a piece of equipment?
- ☐ Yes ☐ No Have I allowed a student to use shop equipment during non-school hours?
- ☐ Yes ☐ No Have I conducted a class demonstration while the observing students were not wearing proper safety equipment?
- ☐ Yes ☐ No Have I left students unsupervised in the classroom or shop while I went for a cup of coffee, or to make a telephone call, or to tend to some personal business?
- ☐ Yes ☐ No Have I allowed students to use dangerous equipment without proper safety equipment?
- ☐ Yes ☐ No Have I not reported a minor accident that occurred in my shop during class time?
- ☐ Yes ☐ No Have I knowingly allowed students to work on projects that were not part of the approved class curriculum?
- ☐ Yes ☐ No Have I not obtained parental permission to seek medical aid for students under the age of 18 in case of an emergency?
- ☐ Yes ☐ No Have I allowed students to "horse around" in the shop during class time?
- ☐ Yes ☐ No Have I knowingly left my shop unlocked while I was busy in other areas of the school building?

If you have answered "Yes" to any of the above questions, there is a possibility that a court could find you negligent and legally liable in the performance of your job. Note: the fact that you can answer "No" to all the above questions does not necessarily mean that you are doing all necessary actions to guard against a negligence ruling against you.

“16 Ways to Lawyer-Proof your Lab”, by Richard Sullivan. Published in *Vocational Education Journal*.

- Require a student acknowledgement form.

At the beginning of the program, each student signs this form indicating that they will follow all safety rules, will only operate tools and equipment after receiving instruction, and will pass all safety tests with a score of 100 percent.

- Require a consent to use form.

By signing this form, parents permit their children to operate tools and equipment being used in the program. This form is often combined with the student acknowledgement so that parents are aware of what is expected of students from the outset.

- Administer safety tests.

Written tests should cover general safety rules and specific safety practices. Students must also demonstrate their ability to use hazardous tools, materials, and equipment by successfully completing performance tests. They must score 100 percent on all safety tests. Once completed, these tests are placed in each student's file.

- Post general safety rules.

General safety rules are those which apply at all times throughout the classroom and laboratory. Examples include stipulations for wearing safety glasses, a policy on horseplay, procedures for entering and leaving the laboratory, guidelines for appropriate dress, and housekeeping requirements.

- Post specific safety procedures.

Specific safety procedures are those which apply to a specific tool, piece of equipment, or process. For example, a carpentry classroom should have safety rules for operating the table saw posted on or near the saw.

- Enforce safety rules.

While it is critical to establish general and specific safety rules, enforcing these rules is even more important. In the event of legal action, the court will want to know whether rules were established and enforced. This is often determined through interviews with students. Could your students state that you enforced your rules?

- Conduct safety inspections.

In the presence of your students, you should conduct periodic safety inspections. Develop an inspection checklist or use one of the many available from various safety and health organizations. These checklists include the condition of the laboratory, emergency exits, equipment, walking surfaces, storage areas, ventilation, lighting, fire alarms and extinguishers, and many other items.

- Establish emergency procedures.

In conjunction with the administration, you must establish procedures to follow in the event of a serious accident. Should the front office be notified? Is a health professional available? Do you

have the authority to call an ambulance? What should the other students do? Are students allowed to use the school's phone system? Be sure you have a plan in place; this is especially important if you are the injured person and cannot respond to the emergency.

- Maintain a first aid kit.

While teachers are usually prohibited from distributing medicine (including aspirin), you can maintain a first aid kit in the event of a serious accident. The kit should contain items such as bandages, antiseptic ointment, gauze, and tape. Talk with a health professional for more information.

- Document safety instruction. "Yes, your honor, I teach safety." But can you prove it?

Safety must figure prominently in your instructional program through lesson plans, information sheets, notes, audiovisual presentations, demonstrations based on job or procedure sheets, guest speakers, and tests.

- Keep equipment in good operating condition.

- Safe operating condition means that all guards are in place, equipment operates to manufacturer's specifications, periodic inspections are conducted, and preventive maintenance schedules are followed.
- You should be able to provide records of all equipment inspections, maintenance, and repair.

- Ensure that the laboratory is safe.

Safety inspections can help you identify areas that need improvement.

- Report and investigate all accidents.

You and your students must report all accidents. You must then investigate each accident to determine the cause and identify procedures for preventing similar accidents in the future. All accident reports should be filed for future reference.

- Supervise students.

- The majority of accidents result from human error, and many of these occur in laboratories because of inappropriate student behavior. Be sure to remain in the classroom and laboratory area to supervise students.
- Only in emergency situations should students be left in a laboratory without teacher supervision.

- Model safe behavior.

Demonstrate an attitude that makes safety a priority, wear personal protective equipment, use tools and materials safely, and follow all safety rules.

- Secure liability insurance.

While legal action against teachers is rare, it does happen. Liability insurance policies are relatively inexpensive and are available through professional associations. Coverage may also be available through your employer or a personal liability provider.

Professional Liability Insurance

The school board, superintendent, the district safety coordinator, the administrator (principal and/or department head), and the teacher are all responsible for a safe working environment. The school board, the administration, and the instructor have the legal responsibility to provide a safe environment for students to work while they are participating in hands-on educational activities. To protect yourself and your school district from liability, you should be familiar with the codes and regulations applicable to your program. This would be an excellent topic for a department staff development program. To protect you against financial loss, liberal liability insurance limits should be carried, either through a school district policy or individually. Liability insurance can vary substantially among school districts. You should be aware of the limitations of your school district's liability policy. Individual coverage may be expanded through many organizations; some are listed below.

Professional liability insurance is coverage for you in the unfortunate event that you find yourself in litigation. Without liability insurance, you are at risk of personal loss if you are found negligent in a case. This risk is higher when students are using tools in a laboratory/shop, and you should ensure you are adequately covered. Also, understand that your insurance may not extend to providing tutoring or extra-curricular activities. An example of this would be supervising a laboratory/shop after hours for tutoring, hosting a club, or other activities. It is a good practice to find the extent that your liability insurance covers and retain records in writing. If you have a verbal conversation with an insurance representative, request a citation of the policy that contains the information.

This sub-section was adapted from *Safety Guidelines for Elementary Science & Technology Education* (Pennsylvania Department of Education).

List of Organizations that may provide Professional Liability Insurance:

- Education Minnesota (Minnesota Teacher Union)
[Educators Employment Liability \(ELL\) Certificate](#)
- International Technology and Engineering Educators Association (ITEEA)
[Insurance Purchase Options for Members](#)
- National Association of Agriculture Educators (NAAE)
[Insurance Purchase Options for Members](#)
- Your local district/employer may carry liability insurance for you separate from their liability insurance.
- Your personal insurance agent or broker.

Remember, a lawsuit could involve suing both your school and you as an individual.

Duties of Responsible Parties

This sub-section was adapted from:

- *Safety Guidelines for Elementary Science & Technology Education* (Pennsylvania Department of Education)
- *General Safety Manual for Vocational-Technical Education and Industrial Arts Programs* (Louisiana Department of Education)
- *An Accident Prevention Program for School Shops and Laboratories* (U.S. Department of Education)
- *Technology Education Safety Guide* (Lenape Regional High School)
- *Safety Program and Management Guide* (Utah State Office for Applied Technical Education)

The Responsibility of the School Board and Superintendent

The school district controls the budget, curriculum, and personnel policy to a significant degree. Without district-level support, safety program effectiveness will, at best, be spotty, carried by dedicated personnel, and ignored by others.

The school board and superintendent should:

- Adopt a district safety policy statement.
- Fund necessary improvements and maintenance to facilities, safety supplies, and equipment to produce a safe instructional environment.
- Provide for the in-service training of teachers in safety.
- Support instructional control measures to promote safety within the CTE program.
- See that the CTE curriculum devotes sufficient time for safety instruction.
- Review and maintain adequate liability insurance coverage to protect the district, administrators, and the instructor from liability claims.
- Evaluate the performance of the school administration and teachers regarding safety procedures, equipment, and instruction quality.
- Provide for the safety of the students when innovations involving curriculum changes are made.
- Include a safety review as an integral part of the design for new or remodeled facilities.
- Appoint a safety coordinator for the school district who will be self-motivated as well as have the zeal to help others in their accident prevention programs.
- Make insurance available so that the student may purchase it at a reasonable cost.

The Responsibility of the District Safety Coordinator

Each school district has a safety coordinator (the superintendent may also fill this role). Teachers and the site administrator should look to the district safety coordinator for assistance and consultation in their accident prevention endeavors.

This could include:

- Coordinating school safety functions.
- Setting up school safety committees.
- Assisting in school safety inspections.
- Assisting in establishing professional development for safety.
- Establishing a communication system to keep teachers and administrators abreast of new standards and procedures.
- Assisting in the implementation of safety instruction programs for students.
- Assisting in investigating and recording accidents and injuries.
- Analyzing and reporting all accidents.
- Researching unique safety problems and analyzing all accidents.
- Assisting in the implementation of safety instruction programs for students.
- Maintaining a liaison with the local government and industrial agencies and the State Department of Labor and Industry and other related agencies and organizations.

The Responsibility of the Administrator (Principal)

The individual school is the central unit of an educational enterprise. Therefore, the building principal is likely to be the administrator who is most directly concerned with the school laboratory/shop safety program. If a specialized supervisor or department head functions under the principal and works directly with the teachers, some of the responsibilities for the safety program may be delegated. The following functions are generally considered the responsibility of the school administrator in a comprehensive CTE safety education program:

- Secure support from and maintain liaison with top school system administration.
 - Secure approval for the safety education program.
 - Secure adequate budgetary support.
 - Expedite building changes necessary for safe operation.
 - Arrange for procurement of safety equipment.
 - See that appropriate staff members are kept informed of the specific maintenance requirements for the safe operation of CTE facilities.
 - Arrange for administrative measures to reduce liability exposures of CTE staff members.
- Provide leadership in planning the program.
 - Initiate a specific program of safety education.
 - Establish teacher accident prevention staff development training.
 - Encourage the instructional staff to maintain first aid proficiency. Required safety supplies and emergency handling procedures to be current and properly organized.
 - Encourage the instructional staff to be knowledgeable and proficient in the use of fire extinguishers.

- Maintain contact with parents to aid safety programs and to take administrative measures to reduce liability exposures.
- Instruct the CTE staff members in the use of this safety manual and the development of a comprehensive safety program.
- Secure action on a program of safety education that will involve not only the CTE student but the entire student body.
 - Check periodically to make sure an adopted safety education program is in effect.
 - Observe teachers for assurance that safety instruction is a functioning part of the course of study.
 - Stimulate the discovery, analysis, and prompt correction of unsafe conditions or practices.
 - Support teachers in enforcing safety regulations.
 - Receive and review accident reports.
 - Utilize District procedures for investigating and analyzing accidents.
 - See that instructional staff maintains first aid proficiency and supplies and emergency handling procedures are current and properly maintained.
- Provide safe facilities and services.
 - Report unsafe conditions that cannot be corrected at the school level to a higher authority.
 - Plan with teachers for the removal of unsafe conditions and other hazards and the installation of safety devices.
 - See that laboratory/shop facilities are regularly inspected for the condition of equipment and safety devices, proper housekeeping, adequacy of exits, ventilation and refuse handling systems, and make the necessary changes as needed.
 - See that safety and applicable safety regulations are individually reviewed in the planning of new or remodeled facilities.
 - Provide class loads that are keeping with the capacity, square footage, and the number of workstations available in each facility.
 - Provide a procedure for the removal of students who repeatedly violate established safety rules and regulations and are identified as safety hazards.
 - Provide necessary funds for the repair or replacement of defective equipment.
- Secure cooperation of outside personnel and agencies.
 - Assist the teachers in locating qualified community personnel and services, which will be helpful in the safety program.
 - Encourage qualified outside individuals to become involved in the school laboratory/shop safety program. Establish communication with parents and members of the community for developing a favorable attitude about safety and the CTE program.
 - Establish communications with parents and members of the community to develop a positive attitude toward safety in the laboratory/shop.

The Responsibility of the Teacher

Teachers are the key to a successful comprehensive safety program. They develop positive safety attitudes and awareness of unsafe working conditions or practices. Teachers are the persons responsible for putting innovative, safe programs into practice. They set an immediate example for the students to follow. The primary responsibility for laboratory/shop safety instruction in accident prevention falls on the teacher. The teacher becomes *in loco parentis*, or in place of parents, while students are under their supervision. All instructors are required to provide three components to safety education in their curriculum, which include:

- demonstration of the safe and proper use of machines and having students complete written safety tests on laboratory/shop procedures and specific equipment
- supervising students' performance of safe equipment usage
- maintenance of the physical space and equipment.

Failure to meet these three areas of duty can be an indication that the teacher failed to exercise the degree of care which a *prudent professional* would exercise in a similar condition.

The following are generally considered the responsibilities of the teacher in a comprehensive accident prevention program in school laboratories/shops:

Duty of Instruction

- Develop a comprehensive safety program, including specific safe practices, rules, regulations, and checks relating to your facilities, and enforce them.
- Incorporate safety instruction, including potential hazards, accident prevention, and proper usage of all tools, machines, and equipment, in the course of study. Maintain documentation as to who received instruction and when the instruction was given.
- Insist that a student be enrolled in a course that provides the required safety instruction before working in the laboratory/shop.
- The teacher should emulate safe practices and techniques at all times.
- The teacher should keep records of students' safety and equipment tests on file.
- The teacher should have set, pre-planned procedures in case of an emergency and train students on these procedures as part of the safety instruction.

Duty of Supervision

- Note: **do not leave the classroom unsupervised at any time when students are present.**
 - Always provide adequate and legal supervision in the classroom or laboratory/shop. When laboratory/shop spaces are not in use, keep doors locked or area secured to avoid having students gathering unsupervised to prevent any potentially inappropriate behavior.
- Misbehavior of any type must not be tolerated. Failure to act or improper action is grounds for liability.
- Insist on proper protective equipment in all laboratory/shop areas and require students to wear appropriate clothing and adequate hair guards while working in the laboratory/shop.
- Be aware of the emotionally disturbed and accident-prone student.

- Provide input in the development of Individualized Education Programs (IEPs) for classified students, placing a particular emphasis on unique safety considerations. Review all IEPs regularly to address the needs of all students enrolled in all CTE classes.
- Criteria for scheduling special needs students into laboratory/shop classes should be established by a team of counselors, CTE teachers, special education teachers, and school administrators. Aides or special equipment should be made available to the CTE teacher. This should also include the appropriateness of the placement of the student.
- Provide timely and thorough reports of accidents, including:
 - A written report by the instructor.
 - Written accounts by witnesses.
 - Photographs of accident scene and conditions.

Duty of Maintenance

- **Never use defective equipment for any reason.**
- Know how to use and maintain equipment properly prior to operation. Manuals provided by the manufacturer will contain this information. If you no longer have a manual, contact the manufacturer to receive guidance.
- Ensure the sharpness of all cutting tools.
- Keep informed about modern and accepted safe practices in the field of accident prevention.
- Establish regular inspection schedules and procedures for checking the safety and first aid equipment.
- Regularly review laboratory/shop facilities to provide for optimum safety conditions. Give special attention to:
 - Layout
 - Utilities and building services
 - Equipment guarding
 - Storage and condition of tools
 - Storage, labeling, and handling of materials
- Monthly safety checks by the teacher will be logged and reviewed by supervisor quarterly
- Insist that guards meeting accepted standards be provided and used whenever a machine is operated.
- Devise and enforce safe housekeeping procedures.
- Submit written recommendations to the administration for improving safety conditions.

The Responsibility of the Student

A prime purpose of any school safety program is to protect the students from accidents. Therefore, the primary recipient of all safety procedures and plans is the student. However, no safety program can succeed without the student bearing a great deal of responsibility for their well-being. They are the catalysts for a successful school safety education program. For anyone to be completely safe, every person in the room must be safe as well. You can be injured if another person is unsafe, and you become the victim. The program of safety education should cause students to develop sound safety habits. Safety must be put at the forefront of each student's mind by:

- Developing a mindset of safety.
- Always wearing proper clothing that is required for the laboratory/shop situation.
- Participating in safety instruction and passing all required tests and demonstrations to 100% mastery.
- Following all School, Instructor, and Classroom policies regarding safety.
- Giving full attention to the demonstration of safe practices on tools, machines, and equipment.
- Reporting all unsafe items or actions that you witness to the supervisor of the room.

The Responsibility of Legal Guardians

Developing positive safety attitudes in students cannot be accomplished by a school safety education program and the classroom instructors' efforts alone. Legal guardians should begin safety education at home, as responsible community members have vital roles in the establishment of safety awareness in their children. They should also concern themselves with the enactment of good school safety laws. An essential part of this concern should be for the hiring of qualified personnel and the quality of equipment and facilities. Legal guardians' cooperation and interest are of the utmost importance. The teacher should capitalize on the influence of legal guardians on the development of their children and involve them in the safety programs of the school. Teachers should make sure that legal guardians are represented on a laboratory/shop safety advisory committee.

- Reinforce safety concepts and the importance of following safety rules at home.
- Teach home safety standards to children in the home.
- Support the school's comprehensive safety education program.
- Provide the student with the proper clothing to function safely in the school environment.
- Support the need for adequate safety equipment and supplies.
- Impress upon the student the importance of thinking safety, talking safety, and practicing safety.

Safety Disciplines for Instructor, Facility Regulations, and District Procedures

This section is intended to provide teachers in the CTE programs of high schools with a general knowledge of requirements that need to be followed as part of your work in safety in your laboratory/shop facilities.

This section will highlight the main areas to focus on ensuring your spaces are safe for occupancy. It is not intended to instruct you on how to teach safety but more designed to assist in setting up and maintaining these non-traditional classroom spaces. Most of these items are meant to be focused on when students are not present in these areas. The training of students and the promotion of a culture of safety starts with having safe facilities, and this checklist will help serve as a list of items to consider when preparing or maintaining the spaces throughout the school year.

The remainder of this section is adapted from

- *An Accident Prevention Program for School Shops and Laboratories* (United States Department of Education)
- *Guide to Equipping Industrial Arts Facilities* (American Industrial Arts Association)
- *Guide to Preparing Educational Specifications for Secondary Industrial Arts Facilities* (American Council of Industrial Arts Supervisors)
- *Florida Industrial Arts Safety Guide* (Florida Department of Education)
- *Laboratory Safety Manual-Colorado* (Colorado State University)
- *Minnesota Industrial Arts Safety Guide, Safety and Health for Industrial/Vocational Education* (United States Department of Health and Human Services)
- *Safety Guide for Career and Technical Education* [United States Centers for Disease Control (CDC)]
- *Safety Guidelines for Elementary Science & Technology Education* (Pennsylvania Department of Education)
- *Safety Instruction Manual* (Alaska Department of Education)
- *Safety Program and Management Guide* (Utah State Office for Applied Technical Education)
- [The Power Tool Institute](#)
- Occupational Safety and Health Administration (OSHA) *Online Resources*

Safe Practices Facility Design and Layout

The way CTE facilities are designed and laid out has a direct bearing on accident prevention. Many accidents, injuries, fires, and occupational illnesses can be avoided by or minimized through careful planning. The planning elements which should be considered are space allocations, lighting, ventilation, personal services facilities, selection of machine tools/equipment, and noise control.

- Laboratories/shops must be adjacent to adequate storage facilities and preparation rooms.
- Each laboratory/shop must be supplied with safety equipment and materials (see next sub-section-Emergency Stations and General Safety Equipment).
- Aisles should be a minimum of three feet and preferably four feet wide.
 - Main aisles should be clearly marked with yellow or white lines.
 - Emergency equipment, supply, and tool rooms should be adjacent to main aisles.
- The facility should accommodate the needs of the permanently and temporarily handicapped student. This includes aisles wide enough to accommodate wheelchairs or students on crutches.
- Care should be taken to prevent current and future overcrowding that would result in a potentially unsafe environment.
 - All machines, benches, and equipment should be surrounded by a minimum of three feet of clear space.
 - Specific machines may need more space to accommodate the long materials that are ordinarily processed with them.
 - Consideration should be given to providing a large open area for project assembly, demonstrations, and activities/projects which take up more space.
 - Sufficient open floor space to prevent crowding and interference among students must be provided around all doorways, around tool cribs and tool panels, and near material storage areas.
- For adequate lighting and ventilation, the window area should not be less than one-fifth of the area of the floor.
- Ceiling heights should be between 10.5 and 14 feet depending on the nature of the activity.
- To the degree possible, utilities such as water, air, gas, electricity, etc. should be inside the floors and walls to facilitate cleaning.
- Floor covering materials should be compatible with the activity and should allow for easy cleaning and maintenance.
- The load-bearing capacity of floors should be considered before purchasing equipment. To be safe, floor structures should have a weight-bearing capacity of at least four times the static load and six times the moving load.
- All laboratories/shops should have at least two exits, one of which is wide enough to accommodate the largest project or activity anticipated.
 - The size and location of doors and exits should facilitate fire or emergency conditions. They should conform to OSHA, National Fire Protection Association (NFPA) Building Exit codes, and local and state requirements. They generally depend on building occupancy.
 - High hazard activity: No person more than 75 feet from an exit.
 - Medium to low hazard activity: 100 to 150 feet is acceptable.

- Make sure fire exits are clearly visible, identified, doors open in the direction of exit travel, illuminated, and not blocked; maps to all routes out of the room/building are posted beside each door in each room.
- Provide a proper eyewash station and possibly a drench shower if hazardous materials, chemicals, and/or cleaning supplies are used in the classroom or laboratory/shop facilities. (Consult ANSI Z358.1 for details on placement and maintenance.)
- Recommended student to space ratios:
 - **Lecture classroom: 45 sq. ft. per student**
 - **Computer laboratories: 50 sq. ft. per student**
 - **Modular laboratories/shops: 75 sq. ft. per student**
 - **Laboratories/shops using tools and equipment: 100–150 sq. ft. per student**

It is recommended that a laboratory/shop-based class never exceed a ratio of twenty-four students per teacher, and you should reduce max class size by one for each student with IEP or ESL specific needs.

- To avoid problems in supervision and arrangement, the length to width ratio of the laboratory/shop facility should be no more than two to one.
- The room should be designed so that there are no inherent **blind spots**. The teacher should be capable of supervision from any point in the room.
 - This is especially critical when young students are involved and when students with special needs are partaking in CTE courses.
 - If such blind spots do exist as the result of structural barriers, which would be prohibitively expensive to eliminate, teachers might explore the installation of large convex mirrors like those used in department stores by clerks to observe customer movement.
 - Machines that are more than four feet in height should be placed toward the outside of the room so that visibility will not be obstructed.
- In planning the arrangements of tools, equipment, and materials, the following need to be considered:
 - The flow of materials from storage to machines and from machine to machine.
 - Placing machines adjacent to those needed for successive operations.
 - Providing sufficient space so that one student's work does not interfere with the work of others.
 - Preventing interference between machine operations and the machine operator.
 - Determining the maximum amount of space needed for machines, including the operator safety zone and, when appropriate, large pieces of stock.
 - Placing machines near to materials storage.
 - Allowing space for hand trucks and other materials handling equipment.
 - Allowing space around tools and machines for ease of cleaning and maintenance.
- At least one washbasin with hot and cold water should be provided for every twenty students.
- Ground fault circuit interrupters (GFCI) and electrical surge protectors should be given serious consideration for some outlets. Electrical outlets within six feet of a water source must have GFCIs on them to prevent shock.
- Laboratories/shops must be well ventilated (separately) from the rest of the school.

- There is a definite relationship between proper ventilation, comfort level, and the frequency of accidents.
- Have the ventilation system checked at the beginning of each school year by experienced personnel to determine effectiveness.
- General ventilation is accomplished by introducing fresh air into school laboratories/shops at the rate of at least six air changes per hour or of sufficient quantity to balance airflow through stock removal and other exhaust systems.
- Make sure your dust/fume/exhaust collection is compliant with [OSHA standard 1926.57 – Ventilation](#).
 - Special consideration should be given to ventilation requirements for welding, foundry, forging, heat treating, machining cast iron, machine woodworking, auto mechanics, plastics forming and grinding, electroplating, etching, painting, and the making of blueprints.
 - For many of the above operations, specially designed hoods must be required.
 - In addition to point source dust collection, ambient dust collectors significantly improve the working conditions and air quality of the facility.

- Consider the quantity and quality of illumination required for various tasks.
 - 70 to 100 foot-candles will suffice for most laboratory/shop areas
 - Consult ANSI/IES RP-7-1979, American National Standard Practice for Industrial Lighting, for correct illumination for specific tasks in the laboratory/shop.
 - Add adjustable lamps for illuminating the point of operations on hazardous machines.
 - Use portable lamps to provide temporary illumination for projects requiring supplemental lighting.
 - Use flexible lamps for fine precision bench work and inspection work.
- Each means of disconnection (e.g., circuit breaker or fuse box) must be legibly marked to indicate its purpose unless its purpose is evident.
- Bulk storage of compressed gas needs ventilation and at least 20 feet of space or a fire barrier between oxygen and fuel gas cylinders. All compressed gas cylinders need to be safely secured in an upright position that will prevent falling over.
- Color should be used to create a pleasant work area, reduce glare, and promote safety.
 - Light pastels are best for walls, partitions, and ceiling areas.
 - A color-coding system for safety must be standard throughout the facility.
 - (See next sub-section-Emergency Stations and General Safety Equipment).
- The teacher should view the laboratory/shop as the environment through which students gain their initial and lasting impressions of CTE courses and themselves as teachers. The room should complement the teaching style of the instructor and be reflective of the course, the teacher's interest in it, and their educational and practical experiences with such. The room should stimulate student interest without restricting creativity due to safety hazards.
- Teachers need to be involved in all aspects of facility renovations and new construction.
- Recommendations based on current regulations and teaching methodology should be actively presented to the architectural firm and the school administration.
- An architect must certify that all applicable laws and regulations have been met.

Emergency Stations and General Safety Equipment

In your teaching career, you may not have the opportunity to be at a school that is renovating its facilities or building a brand new one. Regardless of if you had a say in the design and layout of your space, all instructors need to pay attention to the general safety equipment and emergency stations within their control to maximize their usefulness in the event of an incident.

- Maintain, post, and update a list of emergency phone or contact numbers in the laboratory/shop area. See “Emergency Contacts” in the Forms section.
- Maintain, post, and update an emergency action plan in the laboratory/shop area. See “Emergency Action Plan” in the Forms section.
- Set up and maintain proper first aid stations in laboratory/shop areas in conjunction with your school nurse or safety coordinator.
- Provide proper storage cabinets/containers for hazardous materials, flammable materials, chemicals, and/or cleaning supplies used in the classroom or laboratory/shop facilities. (Work with your school custodial staff on appropriate disposal of old or unneeded items related to this area.)
 - Flammable safety cabinets are storage cabinets (typically metal) manufactured to isolate flammable materials from a potential fire that may occur in the laboratory/shop. Safety cabinets are required for storage of flammable liquids in laboratories/shops with cumulative quantities greater than 40 liters (approximately 10 gal.). Place safety cabinets against exterior walls and away from exits and other potential flammable sources so that explosion relief, ventilation, firefighting, and evacuation will be aided.
 - Flammable safety cans are containers (typically metal) with self-closing spouts and integral flame arresters used to store flammable liquids for quantities higher than four liters (approximately 1 gal.). Safety cans must be properly labeled.
- Provide a proper eyewash station and possibly a drench shower if hazardous materials, chemicals, and/or cleaning supplies used in the classroom or laboratory/shop facilities. (Consult ANSI Z358.1 for details on placement and maintenance.)
- Work with your school custodian or safety coordinator to ensure you have the correct number and location of smoke detectors, fire extinguishers, fire blankets, and metal waste containers with a lid. Also, work out a plan to make sure these items are checked and ready for use.
- Work with your school custodian or safety coordinator to get and maintain a spill kit and/or chemical spill kit.
- Regularly check the condition of ladders, scaffolding, and fall protection body harnesses. Always enforce their correct use as outlined but the manufacture of that equipment.
- Purchase your safety signage from a reputable supplier or make sure all your safety signage you create meets the guidelines from [OSHA 1910.145 - Specifications for accident prevention signs and tag](#), [ANSI Z535.1 Safety signs and colors](#), and [ANSI Z535 Safety alerting standards](#).
- Color Coding/Safety Zones are as follows:
 - Red shall be used as the primary color for fire, stop, and danger.
 - Fire: Primary color for the identification of fire protection equipment and apparatus.
 - Stop: Emergency stop bars, buttons, or electrical switches on hazardous machines shall be red.
 - Danger: Safety cans and safety signs shall be painted red.

- Orange shall be used as the primary color for designating dangerous parts of machines or energized equipment. Orange shall be used to emphasize hazards when enclosure doors are open or when gear bolts or other guards around moving equipment are open or removed, exposing unguarded hazards.
- Yellow shall be the primary color for designating caution and for marking physical hazards. Solid yellow, yellow and black stripes, or checkers (or yellow with suitable contrasting background) should be used interchangeably with the combination that will attract the most attention.
- Green shall be used to designate safety and the location of first aid equipment (other than firefighting equipment).
- Blue shall be the primary color for designation of caution, limited to warning against the starting, use of, or the movement of equipment under repair or being worked upon.
- Purple shall designate radiation hazards.
- Black, white, or a combination of these two shall be the primary colors for the designation of traffic and housekeeping markings.

Personal Protective Equipment

Personal protective equipment, commonly referred to as "PPE," is equipment worn to minimize exposure to hazards that cause serious injuries and illnesses. These injuries and illnesses may result from contact with chemical, radiological, physical, electrical, mechanical, auditory, or other hazards. The ability to use our five senses and to have a full and complete set of appendages is a precious gift. Without it/them, it is difficult to lead a fully productive life. Personal protective equipment may include items such as gloves, safety glasses or goggles, face shields, welding helmets, steel-toed shoes, earplugs or muffs, respirators or dust masks, hard hats, or coveralls, aprons, and full bodysuits.

For more information, see [OSHA'S PPE Standards](#) and [OSHA'S PPE Hazards and Solutions](#).

- Provide appropriate personal protective equipment for specific work areas in a readily accessible space for students, staff, and visitors.
 - Extra devices should be available at all times to lend to visitors.
 - Devices called "visitors specs" do not meet ANSI standards.
 - All safety glasses or goggles need to be ANSI Z87.1 rated.
 - A face shield is not "eye protection" unless used with safety glasses or goggles.
 - Cotton should not be used as protection against abrasive sound.
 - Protective headgear must meet ANSI standard Z89.1-2009 or later.
- Identify all eye protection areas with appropriate signs.
 - The entrance to all laboratories/shops.
 - Also, machines, equipment, or other areas requiring operators to wear specific eye and face protection should be posted with warning signs.
- Besides employing hearing protection, evaluate the ability to create noise control/reduction at the source of the noise or along the noise's path to the ear. Noise is an unwanted sound. It is a form of energy or vibration that is conducted through the atmosphere. Since hearing is affected by the totality of the noise that one is exposed to, any precautions are appropriate. It also deserves noting that instructor exposure is often the equivalent of industry settings, even though student exposure may not be. This is because of the difference in duration of exposure between the teacher and students. Propose that your district begins a "hearing conservation program" for all CTE teachers exposed to loud noises for an extended period. Refer to [OSHA's Table G-16 – Permissible Noise Exposures](#).

Safe Practices in the Care and Operation of Equipment

Along with keeping facilities and equipment consistent with industry, instructors need to provide proper tools and equipment for the type of instruction that will be occurring in these laboratory/shop spaces. Maintaining safe practices of operating equipment and caring for this equipment is a daily ongoing requirement for any CTE instructor. Much of the purchasing and planning will take place before students arrive; however, it is the responsibility of the teacher to continually update and care for all tools and equipment for their laboratory/shop. Some general rules to follow when completing these tasks are listed below.

- Maintain an awareness of the effective use of safeguards against the potential hazards associated with CTE activities.
- Tools and equipment must be maintained according to manufacturer's specifications or established guidelines.
- Inspections for damage, corrosion, wear, and contamination must be performed and documented regularly. See "Laboratory/Shop Safety Inspection Checklist" and "Bi-Monthly (Even Months) Machine/Tool/Equipment Safety Inspection Checklist" in the Forms section or those found in the [OSHA Safety Checklists](#).
- Ensure all machines have proper guarding in place and other power transmission devices have properly functioning guards or safety mechanisms in place.
- Prohibit the removal of guards and safety devices from any stationary or portable hand tools.
- Post safety signage/rules for each machine tool near that machine, preferably near the on/off switch.
- Provide "Operations Safety Zone" marking for each piece of stationary equipment. This zone should be sufficient distance from the operating surface of the machine so that a person standing outside the zone cannot reach the operating surface without bending over. In general, this distance is between 24 and 30 inches from the machine. It should be clearly marked on the floor with a yellow or a yellow and black striped line.
- Secure all machinery and equipment in place.
- Identify all potential safety hazards in specific areas with appropriate signs in plain view of room occupants.
- Be sure all lockout start and stop switches are functional on all machines or stationary equipment.
- Apply lockout tagout procedures on machines that are temporarily non-compliant for students or staff to use, then post signage on them, and finally, report the problem to school administration for repairs. Retain a copy of the communication and any subsequent action taken. See [Eight Steps for Safer Lockout/Tagout Programs](#) in the Resources section see also "Hazardous Condition Report" in the Forms section.
 - If servicing, maintaining, or repairing equipment yourself, be sure to control hazardous energy. The unexpected startup or release of stored energy can result in serious injury or death. Proper lockout/tagout (LOTO) practices and procedures safeguard workers from hazardous energy releases.
- Ensure all electrical cords, devices, and connections shall be maintained in a safe condition.
- Extension cords should only be used for temporary/moveable service.
 - Especially critical is the need to assure that extension cords are out of the mainstream of traffic or enclosed in electrical cord ducting strips to prevent tripping.

- They cannot be run through doors, windows, holes in the wall, ceiling, floor, or attached to building surfaces.
 - They must be replaced when frayed or when the insulation has deteriorated.
- Outlets, switches, junction boxes, etc. must be covered.
- Do not overload electrical outlets.
- Check and maintain exhaust ventilation, dust collection, or fume evacuation equipment regularly. For system requirements, see [OSHA standard 1926.57 – Ventilation](#).
- Complete an equipment and tool inventory as well as repair documentation for all laboratory/shop equipment that will be available. See “Tool/Machine/Equipment Inventory and Repair Log” and “Bi-Monthly (Even Months) Machine/Tool/Equipment Safety Inspection Checklist” in the Forms section.
- See [Eight Steps for Safer Lockout/Tagout Programs](#) in the Resources section.

Housekeeping Practices

Housekeeping or proper organization of the laboratory/shop spaces will ensure that teachers and students will have a safe work environment. These practices should be implemented into the teacher's regular routine. The following are examples of daily housekeeping checks that an instructor must make before student arrival and as often as you can throughout the workday when not instructing or supervising students.

- Provide proper storage for all tools and equipment to keep these items organized.
- Compressed gas cylinders not in use need to have the valves closed and safety caps screwed on. Furthermore, bulk storage of compressed gas needs ventilation and at least 20 feet of space or a fire barrier between oxygen and fuel gas cylinders. All compressed gas need to be safely secured in an upright position that will prevent falling over.
- Arrange all equipment and materials to permit safe and efficient work practices.
- Provide properly marked boxes or bins for various kinds of scrap stock.
- Utilize sturdy racks and bins for material storage, arranged to keep material from falling on students and to avoid injuries from protruding objects.
- Keep walkways and work areas free of all obstructions.
- Materials, racks, bins, tools, machines, and other equipment should be at least 3 feet away from aisles, exits, firefighting equipment, lighting, power panels, etc., as not to block access. Fire escape doors must be kept clear.
- Provide for the daily removal of all sawdust, shavings, metal cuttings, and other waste material.
- Maintain an up-to-date clean-up schedule to assist students in daily clean up routines.
- Provide brooms, dustpans, brushes, and mops for the cleaning of equipment and floors after each use.
- Provide regular custodial service in addition to the end of the class cleanup.
- Maintain non-slip floors and have appropriate materials available for spill cleanup.
- Have and maintain material Safety Data Sheets (SDS) for any chemicals that may be used in the laboratory/shop areas. See the Resources section for a helpful website with this task.
- Provide and update a bulletin board for safety bulletins, safety posters, and safety rules and regulations. Furthermore, post a copy of the general safety rules near the entrance of the laboratory/shop.
- Develop an awareness of lighting, ventilation, traffic flow, and other general physical conditions of a work area that affect the safety of students or teachers.
- Develop the ability to recognize potential hazards and take appropriate measures to avoid or eliminate them.
- Keep laboratory/shop areas locked when classes are not in session to avoid unauthorized use when the instructor is not present.

Safety Inspections

Conducting a thorough hazard assessment or safety inspection is the first step in determining what safety precautions and equipment are necessary for a CTE facility, classroom, or laboratory/shop. It is the responsibility of the instructor to inspect facility spaces and equipment regularly.

- The school or employer must provide teachers with proper equipment and time for training to prepare the laboratory/shop.
- Develop and maintain a safety inspection plan for facilities.
- Work with your local administration to ensure proper equipment, adequate safe space, and personal protective equipment is in place when planning for your students working in these facilities.
 - Use a safety checklist to ensure that all safety factors are checked during safety inspections. See “Laboratory/Shop Safety Inspection Checklist” and “Bi-Monthly (every other month) Machine/Tool/Equipment Safety Inspection Checklist” in the Forms section or those found at the [OSHA Safety Checklist](#).
 - After the completion of the regular safety inspection, duplicate the checklist and share a copy with all relevant parties at your school, retain one copy in your records until the statute of limitations runs out.
 - Report any problem conditions or unsafe facilities or equipment you identified during the safety inspection, and documented on the checklist, to school administration before having students occupy or use the laboratory/shop areas. Retain a copy of the communication and any subsequent action taken. See “Hazardous Condition Report” in the Forms section.
- Have in-depth safety inspections of the CTE facility made at least annually.
 - School personnel - state and/or local level.
 - A student safety committee.
 - A student inspector or foreman.
- Encourage teachers to welcome inspections by:
 - Insurance safety engineers.
 - Inspectors from the State Department of Labor and Industry.
 - State fire inspectors.
 - District Safety Coordinator.

Incident/Emergency Reporting and Analysis

Emergencies can arise at any time when teachers and students are working in a CTE laboratory/shop. Accident situations and incident reporting is a part of the work that the instructor will need to be aware of in the event a situation does occur. It is the responsibility of the teacher to know what to do in case of an accident and also what not to do. The first few seconds or minutes following a student's injury are the most critical. The following information is provided as a guide for the CTE teacher to prepare for any emergency procedures.

- Establish and maintain an incident reporting system compatible with the State Department of Education requirements or local school district requirements.
 - Require students to report all incidents of near-misses or those resulting in an injury, regardless of the nature or severity. Studying these reports will help improve practices, procedures, and instruction for the prevention of future incidents. See “Student Report of Injury Form” in the Forms section.
 - Use an official form to record the details of the incident and forward it to the appropriate personnel. See “Incident Report Form” in the Forms section.
 - Keep a record of all CTE incidents resulting in injury to students, regardless of nature or severity, until the statute of limitations runs out or until that student turns 21 (whichever is longest).
 - Analyze all incident reports to determine the root cause and effect, and use the investigation to help improve practices, procedures, and instruction for the prevention of future incidents. See “Instructor’s Incident Investigation Form” in the Forms section.
- After an incident, follow up in the classroom with discussion and instruction regarding any safe practices that were violated and that contributed to the incident. Also, recommend to the school/administration corrective measures as appropriate. Retain a copy of the communication and any subsequent action taken.
- Report any problem conditions or unsafe facilities or equipment to school administration before having students occupy or use the laboratory/shop areas. Retain a copy of the communication and any subsequent action taken. See “Hazardous Condition Report” in the Forms section.

Teaching Procedures

Creating a Culture of Safety

*There are no essential pieces or elements to the safety program. Rather, it's the **environment and the culture** in which those things are placed that determine whether or not they're going to work. Behind every unsafe condition, there is a **management system** that could have allowed that hazard to exist. Behind every unsafe behavior or unsafe act, there is a reason that those people engage in those behaviors. A lot of times, that has to do with the management system—the way people are measured and rewarded, the culture of the organization that leads unsafe behavior to be [okay]. (Why Safety Is a People Problem, by Dan Petersen, StackPath)*

Training for safety is as essential as training how to use equipment properly. As teachers, demonstrating and cultivating the proper attitude towards safety in and out of the laboratory/shop may develop safe work habits among your students.

Creating a culture of safety requires involvement and dedication by all the individuals who are involved with the laboratory/shop areas. It begins with the school board and superintendent and continues down to the buy-in of the students after strong examples and high expectations set by the instructor. The district's safety committee and others associated with the areas need to be involved, trained, and kept in communication about the needs of the laboratory/shop.

You and your school must elevate your focus beyond this safety manual, physical hazards, and compliance issues to the students and people in your laboratory/shop. A behavior-based approach to safety stresses observable behaviors, providing immediate feedback, and empowering students to actively care for the safety of others. The focus on behaviors and subsequent feedback lead to changes in unwanted habits, reinforcement of safe work practices, and improvement of student's attitudes.

Adapted from *Behavior Based Approach to Creating a Strong Safety Culture* by W. G. Hubler.

Steps to Creating a Culture of Safety in the Classroom/Laboratory/Shop

Adapted from *8 Steps to a Strong Safety Culture* by Stephanie Zizzo.

- Define safety responsibilities
Do this for each level within your organization. This should include policies, goals, and plans for the safety culture. (See Duties of Responsible Parties in the Introduction)
- Share your safety vision
Everyone involved should understand your goals and objectives for the culture.
- Enforce Accountability
Create a visible process to hold students accountable as well as instructors and other vital stakeholders.
- Provide a platform
Stakeholders should be heard and valued. Give them a platform to express their concerns or issues.
- Report, report, report
Stress the importance of communicating potential issues, near misses, injuries, or incidents immediately.
- Build an investigation system
There should be an investigation done after any incident to get to the root cause of the event. (See Instructor's Incident Investigation Form)
- Celebrate success
Make sure the effort is visible and success is rewarded.

This section is adapted from:

- *An Accident Prevention Program for School Shops and Laboratories* (United States Department of Education)
- *Minnesota Industrial Arts Safety Guide, Safety Guide for Career and Technical Education* (Centers for Disease Control)
- Safety Guidelines for Elementary Science & Technology Education (Pennsylvania Department of education)
- *Safety Instruction Manual* [Alaska Department of Education]
- *Safety Program and Management Guide* (Utah State Office for Applied Technical Education)
- *Shop Safety Manual* (Iowa State University)
- *Technology Education Safety Guide* (Lenape Regional High School)
- [The Power Tool Institute](#)
- Occupational Safety and Health Administration (OSHA) *Online Resources*

Safety Content/Curriculum Delivery

The safety and health of all individuals participating in career and technical education is a significant responsibility of the school and teaching staff responsible for this type of classroom learning. The laboratory/shop and learning environment can expose participants to situations that are potentially threatening to their safety and health. Teachers need to have information planned out that aims to draw attention to the necessity for planned safety instruction.

- Establish uniform machine and equipment safety instructions. Post these items in the class standards or syllabus.
- Make parents and students aware of the importance of safety and the gravity of safety infractions.
 - Duplicate enough of the Parent/Guardian Consent Forms (see Forms section) and student safety pledges (see Forms section) for each of your students. There is room at the top of the documents to include the name of the school or the school letterhead.
 - Require a signed and dated copy of both documents before students touch a tool.
 - File and keep both of those documents until the statute of limitations runs out or until that student turns 21 (whichever is longest); and indicate in the record book that they have been received.
- Use information sheets dealing with the general safety rules of the CTE laboratory/shop.
- Require all beginning students to make a careful study of potential hazards in the laboratory/shop during the first few days of the course.
- Develop a permanent safety consciousness in students through teacher example -- always show the safe way while pointing out the potential hazard.
- Present safety instruction with the following objectives in mind:
 - Develop in students a sense of responsibility for their safety and that of others.
 - Emphasize the importance of hair protection and clothing to safety.
 - Help students understand that the safe way is effective.
 - Help students recognize situations involving potential hazards.
 - Help students learn safe practices to use in their day-to-day activities.
- Select the learning material/instructional content from this manual that applies to your program. Introduce safety in multiple formats.
 - Provide a list of correct uses and safety rules for all tools.
 - Provide an informational text and worksheet for each tool.
 - Provide an identification activity for names of tool/machine parts.
 - Have a video (factory or create one) demonstrating the correct use of all the tools.
- Teach accident prevention with a positive approach -- stressing the right way to perform an operation.
- Give laboratory/shop demonstrations emphasizing the safe use of potentially hazardous machines and hand tools.
- Provide instruction on what to do in case of a laboratory/shop accident.
- Permit each student to operate a machine only after demonstrating an ability to operate the machine safely.
- Require students to report all accidents to the teacher, regardless of nature or severity.
- Give periodic demonstrations on the proper use and care of personal protective devices.

- Provide instruction in the essential maintenance of laboratory/shop tools, machines, and other equipment.
- Provide instruction in the safe methods of lifting and/or moving heavy equipment or other loads.
 - Attach handles or holders to loads if you can.
 - Use mechanical assistance where possible.
 - Use proper lifting techniques (use legs, not back, keep materials close to the body, etc.).
 - Wear steel-toed safety shoes/boots if the load is heavy and gloves for loads with sharp or rough edges.
 - Seek help when a load is so bulky that you cannot properly grasp or lift it, you cannot see around or over a load, or you cannot safely handle a load.
- Provide instruction in ergonomic principles to reduce injuries, reduce fatigue and discomfort, prevent Work-related Musculo-Skeletal Disorders (WMSDs), and improve the quality of work and life.
 - Maintain a neutral posture as much as possible.
 - Position work to be able to reduce the number of times you must bend, kneel, or squat.
 - Reduce the length of reach by keeping items as close as possible, removing obstacles, and letting gravity assist.
 - Attempt to arrange work to avoid unnecessary motions.
 - Use power tools or machinery to do the work.
 - Keep wrists straight by using tools and procedures that allow proper positioning.
 - Use low vibration tools if available, use anti-vibration gloves, keep hands warm.
- Use a student safety committee to strengthen the safety program.
- Rotate assignments of students to the safety committee.

Conducting Safety Assessments

- Select those tests from this manual that apply to your program. Administer a standard written and performance safety test for each machine operation as well as general laboratory/shop safety practices.
- Follow this procedure to “test out” on a tool/machine so students can use it:
 - Students complete learning material/instructional content (e.g., tool informational reading, worksheet, video).
 - The students view the instructor demonstrating the safe use of the tool. Each student must sign and date a document that they saw the demonstration. See “Student Machine Use Safety Evaluation Record/Tool Check-Off Form” in the Forms section.
 - Each student completes a safety test at a 100% pass rate (see below). Each student should sign and date the actual test, the instructor keeps the test, and the instructor signs and dates a document for each student that this step was done. See “Student Machine Use Safety Evaluation Record/Tool Check-Off Form” in the Forms section.
 - The instructor watches each student use the tool for the first time. The instructor signs and dates a document for each student that they saw their first use. See “Student Machine Use Safety Evaluation Record/Tool Check-Off Form” in the Forms section.
 - Each of these records and the individual tests are kept until the statute of limitations runs out or until that student turns 21 (whichever is longest).
- Follow these rules for the tool/machine safety tests:
 - Require students to pass safety tests to 100% (60% or even 90% is not passing because 60% or even 90% of your fingers is not a successful result when operating a tool/machine).
 - Students are limited to four attempts on each test for each tool to get 100%. After that, they are only allowed to use the hand tool equivalent to the said power tool.
 - Tests must be repeated each year for a new class, no “grandfathering-in,” (e.g., a twelfth grader can skip the safety tests because they passed the tests their ninth-grade year).

Student Supervision in the Laboratory/Shop

- Develop a consciousness in all participants of wearing specific protection gear as required in designated laboratory/shop areas at all times, even if the individual is not currently using a tool. Most school laboratory/shop eye injuries happen because something flew across the room at high speed.
 - All safety glasses or goggles need to be ANSI Z87.1 rated. Devices called “visitors specs” do not meet ANSI standards.
 - Prescription glasses are not acceptable unless they are prescription safety glasses with shatterproof Polycarbonate lenses that are ANSI Z87.1 rated.
 - A face shield is not “eye protection” unless used with safety glasses or goggles.
 - Provide dust masks or respirators for students when dust or harmful fumes exist.
 - When noise levels are excessive, hearing protection should be worn. Cotton should not be used as protection against abrasive sound. Sound at a level of 85dB begins to lead to a loss of hearing, depending on (1) the intensity, (2) the frequency, (3) the duration of exposure, and (4) individual sensitivity.
 - Visitors must wear protective devices that are required in the area. Extra devices should be available at all times to lend to visitors.
 - Head protection is required to be worn in all areas when overhead, falling, or flying hazards exist. Hard hats can protect employees from impact and penetration hazards as well as from electrical shock and burn hazards. Protective headgear must meet ANSI standard Z89.1-2009 or later.
- Develop a consciousness in all participants of appropriate appearance as required in designated laboratory/shop areas at all times.
 - Confine long hair so that it is not exposed to machinery.
 - Prohibit the wearing of loose-fitting clothing and jewelry in the laboratory/shop to reduce caught-in hazards.
 - No open toe footwear allowed in the laboratory/shop area.
- Identify the physical limitations of all students so that they will not be assigned tasks detrimental to their health or physical conditions (reference IEP).
- Maintain strict supervision of students who are using machines and tools.
- Prohibit conversations between machine operators and other students while using a machine.
- Prohibit the use of defective tools, machines, or other equipment.
- Require students to use a vice or clamps to secure small projects that are too difficult or dangerous to hold by hand, this ensures a secure workpiece.
- Never leave the laboratory/shop unsupervised (i.e., run to make a copy, etc.), and when you find another adult to supervise the class so you can step out, make sure the students and that supervisor know they are prohibited from using tools/operating machines while the instructor is gone unless the stand-in supervisor is a correctly licensed teacher.
- Cleanliness reduces accidents. Dirty, cluttered, and oily tools and work areas can cause accidents.
 - Develop a student routine of proper housekeeping (including the orderly arrangement of tools, equipment, walkways, work areas, storage facilities, and materials) before, during, and after a work session.

- In addition to a normal routine, encourage students to clean and put away unneeded tools and materials and maintain a large enough workspace for the job being done.
 - Employ a standard procedure to keep floors free of oil, water, and foreign material.
- Develop the ability to recognize potential hazards and take appropriate measures to avoid or eliminate them.
- Use a bell, whistle, or some other type of alarm to command the attention of every student in the laboratory/shop during emergencies.
- Prohibit the use of compressed air to clean clothing, equipment, and work areas. (4 psi will dislodge an eye, and air can enter the bloodstream through the skin.)
- Develop the ability to recognize potential hazards and take appropriate measures to avoid or eliminate them.

Student Safety Infraction Procedure

- Develop corrective procedures for infractions of the safety education program.
- See “Safety Rule Violation/Retraining Form” in the Forms section.

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Emergency Contacts

	Name	Phone Number
Ambulance	_____	_____
Fire Department	_____	_____
Police Department	_____	_____
Hospital (Nearest)	_____	_____
Doctor (Nearest)	_____	_____
School Office	_____	_____
District Office	_____	_____
School Nurse	_____	_____
Poison Control Center	<u>American Association of Poison Control Centers</u>	<u>1-800-222-1222</u>
Electrical Service Utility	_____	_____
Natural Gas Service Utility	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Emergency Procedures should be adapted to local conditions and regulations.

An outside telephone should be available in each school laboratory/shop.

Emergency Action Plan

The following procedures should be followed in the event of an emergency. This form was adapted from *Safety Program and Management Guide* (Utah State Office for Applied Technical Education) and *Shop Safety Manual* (Iowa State University).

Fire

- Pull the nearest fire alarm and notify building occupants.
- Call 911.
- Assist injured or disabled personnel.
- Evacuate the building. Activate emergency shutoffs.
- Attempt to use a fire extinguisher only if you have been trained.
- Meet at _____.

Medical Emergency

- Identify the medical emergency.
- If life-threatening, call 911.
- Administer first aid if professionally trained.
 - Do not move or transport an injured person unless absolutely necessary.
 - If bleeding, use compression to slow the bleeding.
 - Do not use a tourniquet unless trained.
 - If burned, flood area with cold water to draw heat away from the area until help arrives.
 - Do not apply any ointments.
 - If spill to eyes, hold the eyes open and wash the eyes for a full fifteen minutes.
 - If an injured person is in shock, keep them warm and try to calm them down.
 - If breathing stops, start mouth-to-mouth resuscitation if properly trained.
 - If you cannot detect a pulse, start CPR if properly trained.
- Contact the school office.

Urgent Situation

Suspicious person, package, activity, or bomb threat.

- Call 911.
- State who, what, where, when, why, and how the situation occurred.
- If bomb threat, turn off all electronics.

Violent Incident

- Avoid: evacuate when you can.
- Deny: lock/block doors, turn off lights, silence phones.
- Defend: distract, attack, subdue.
- Call 911.

Severe Weather

If you hear outdoor sirens or a severe weather warning.

- Proceed to the storm shelter in _____.
- Stay away from exterior doors and windows.
- Stay in the shelter until the danger has passed.

Utility Outages

- Identify in advance any critical research materials or processes that may be affected by utility outages.
- Identify backup systems or other resources to employ.
- Have backups in remote locations for data stored on computers.
- Notify appropriate contacts.

Chemical Spill - Small or Low Hazard (Indoors or Outdoors)

- Notify people in the immediate area.
- Assist with injured persons.
- Confine/limit the spill.
- Contact the school office.
- A chemical spill kit is located: _____.

Chemical Spill - Large or Hazardous (Indoors or Outdoors)

- Evacuate the immediate area and secure entrances or perimeter.
- Pull the chemical spill alarm or fire alarm.
- Dial 911. Report your name, chemical name, amount, and location of the spill.
- Assist injured personnel.
- Stay in a safe location until responders arrive.

Emergency Evacuation Routes

Please print your building emergency map and post it with your Emergency Action Plan.

Parent/Guardian Consent Form

District _____ Building _____
Teacher _____ Department _____
Class _____ Term/Hour _____

Dear Parent or Guardian:

Your child is enrolled in the educational program above and will participate in supervised classroom instruction that involves the use and operation of various tools, machines, and equipment. This course will provide them with an excellent opportunity to learn by doing hands-on activities.

Appropriate instruction in the safe operation of assigned tools, equipment, and procedures will be given that will include supervised student performance testing on each item. Precautions are taken to prevent accidents, but a certain risk is involved due to the nature of the experience and the learning environment. Students have been told they must inform the teacher of any injury, regardless of how slight, at the time of injury.

Proper eye protection is required by state law. We ask your support in discussing with your child the necessity to observe safety policies that have been established. Our laboratories/shops are well kept and have proper safety equipment in place, which will ensure all students' safety in the class if they follow the rules. You are invited to visit or school programs to discuss any of the course requirements. Please contact the teacher to arrange for a visit.

Finally, I am excited to have your child in my class, and am looking forward to a great term. I hope that your child will learn a great deal in my class, and I will do my very best to make the environment conducive to learning. If you have any questions, please contact me at school via email _____ or phone _____.

Thank you for your help,

(Teacher Name)

I have read this communication and understand the type of program in which my child is enrolled and the hands-on nature of it. I consent to my child using various tools and equipment as a part of the curriculum of this class and will discuss the safety aspects of the program with my child. I am aware that my child is expected to adhere to the rules of safety while in the laboratory/shop. They have been instructed as to the possible consequences of infractions. Furthermore, I realize that my child is subject to disciplinary action for failure to comply with these rules, which could include dismissal from class. Finally, I permit the school and teacher to seek medical aid for my child in case of an emergency.

Parent/Guardian Signature: _____ Date: _____

Home Phone: _____ Mobile Ph.: _____ Work Ph.: _____

Student Safety Pledge

District _____ Building _____
Teacher _____ Department _____
Class _____ Term/Hour _____

All work performed in the laboratory/shop will be carried out in the safest possible manner. Any person working in the laboratory/shop agrees to be safety conscious at all times. It is understood that any violation of the safety regulations contained herein, or given verbally by a teacher, is grounds for immediate removal from the program.

- Do not enter the laboratory/shop unless a teacher is present.
- Wear approved eye protection per state law.
- Long hair is dangerous. Special care must be taken to prevent accidents. Long hair will be held back by a headband, ponytail holder, or hairnet.
- Proper clothing must be worn. No loose, torn, frayed, ragged, or sloppy clothing will be allowed. No hats or hoods. No shorts, flip-flops, crocs, sandals, high heels, or open-toe shoes. All loose jewelry must be removed before operating a machine.
- **Absolutely no horseplay in the laboratory/shop.** Your actions can injure others.
- Only covered spill-proof beverage containers containing no sticky liquids are allowed in the laboratory/shop. Food is not permitted; neither are trays, plates, silverware, and or other empty food containers.
- Devote all your attention to the machine or tool you are using.
- Safety lines are for your protection. Stay behind them unless you are using a machine within the safety line area.
- Tools and materials can be very dangerous. Do not handle them unless you have something specific in mind.
- When help is needed on an operation, ask for only enough to do the job.
- Always clean your area when through.
- Always disconnect power before changing blades or belts.
- Never leave a machine until all motion has stopped.
- Throwing any object in the laboratory/shop is strictly forbidden.

I know that tools will be used in this course, and I agree to observe all safety rules and procedures for safe operation and conduct in this course. I know that if I violate any of the safety policies or instructions given by my teacher (teacher's name) _____, serious injury or removal from class may result. I have read the general safety listed above, and my teacher has explained them to me. I fully understand them and agree to obey them **at all times** while I am working in the laboratory/shop. If at any time, I do not understand the safe way to use any hand tool or power tool, I will ask my teacher for help before I proceed.

Student Signature: _____ Date: _____

Student Machine Use Safety Evaluation Record/Tool Check-Off Form

District _____ Building _____
 Teacher _____ Department _____
 Class _____ Term/Hour _____

If all three columns are filled in, then _____ has been given the proper demonstration, has passed the required safety exams at 100%, was viewed during their first use of said item, and is, therefore, permitted to use the following item according to the accepted safety procedures. This form will be held on file in the office as a record of your safety instruction.

Tool/Machine:	<i>Instructor Demo</i> Date, Signature	<i>Safety Test</i> Date, Score, Signature	<i>Student Demo</i> Date, Score, Signature
General Safety			
Other:			
Other:			
Other:			
Hand Tools			
Other:			
Other:			
Other:			
Power Sources			
Air Compressor			
Cordless Tool Batteries & Charger			
Small Engine			
Other:			
Other:			
Other:			
Portable Power Tools			
Air Chisel/Impact Hammer			
Air Nozzle			
Air/Power Ratchet			
Angle Grinder			
Automotive Battery Charger			

Tool/Machine:	<i>Instructor Demo</i> Date, Signature	<i>Safety Test</i> Date, Score, Signature	<i>Student Demo</i> Date, Score, Signature
Automotive End/Bumper Lift			
Automotive Engine Lift			
Bandfile			
Bernzomatic Torch			
Biscuit Jointer			
Circular Saw			
Cut Off Tool			
Die Grinder			
Dual Action (DA) Sander			
Finish Sander			
Gas Metal Arc Welder (MIG Welder or Wirefeed Welder)			
Gas Tungsten Arc Welder (TIG)			
Heat Gun			
Heat Press			
Hot Glue Gun			
Impact Wrench			
Jacks			
Jigsaw			
Multimeter			
Nailer/Stapler			
Oscillating Multi-Tool			
Oxy-Fuel Torch			
Paper Shear			
Plasma Cutter			
Portable Belt Sander			
Portable Buffer			
Portable Drill			
Portable Metal-Cutting Band Saw			

Tool/Machine:	<i>Instructor Demo</i> Date, Signature	<i>Safety Test</i> Date, Score, Signature	<i>Student Demo</i> Date, Score, Signature
Portable Power Planer			
Pressure Washer			
Reciprocating Saw			
Router			
Rotary Saw/Cut Out Tool			
Rotary Tool			
Shielded Metal Arc Welder (Stick)			
Soldering Gun			
Soldering Iron (Pen) and Soldering Station			
Straight Line Sander			
Wood Burner			
Other:			
Other:			
Other:			
Stationary Power Tools			
3D Printer			
Automotive Hoist			
Bar Folder			
Belt/Disc Sander			
Bench/Pedestal Grinder			
Bench Buffer			
Beverly/Throatless Shear			
Box and Pan/Finger Brake			
Brake Lathe			
CNC Lathe			
CNC Mill			
CNC Plasma Cutter			
CNC Router			

Tool/Machine:	<i>Instructor Demo</i> Date, Signature	<i>Safety Test</i> Date, Score, Signature	<i>Student Demo</i> Date, Score, Signature
Drill Press			
Drum Sander			
Edge Sander			
Foot Shear			
Furnace/Foundry			
Gas Forge			
Horizontal Metal-Cutting Band Saw			
Hydraulic Press			
Ironworker/Metalworker			
Jointer			
Laser Engraver			
Media Blaster			
Metal Belt Grinder			
Metal Cut Off Saw (Abrasive Wheel Saw or Chop Saw)			
Metal Lathe			
Milling Machine			
Mortising Machine			
Notcher			
Oscillating Spindle Sander			
Panel Saw			
Parts Washer/Solvent Tank			
Planer/Surfacar			
Power Miter Saw			
Radial Arm Saw			
Rotary Machine			
Scroll Saw			
Shaper			

Tool/Machine:	<i>Instructor Demo</i> Date, Signature	<i>Safety Test</i> Date, Score, Signature	<i>Student Demo</i> Date, Score, Signature
Slip Roller			
Spot/Resistance Welder			
Table Saw			
Tire Balancing Machine			
Tire Changer/Mounting Machine			
Vertical Band Saw			
Wide Belt Sander			
Wood Lathe			
Other:			
Other:			
Other:			

Automotive Mechanics Class Student Vehicle Policies and Permissions Form

District	_____	Building	_____
Teacher	_____	Department	_____
Class	_____	Term/Hour	_____

Introduction: This policy was a joint effort of students and teachers covering rights and responsibilities regarding student-owned and/or operated vehicles.

- General Policy
 - Bringing a vehicle into the laboratory/shop is a privilege, not a right.
 - The student must have a valid driver's license, liability insurance, and a parking permit (or a one-day pass) before a vehicle can be driven into the compound or the laboratory/shop.
 - This form must be filled out first and submitted to the instructor before bringing a vehicle into the compound and/or laboratory/shop.
- Driving Policy
 - Student drivers may go to the lot and drive directly back to class only when the instructor grants permission. No riders and no laps of lot permitted.
 - Speed limits are 5 MPH in the parking lot and 1 MPH in the laboratory/shop. (**no** speeding and **no** reckless driving)
 - Engines will not be recklessly revved to high RPM.
 - Rubber burning is strictly forbidden.
 - Stereos will not be able to be heard outside the car (no loud bass, etc.).
 - Vehicle accidents are the responsibility of the individuals involved and not the school.
 - No loud exhaust during school hours.
 - No low-speed vehicle testing will be allowed in the parking lot or compound during class work time unless authorized by the instructor.
 - Vehicles are to be backed out of the laboratory/shop during cleanup with **no** riders and parked out back. The driver is to return to work on clean-up immediately. The driver must get permission to return the vehicle to the lot at the end of clean-up.
- Parking Policy
 - No vehicles should be parked in the compound or the laboratory/shop without permission from the instructor.
 - Overnight or prolonged parking is prohibited except with the instructor's permission.
 - Vehicles parked in the laboratory/shop are parked at the risk of the owner. (Remember the laboratory/shop is shared with other classes.)
 - Entrance to all overhead doors and gates must remain clear unless otherwise permitted by the instructor.
 - Fire lanes must remain clear of vehicles at all times.
 - Students should leave other people's vehicles and possessions alone.
 - The instructor shall have the right to move any vehicle in the laboratory/shop without owner permission when it obstructs a fire lane, a door, and/or class operation.
 - A towing company may be called if no other solution exists (at the expense of the driver/owner).

- The instructor will exercise reasonable prudent judgment at all times.
- Miscellaneous
 - Driving offenses at any time in the school lot or school road will be noted on this document.
 - Reports by other school authorities on your driving to or from this class will be dealt with in the discipline procedures below.
 - Removal of parking lot privileges by the principal automatically results in the removal of class vehicle privileges because vehicles cannot enter laboratory/shop without violating the parking lot ban.
 - These policies must be taken home, read, filled in, and signed by the student, their parent and/or guardian, and vehicle owner, if the student wishes to bring a vehicle into the compound or laboratory/shop. These signatures constitute agreement with the above-published policies.
- Vehicle Information

Vehicle #1: Year: _____ Make: _____ Model: _____

Vehicle License Plate #: _____ Expires: _____

Insurance Company: _____

Vehicle #2: Year: _____ Make: _____ Model: _____

Vehicle License Plate #: _____ Expires: _____

Insurance Company: _____

Vehicle License Plate #: _____ Expires: _____

Vehicle License Plate No: _____ Expires: _____

Insurance Company: _____
- Permission Signatures

Student Driver: _____ Date: _____

Driver's License No.: _____ Expiration Date: _____

Vehicle Owner: _____ Date: _____

Parent/Guardian of student driver: _____ Date: _____

This Page for Instructor's Use Only

Discipline Procedures

Violations of the above-published policies will be handled as follows:

First Violation results in a 10% participation point subtraction and a written warning.

Rule No.: _____ Date: _____ Student Sig.: _____

Second Violation results in a 10% participation point subtraction and class driving privileges being removed for ten (10) class working days.

Rule No.: _____ Date: _____ Student Sig.: _____

Third Violation results in a 10% participation point subtraction and class driving privileges being removed for sixty (60) class working days.

Rule No.: _____ Date: _____ Student Sig.: _____

Fourth Violation results in a 10% participation point subtraction and permanent loss of class driving and vehicle privileges.

Rule No.: _____ Date: _____ Student Sig.: _____

Safety Rule Violation/Retraining Form

District	_____	Building	_____
Teacher	_____	Department	_____
Class	_____	Term/Hour	_____

Adapted from Dr. Dale R. Derrickson, Utah State Office of Education

This is a Safety Retraining assignment! Before this assignment, you were given safety training. Because you recently demonstrated an incomplete understanding of this safety training, you need to complete this retraining assignment satisfactorily! Your safety retraining will be a two-step process.

Step 1

What safety rule(s) or procedure(s) did you violate?

You must describe the rule violated, what you should have done, what injuries could have happened, and what you intend to do differently next time. The quality of your answers must show that you now understand the safety rule or procedure that was incorrectly demonstrated.

Response: (10-word minimum)

What should you have learned and practiced from your initial safety training on this safety rule(s) or procedure(s)?

During your initial safety training, you were given written information about safety rules. This written information is still in the classroom. For the next question, you might need to look up the original safety training information.

You may have been lucky this time! You or someone else may not have been seriously injured when you violated this safety rule this time. That does **not** mean that you will not seriously injure yourself or someone else if you violate this safety rule again!

Response: (20-word minimum)

Using your imagination, describe what serious injuries could have resulted from your unsafe actions.

If your unsafe actions severely hurt someone, it would probably make a significant impression on you and your classmates. This is what probably happened on the job to workers who helped to make up the safety rule or procedure that you just violated.

Response: (30-word minimum)

When you received safety training and had to pass a written safety test, you were expected to demonstrate what you had learned in the laboratory/shop setting. You are in the retraining process because you failed to demonstrate safe actions adequately.

Step 2

After satisfactorily writing your reviewed understanding of the safety rules violated, you will re-enter the laboratory/shop. There, you will be expected to demonstrate safe conduct. If your actions do **not** convince the instructor, you may need further retraining.

What do you intend to do about the safety rule or procedure described in Question # 1 when you return to the laboratory/shop? How will your actions be different?

Response: (40-word minimum)

Express Assumption of Risk

Associated with the Purchase of Student Manufactured Products and Student Services

Adapted from *Safety Instruction Manual* (Alaska Department of Education).

I, _____ do hereby affirm and acknowledge that I have been fully informed of the inherent hazards and risks associated with the purchase of student manufactured products and services conducted by or with the help of students. I understand that these products and services are being made available to me as is without any warranty whatsoever, either express or implied, including no warranty of merchantability or fitness for a particular purpose. I have fully inspected this product or service and agree that any and all defects or hazards are my responsibility. Such defects in workmanship or materials may create risks or conditions which could result in property damage and/or bodily injury (up to and including death) to myself or others.

In consideration of being allowed to purchase the item(s) or service(s) listed below in the amount of

\$ _____, the following is being made available to me: _____

By entering into this agreement, I am not relying upon any oral or written representation or statements made by any employee, representative, volunteer, agent, director, officer, or student of the _____ School District.

To the maximum extent allowed by law, I fully agree to indemnify, defend and hold harmless the _____ School District, its employees, representatives, volunteers, agents, directors, officers, and students from all liability and responsibility, whatsoever, for any claim or cause of action that I, my estate, heirs, executors or assigns may have for damages to property, whether tangible or intangible, including without limitation for personal injury, property damage or wrongful death, arising from the purchase, provision or use of the above student-related services or student manufactured products or products produced with the help of students.

I hereby declare that I am of legal age and am competent to sign this agreement. In the event a parent or guardian signs on behalf of the minor, the signor hereby agrees to defend, indemnify, and hold harmless the _____ School District from any claims of the minor arising from this transaction.

I have read this agreement, understand it, and agree to be bound by it.

Student Name: _____

Student Signature: _____ Date: _____

Work Ethic/Professionalism Rubric

District	_____	Building	_____
Teacher	_____	Department	_____
Class	_____	Term/Hour	_____

Grading Scale

3=Exceeds Expectations, 2=Meets Expectations, 1=Needs Improvement, 0=Unacceptable

Exceeds Expectations: Work ethic performance is exemplary. The student has consistent characteristics that will stand out in the work environment.

Meets Expectations: All work ethic standards are met. The quality of a student's work ethic is that of a good employee in the typical work environment.

Needs Improvement: Some standards are not met. Additional training in employability skills is recommended.

Unacceptable: Work ethic performance was below average. Additional training in employability skills is a must if the student is to survive in the work environment.

Competency Chart

Work Ethic Trait	Description	Point Score
Attendance	Attends class, arrives on time, notifies instructor in advance of planned absences	
Character	Displays loyalty, honesty, trustworthiness, dependability, initiative, and self-discipline	
Teamwork	Respect rights of others, respects confidentiality, cooperative, demonstrates mannerly behavior, is a team worker	
Appearance	Displays appropriate dress, grooming, hygiene, and etiquette	
Attitude	Demonstrates a positive attitude, appears self-confident	
Productivity	Follows safety practices, participates, keeps work area clean and organized, follows directions and procedures, makes up assignments punctually	
Organizational Skills	Demonstrates skill in prioritizing and managing time and stress; Demonstrates flexibility in handling change	
Communication	Displays appropriate non-verbal (eye contact, body language) and oral (listening, grammar) skills	
Cooperation	Displays leadership skills, appropriately handles criticism, conflict, and complaints, demonstrates problem-solving skills	
Respect	Deals appropriately with diversity, does not engage in harassment	
	Total Score /Grade	

Laboratory/Shop Safety Inspection Checklist

District _____ Building _____

Teacher _____ Department _____

Class _____ Term/Hour _____

Documentation

Criterion	Complete
Chemical and biological material inventories are current and on file.	
An emergency action plan is posted.	
Current safety training records are available.	
Current safety manuals are available in laboratory/shop or online, as appropriate.	
Standard Operating Procedures (SOPs) have been developed for the use of hazardous materials and/or equipment.	
Safety Data Sheets (SDSs) for hazardous materials are available.	
Safety Surveys are being conducted and documented.	

Fire and Life Safety

Criterion	Complete
Room corridor doors are closed unless held open by alarm-deactivating magnets. Fire extinguishers are charged and unobstructed.	
Electrical items are used correctly (i.e., cords in good condition, breakered UL power strips, high wattage equipment plugged-in directly, no extension cords, and no tandem power strips).	
Good housekeeping is in evidence. (Exits and aisles are unobstructed. Areas are clean, uncluttered, and trash is disposed of correctly.)	
Eyewash and safety shower are available, unobstructed, and eyewash is flushed monthly (documented) by occupants.	

General Safety

Criterion	Complete
Appropriate signage is present on the entry door and within the laboratory/shop (i.e., emergency contacts, appropriate biosafety level, equipment markings).	
Access to the facility is controlled.	
Work practices are being performed safely.	
Food, beverages, tobacco products, and cosmetics are absent from work areas. Sink, soap, and towels are available for handwashing.	
Suitable personal protective equipment is available, worn, in good shape, left in the laboratory/shop, and appropriately stored.	

Equipment

Criterion	Complete
An appropriate spill kit is available.	
An appropriate first aid kit is available.	
Fume hoods are certified annually and used correctly.	
Refrigeration equipment is appropriately labeled.	
Vacuum equipment is protected with a trap or filtered correctly.	
Machine and power tools are fitted with appropriate guards.	
Ladders should be maintained in good condition and inspected regularly.	
Bench-top tools are secured to the bench.	
Machines designed for a fixed location are securely anchored.	
Tools are used in ways that are consistent with their design.	
Tools are kept in good working condition.	
Specific lockout/tagout procedures are written for covered equipment. See Eight Steps for Safer Lockout/Tagout Programs in the Resources section.	
Compressor air nozzles are provided with a pressure reducing devices to restrict pressure to 30 psi.	

*Be sure to also utilize the “Bi-Monthly (Even Months) Machine/Tool/Equipment Safety Inspection Checklist” found in the Forms section OR other useful machine-specific checklists can be found at [CDC Safety Checklist for Schools website](#) or [OSHA Small Business Handbook](#).

Chemicals and Storage

Criterion	Complete
Containers (including waste) are appropriately labeled, with names spelled out and closed when not in use. Incompatible chemicals are being stored separately, and all chemicals are stored by their hazard category.	
Flammable liquids are being stored correctly. (>1gal in approved containers, >10gal (accumulative) in a flammable cabinet)	
Gas cylinders are secured, away from heat sources, and capped when not in use.	
Oily rags are discarded in a metal waste container with a lid.	

Additional Information

Criterion	Complete
Additional Comments.	
No deficiencies noted at this time.	
No deficiencies were noted in this space at the time of this survey.	

This form was adapted from *Shop Safety Manual* (Iowa State University)

Bi-Monthly (Every Other Month) Safety Inspection Checklist

District _____ Building _____

Teacher _____ Department _____

Class _____ Term/Hour _____

Item	Yes	No	N/A	Comments
Bi-Monthly Machine Safety Inspections are available in the laboratory/shop area.				
A licensed instructor supervises the laboratory/shop area at all times when students are present.				
All chemicals are properly labeled.				
Chemical inventory and associated SDSs are updated and available.				
Chemical storage requirements are fulfilled.				
Aisles and egresses are maintained open and unobstructed.				
The dust and air collection system is operational and is used during activities.				
Instructors and students observe safe clothing/dress procedures.				
PPE requirements have been identified, and equipment is available and maintained.				
All machine safeguards are in place and operational.				
Damaged or non-compliant equipment is not used and is properly labeled.				
Machinery, equipment, and tools are only used for their designed usage.				
Hand and power tools are used with the correct PPE, shield, or guard as recommended by the manufacturer.				
Damaged electrical equipment has been taken out of service.				
All electrical equipment and cords are properly grounded.				
Access to electrical service panels and emergency shut offs are unobstructed.				
Compressed gas cylinders are labeled and secured				
Compressed air nozzles are reduced to below 30 psi.				
Safety equipment, including fire extinguishers, fire blankets, and eyewash fountains, are accessible and operational.				
Eyewash fountains are flushed weekly (for at least five minutes).				
Spill control material (floor dry) is available.				
Emergency phone numbers and procedures are clearly posted.				
Documentation of Student Competency for Safe Machine Operation is on file for each student.				

Instructors are responsible for inspecting laboratory/shop areas under their control. The inspection checklists are to be maintained by the instructor as part of the Safety Management Plan. Other useful machine-specific checklists can be found at [CDC Safety Checklist for Schools website](#) or in the [OSHA Small Business Handbook](#).

Tool/Machine/Equipment Inventory and Repair Log

District _____ Building _____

Teacher _____ Department _____

School Year _____

The purpose of this form is to identify equipment for theft recovery or to utilize for insurance purposes in the event of a fire loss, as well as having an ongoing record of the repair. Repairs should be documented if done in-house or outsourced to a vendor. Items to include on repair documentation are date, replacement parts, and who performed the repair.

[illegible]

Add more pages as necessary for the number of tools/machines/equipment in your facility.

Cylinder Inventory Sheet

District _____ Building _____

Teacher _____ Department _____

Date _____

Style	Product	Full Cylinders	Empty Cylinders	Cubic Feet
GP-45	Oxygen (Liquid)			4274
K	Oxygen			249
S	Oxygen			125
Q	Oxygen			80
V	Oxygen			40
R	Oxygen			20
T	Compressed Air			
	Nitrogen Liquid			
T	Nitrogen			304
S	Nitrogen			142
Q	Nitrogen			76
V	Nitrogen			40
R	Nitrogen			20
GP-45	Argon (Liquid)			4110
T	Argon			336
S	Argon			154
Q	Argon			83
V	Argon			154
R	Argon			83
T	C10 Argon (Argon CO ₂)			310
T	Stargon			344
T	C25 Argon			380
S	C25 Argon			172
Q	C25 Argon			95
V	C25 Argon			40
R	C25 Argon			20
T	95/5 Argon/Oxygen			333
T	1025			286
K	1025			214
T	A75			322
T	Helium			291
K	Helium			217
S	Helium			135

Style	Product	Full Cylinders	Empty Cylinders	Cubic Feet
Q	Helium			73
V	Helium			40
GP-45	Carbon Dioxide			387#
50#	Carbon Dioxide			50#
50# T	Carbon Dioxide			50#
20#	Carbon Dioxide			20#
5#	Carbon Dioxide			5#
E PUR TW	Oxygen Reg			23
D PUR	Oxygen			13
E PUR	Oxygen			23
H PUR	Nitrous Oxide			561
M PUR	Nitrous Oxide			267
E PUR	Nitrous Oxide			267
T	Nitrogen NF			56.2
K	Oxygen USP			249
S	Oxygen USP			125
34#	Propane			34#
100#	Propane			100#
25#	Chemtane			25#
60#	Chemtane			60#
A145	Acetylene			145
WM	Acetylene			366
WS	Acetylene			139
WQ	Acetylene			60
B	Acetylene			40
MC	Acetylene			10
T	SPG.			
T	SPG.			

Hazardous Condition Report

District _____ Building _____
Teacher _____ Department _____
Date _____

If a hazard exists, the operation should be locked out and tagged out until corrected. Then use this form to report the hazard and direct action to see that the hazard is corrected or removed.

To: (Building Administrator), (Position), (School)

CC: Department Head, Teacher Reporting Hazard, District Safety Officer

Description and Location of Health or Safety Hazard: _____

Suggested Solution: _____

Teacher Signature: _____

Admin Signature: _____ Date: _____

Admin Action: _____

This form was adapted from the *Minnesota Industrial Arts Safety Guide* and *Safety Guidelines for Elementary Science & Technology Education* (Pennsylvania Department of Education).

Student Report of Injury Form

District _____ Building _____
Teacher _____ Department _____
Class _____ Term/Hour _____

Instructions: Students shall use this form to report ***all*** work-related injuries, illnesses, or “near miss” events (which could have caused an injury or illness)—***no matter how minor***. This helps us to identify and correct hazards before they cause serious injuries. This form shall be completed by students as soon as possible and given to a supervisor for further action.

I am reporting a work-related: ☐ Injury ☐ Illness ☐ Near miss

Name: _____

Date and Time: _____

Instructor is aware of this injury/near miss? ☐ Yes ☐ No

Where, exactly, did it happen? _____

What were you doing at the time? _____

Describe step by step what happened in the injury/near miss: _____

What could have been done to prevent this injury/near miss: _____

Did you see a doctor about this injury/near miss? ☐ Yes ☐ No

If yes, whom did you see (name, date, phone number)? _____

Has this part of your body been injured before? ☐ Yes ☐ No

If yes, when? _____

Student Signature: _____ Date: _____

Adapted from *OSHA Resources*.

Incident Report Form

District _____ Building _____

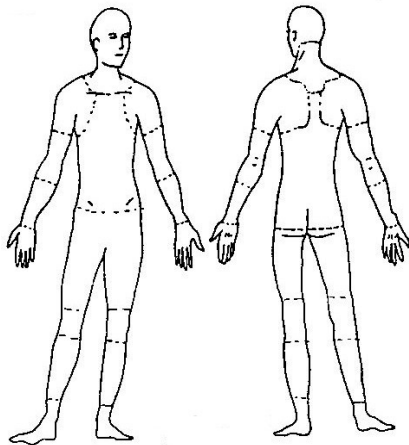
Teacher _____ Department _____

Class _____ Term/Hour _____

Instructions: Complete this form as soon as possible after an incident that results in serious injury or illness. (Optional: Use to investigate a minor injury or near-miss that *could have resulted in a serious injury or illness.*)

This is a report of a: <input type="checkbox"/> Death <input type="checkbox"/> Lost Time <input type="checkbox"/> Dr. Visit Only <input type="checkbox"/> First Aid Only <input type="checkbox"/> Near Miss	
Date of incident: _____	This report is made by: <input type="checkbox"/> Student <input type="checkbox"/> Instructor <input type="checkbox"/> Team <input type="checkbox"/> Other _____

Step 1: Injured student (complete this part for each injured student)

Name: _____	Sex: <input type="checkbox"/> Male <input type="checkbox"/> Female	Age: _____
Class: _____	Role at time of incident: _____	
Part of body affected: (shade all that apply)	Nature of injury: (most serious one)	This student has attended this school for how many months: _____
	<input type="checkbox"/> Abrasion, scrapes <input type="checkbox"/> Amputation <input type="checkbox"/> Broken bone <input type="checkbox"/> Bruise <input type="checkbox"/> Burn (heat) <input type="checkbox"/> Burn (chemical) <input type="checkbox"/> Concussion (to the head) <input type="checkbox"/> Crushing Injury <input type="checkbox"/> Cut, laceration, puncture <input type="checkbox"/> Hernia <input type="checkbox"/> Illness <input type="checkbox"/> Sprain, strain <input type="checkbox"/> Damage to a body system: <input type="checkbox"/> Other _____	Months in this class: _____
		Days in this activity: _____

Step 2: Describe the incident

Exact location of the incident: _____		Exact time: _____	
What part of the student's school day? <input type="checkbox"/> Entering or leaving class <input type="checkbox"/> Doing normal work activities <input type="checkbox"/> During meal period <input type="checkbox"/> During break <input type="checkbox"/> Working after school <input type="checkbox"/> Other _____			
Names of witnesses (if any): _____			
Number of attachments: _____	Written witness statements: _____	Photographs: _____	Maps/drawings: _____

What personal protective equipment was being used (if any)?

Describe, step by step, the events that led up to the injury. Include names of any machines, parts, objects, tools, materials, and other important details.

Description continued on attached sheets: ☐

Step 3: Why did the incident happen?

Unsafe workplace conditions: (Check all that apply)

- ☐ Inadequate guard
- ☐ Unguarded hazard
- ☐ Safety device is defective
- ☐ Tool or equipment defective
- ☐ Workstation layout is hazardous
- ☐ Unsafe lighting
- ☐ Unsafe ventilation
- ☐ Lack of needed personal protective equipment
- ☐ Lack of appropriate equipment/tools
- ☐ Unsafe clothing
- ☐ No training or insufficient training
- ☐ Other: _____

Unsafe acts by people: (Check all that apply)

- ☐ Operating without permission
- ☐ Operating at unsafe speed
- ☐ Servicing equipment that has power to it
- ☐ Making a safety device inoperative
- ☐ Using defective equipment
- ☐ Using equipment in an unapproved way
- ☐ Unsafe lifting
- ☐ Taking an unsafe position or posture
- ☐ Distraction, teasing, horseplay
- ☐ Failure to wear personal protective equipment
- ☐ Failure to use the available equipment/tools
- ☐ Other: _____

Why did the unsafe conditions exist?

Why did the unsafe acts occur?

Is there a reward (such as “the job can be done more quickly,” or “the product is less likely to be damaged”) that may have encouraged the unsafe conditions or acts? ☐ Yes ☐ No

If yes, describe:

Were the unsafe acts or conditions reported prior to the incident? ☐ Yes ☐ No

Have there been similar incidents or near misses prior to this one? ☐ Yes ☐ No

Step 4: How can future incidents be prevented?**What changes do you suggest to prevent this incident/near miss from happening again?**

- ☐ Stop this activity ☐ Guard the hazard ☐ Train the student(s) ☐ Train the supervisor(s)
- ☐ Redesign task steps ☐ Redesign work station ☐ Write a new policy/rule ☐ Enforce existing policy
- ☐ Routinely inspect for the hazard ☐ Personal Protective Equipment ☐ Other: _____

What should be (or has been) done to carry out the suggestion(s) checked above?

Description continued on attached sheets: ☐**Step 5: Who completed and reviewed this form? (Please Print)**

Written by:

Title:

Department:

Date:

Names of investigation team members:

Reviewed by:

Title:

Date:

This form as adapted from OSHA Resources

Instructor's Incident Investigation Form

District _____ Building _____

Teacher _____ Department _____

Class _____ Term/Hour _____

Name of Injured Person: _____ Gender: _____

Date of Birth: _____ Telephone Number: _____

Address _____

What part of the body was injured? Describe in detail: _____

What was the nature of the injury? Describe in detail: _____

Describe the event, including equipment/tools involved. What was the student doing prior to the event?

Witness 1: _____ Witness 2: _____

Witness 3: _____ Witness 4: _____

Date of Event: _____ Time of Event: _____

Exact location of event: _____

What caused the event? _____

Were safety regulations in place and used? If not, what was wrong? _____

Did student go to doctor/hospital? Doctor: _____ Hospital: _____

Recommended preventive action to take in the future to prevent reoccurrence: _____

Student Signature: _____ Date: _____

Adapted from *OSHA Resources*.

Glossary

This section is adapted from [Powertool Institute](#) unless otherwise noted.

Abrasive Wheel (including diamond wheels) – A rotating accessory designed to grind, cut, or remove stock from various materials such as metal or concrete. Three types of wheels are most frequently encountered:

Type 1A Wheel (ISO 41) – A disc-shaped wheel intended for cutting by the periphery of the wheel.

Type 11 Wheel – A cup-shaped wheel intended for grinding by the face of the wheel.

Type 27 Wheel – A saucer/center depressed shaped wheel intended for grinding by its periphery or the face of the wheel.

Accident - Includes any suddenly occurring, unintentional event which causes injury or property damage. (Utah State Office for Applied Tech Ed)

Amperage (Amps/Rated Amperage) – A measure of the flow of electric current. If you think in terms of water through a hose, amperage would be a measure of water volume flowing through the hose. As it applies to electric power tools, "Rated Amperage" is how many amps the tool uses when tested under a specified condition. Rated amperage is useful in choosing the correct extension cord gauge and length (refer to the tool's instruction manual).

Anti-Kickback Device – A device incorporated into some power tools intended to minimize the effects of kickback. (See "Kickback.")

Anti-Kickback Pawl – A device with teeth intended to permit motion in one only direction, and helps minimize the effect of kickback. (See "Anti-Kickback Device.")

Blade Guard – See "Guard."

Chip Shield – An attachment to tools designed to contain wood or metal chips, and sawdust, and help keep them away from the operator.

Clamp – A restraining device used to hold a workpiece in place while you work on it.

Cutter Guard – See "Guard."

Defective Equipment - Any equipment, machine, or tool that is damaged, broken, missing guards or is altered from original manufacturer condition.

Double-Insulated (DI) – A form of electrical protection featuring two separate insulation systems to help protect against electrical shock from internal malfunctions. DI tools have no provision for grounding (no third grounding prong) and are equipped with a polarized two-prong plug. (See "Polarized Plug"). Double- insulated tools will be marked with a "double square" or the words "Double-Insulated" on the tool's rating plate.

Ear Protection – Devices such as earmuffs or earplugs that reduce the intensity of the noise entering your ear. Ear protection will carry a NIOSH Noise Reduction Rating, or "NRR," which indicates how much the noise level you experience is reduced (in decibels) when the device is used correctly.

Ergonomics - The science and practice of designing jobs and workplaces to match the capabilities of the human body. Ergonomics means "fitting the job to the worker."

Extension Cord – An electric cord used between power tools and outlets to extend the range of the tools. The more amperage your tool uses, and the longer the distance, the larger the size of the wire needed in your extension cord (larger wire = smaller gauge).

Eye Protection – Goggles or spectacles intended to protect your eyes. Eye protection should meet the requirements of ANSI Z87.1 – These products will be marked with "Z87.1" or "Z94.3" (Canada).

Note: A face shield is not "eye protection" unless used with goggles or spectacles.

Face Shield – An impact-resistant shield that helps to protect your face from chips, sparks, small debris, or wire wheel bristles. Face shields should be used only in conjunction with spectacles or goggles.

Featherboard – A multiple fingers-like aid, used to firmly hold your workpiece against the fence or table while you are feeding the workpiece through the tool. A device used whenever your hands would otherwise need to pass near the blade or cutter. (See Push Block/Push Stick).

Fence – A vertical surface that helps locate and/or guide your workpiece during the cutting process.

First aid - Immediate, temporary care given to the victim of an accident or sudden illness until the services of a physician can be obtained. (CDC)

Flammable Safety Cabinets - Storage cabinets (typically metal) manufactured to isolate flammable materials from a potential fire that may occur in the laboratory/shop. Safety cabinets are required for storage of flammable liquids in laboratories/shops with cumulative quantities greater than 40 liters (approximately 10 gal.). Place safety cabinets against exterior walls and away from exits and other potential flammable sources.

Flammable Safety Cans - Containers (typically metal) with self-closing spouts and integral flame arresters used to store flammable liquids for quantities greater than four liters (approximately 1 gal.). Safety cans must be properly labeled.

Flying Chips/Material - Employees may be exposed to splinters and chips that are flung by the cutting action of woodworking equipment (OSHA).

Goggles (Safety Goggles) – See "Eye Protection."

Ground Fault Circuit Interrupter (GFCI) – A safety device designed to sense electrical leakage to ground and quickly shut off the circuit to prevent electric shock.

Grounded Outlets (Receptacles) – An electrical outlet in a typical 120V application is equipped with two vertical slots and a third rounded hole (the "ground"). The use of an adapter with a grounded outlet eliminates the grounding protection.

Guard – Protective device that forms a barrier between a hazardous object such as a blade, wheel, or a cutter and the operator.

Hearing Protection – See "Ear Protection."

Hold-down – A device used to help hold the workpiece down to the support surface during the work. (See "Clamp" or "Featherboard.")

Horsepower (HP) – A measure of power – that is the amount of work done in a given time. In terms of electric power, one HP = 746 Watts. Horsepower of power tools is typically stated in the following ways:

Motor-only Horsepower – A horsepower measurement performed at the output of the motor only without reduction thru gears or belts.

Tool Horsepower – A horsepower measurement performed at the "work end" of the tool. In other words, the point where the accessory performing the work is attached, i.e. the blade on the spindle or the drill bit in the chuck.

Continuous Horsepower – The maximum output that can be produced continuously without exceeding the rated current. A motor's Continuous Horsepower is usually lower than its Peak Horsepower. It is sometimes referred to as "Continuous Duty Horsepower."

Peak Horsepower – The maximum output that can be developed in actual use.

Impact Energy – Represents the amount of work that can be performed by a single blow of the hammering mechanism. It is usually measured in foot-pounds (or inch-pounds) of energy.

"in loco parentis" - Latin for "in the place of a parent"; refers to the legal responsibility of a person or organization to take on some of the functions and responsibilities of a parent. (Wikipedia)

Instruction Manual (Manual, Owner's/Operator's Manual, Use and Care Guide) – The booklet accompanying your power tool that describes the hazards and safe operating procedures, outlines essential tool operation, care, and maintenance.

Kickback – Sudden and unintended movement of the tool or workpiece. It is typically caused by binding or pinching of the workpiece.

Listed – As in "UL Listed" means the product has been tested for conformance to the applicable national standards. Listed products can be identified by a "mark" on the tool's rating plate (e.g., a "UL," "ETL," or "CSA" mark or symbol).

Motor – There are several types of electric motors typically used in power tools:

AC Motor – An electric motor that operates on "alternating current" – the kind of power source found in a household outlet.

DC Motor – An electric motor that operates on "direct current."

Induction Motor – An AC motor which has no brushes, and is typically larger, heavier, slower, and used in benchtop and stationary equipment, such as table saws, planers, band saws, and jointers.

Permanent Magnet Motor – A DC motor that is commonly used in battery tools.

Near Miss - A narrowly avoided collision or other accident.

Negligence – Conduct which breaches a duty established by law or the profession that causes damage or injury. This is usually a failure to do something that a reasonable person would do to prevent harm. (Utah State Office for Applied Tech Ed)

Nip Points or Pinch Points - In-running nip points (or pinch points) are a particular danger arising from rotating or reciprocating parts. They occur whenever machine parts move toward each other or when one part moves past a stationary object. Figure 1 shows some in-running nip points that may be encountered in the woodworking industry. The nip points in this figure are located where the belts or chains approach the pulleys or gears, or where the rotating parts approach the stationary components. (OSHA)

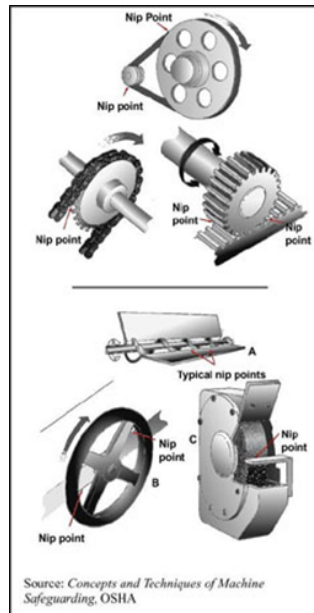


Figure 1

NRTL – Nationally Recognized Testing Laboratory – The OSHA Program recognizes private sector organizations as NRTL's, and recognition signifies that an organization has met the necessary qualifications specified in the regulations for the Program. Examples of laboratories that are listed with OSHA as NRTL's include CSA, ETL, and UL.

Overreaching – Extending your body with a tool or a workpiece in hand such that a loss of balance is likely. For example: reaching over the blade or cutter area or reaching from scaffolding to drive a screw.

Personal Protective Equipment - Commonly referred to as "PPE," is equipment worn to minimize exposure to hazards that cause serious injuries and illnesses. These injuries and illnesses may result from contact with chemical, radiological, physical, electrical, mechanical, or other 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 bodysuits. (OSHA)

Point of Operation – The point of operation is the place where work is performed on the material. This is where the stock is cut, shaped, bored, or formed. Most woodworking machines use a cutting and/or shearing action.

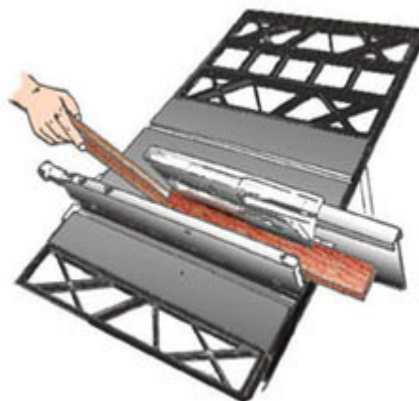


Figure 2 Point of Operation

Polarized Plug – A type of plug which has one prong larger than the other, so it can only be inserted into an outlet in one way.

Power Source – A household workplace electrical outlet, battery, or generator is providing the electricity for your tool. The power source must be compatible with the requirements found on the tool's rating plate; voltage, amperage, AC or DC, frequency.

Power Switch – A control device that energizes your tool in the "on" position, and de-energizes the tool in the "off" position.

Professional Liability Insurance - Also called professional indemnity insurance (PII) but more commonly known as errors and omissions (E&O) in the U.S.; is a form of liability insurance which helps protect professional advice- and service-providing individuals and companies from bearing the full cost of defending against a negligence claim made by a client and damages awarded in such a civil lawsuit. (Wikipedia)

Prudent – Cautious, discreet, managing very carefully. (Utah State Office for Applied Tech Ed)

Prudent Professional - Acting with or showing care and thought for the future.: "No prudent money manager would authorize a loan without first knowing its purpose." (Google Docs Dictionary)

Push-Block/Push Stick – A suitably shaped and designed hand-held device used to push the workpiece into and past cutting edges on stationary power tools.

Reasonable – Rational and commonsense behavior given the potential danger. (Utah State Office for Applied Tech Ed)

Respiratory Protection – A device placed on your face used to filter the air you breathe. Available in a variety of styles (such as disposable dust masks, half-face respirators, and full-face respirators), respiratory protection devices are typically provided with a NIOSH approval rating (e.g., "N95").

Revolutions Per Minute (RPM) – For a tool that rotates an accessory (e.g., a drill, saw, router...), RPM is the number of complete turns the accessory makes in one minute.

Rotary and Reciprocating Movements - All machines operate by rotating or reciprocating motion or by a combination of these motions. Reciprocating movement is back-and-forth or up-and-down motion. Rotary cutting and shearing mechanisms, rotating wood stock, flywheels, shaft ends, and spindles all rotate. Rotating action is hazardous regardless of the speed, size, or surface finish of the moving part. (OSHA)

Safety Glasses (Spectacles) - See "Eye Protection."

Speed

Maximum Speed – The highest speed at which a product (i.e. tools, accessories, attachments) can be safely operated.

No-Load Speed – Speed measured when the tool is operating at the rated voltage but not engaged in work. It is usually listed on the tool rating plate.

Rated Speed – Speed measured when the tool is operating at the rated voltage and loaded to work at the rated load current.

Tool Projection - Many pieces of woodworking equipment—such as routers, shapers, and molders—employ rotating cutter heads with multiple knives. Cutter heads that are not correctly adjusted, that are poorly mounted, or have broken knives, can become unbalanced. Balance is critical for keeping knives secured to a rapidly moving cutter head. (OSHA)

Torque – A twisting action tending to cause rotation typically measured in foot-pounds or inch-pounds.

Vise – See "Clamp."

Voltage – The electric potential difference measured between two conductors such as the "hot" and "neutral" for AC power supply or the potential difference between the + and the – poles of the DC supply. If you think in terms of water through a hose, the voltage would be the water pressure. So, the higher the voltage, the more "pressure" is pushing the electricity.

Wattage (W) – A measure of power that is the amount of work done in a given time. If you think in terms of water through a hose, wattage is a measure of how much pressure is required to push the volume of water delivered in a period of time. Note: For A.C. electric tools, the wattage is more complicated than merely amps times volts.

References

- [American National Standards Institute \(ANSI\)](#)
 - [ANSI Z535 Safety Alerting Standards](#)
- [Centers for Disease Control](#)
 - [Safety Checklist Program for Schools](#)
 - [Safety Guide for Career and Technical Education](#)
- [Eight Steps for Safer Lockout/Tagout Programs](#)
- [Federal Child Labor Laws](#)
- [Federal OSHA](#)
 - [Factsheet Lockout Tagout](#)
 - [Full Construction Standards 1926](#)
 - [Ventilation](#)
 - [Full Industrial Standards 1910](#)
 - [Occupational noise exposure](#)
 - [Specifications for accident prevention signs and tags.](#)
 - [Laboratories Safety Culture](#)
 - [Materials Handling and Storage](#)
 - [Personal Protective Equipment \(PPE\) Hazards Solutions](#)
 - [Personal Protective Equipment \(PPE\) Standards](#)
 - [Small Business Safety and Health Handbook](#)
- [Minnesota Child Labor Laws](#)
- [Minnesota OSHA](#)
- [Safety Data Sheet \(SDS\) Database](#)
 - [Safety Data Sheet \(SDS\) Glossary](#)
 - [Safety Data Sheet \(SDS\) Index](#)
 - [Safety Data Sheet \(SDS\) Info](#)

Resources adapted from

- An Accident Prevention Program for School Shops and Laboratories (United States Department of Education)
- CTE Health and Safety Education Guide (Washington State Office of Superintendent of Public Instruction 2002)
- CTE Health and Safety Education Guide (Washington State Office of Superintendent of Public Instruction-2009)
- General Safety Manual for CTE Education and T&I Programs (Louisiana Department of Education)
- Guide to Equipping Industrial Arts Facilities (American Industrial Arts Association)
- Guide to Preparing Educational Specifications for Secondary T&I Facilities (American Council of T&I Supervisors)
- Florida T&I Safety Guide (Florida Department of Education)
- Laboratory Safety Manual-Colorado (Colorado State University)
- Minnesota T&I Safety Guide, Safety and Health for T&I/CTE Education (United States Department of Health and Human Services)
- Safety Best Practice Guided for CTE Education (Virginia Department of Education)
- Safety Guide for CTE (United States Centers for Disease Control)
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- Safety Program and Management Guide (Utah State Office for Applied Trade and Industry)
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- T&I Education Safety Guide [Lenape Regional High School]
- 16 ways to Lawyer-Proof your Lab by Richard Sullivan
- Safety and Liability in STEM Education Laboratories by Tyler S. Love
- Safety in the Laboratory...CYA by Dr. Ryan Saucier
- [CTE Safety Solutions](#)
- [The Power Tool Institute](#)
- American National Standards Institute (ANSI) Online Resources
- Occupational Safety and Health Administration (OSHA) Online Resources